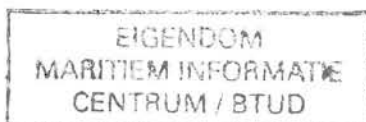614 542

EUROPEAN SHORTSEA SHIPPING

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PROCEEDINGS FROM THE

SECOND EUROPEAN RESEARCH ROUNDTABLE CONFERENCE ON SHORTSEA SHIPPING

Strategies for achieving cohesion in Europe through shortsea shipping

2-3 JUNE 1994 ATHENS/VOULIAGMENI

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EUROPEAN SHORTSEA SHIPPING

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INTRODUCTION

PREFACE

Shortsea shipping plays a vital role in the international movement of goods and passengers within Europe; a role that is increasingly recognized by European policymakers, witnessing the European Commisson's White Paper on a future European Transport Policy and the reports from the Maritime Industries Forum.
In spite of its importance, shortsea shipping has attracted relatively little attention from maritime and tranportation rsesearchers. For this reason the *First European Research Roundtable Conference on Shortsea Shipping* was organized on 26-27 November 1992, at the Delft University of Technology in The Netherlands.
The success of this Conference demonstrated the value of uniting maritime researchers and maritime policymakers (from business and government), and led to the organisation of the Second Conference on 2-3 June 1994 in Athens/Vouliagmeni. This Conference was hosted by two universities: the National Technical University of Athens and the University of Piraeus.

The 25 papers which will be discussed at the Conference, approach the general theme from the following three perspectives:

* General and business economics: demand, supply, industry structure, freightmarkets;
* Operational and technical innovation in the logistical chains: ships, ports, handling, hinterland transport, control;
* Maritime transport policy and regulatory analysis at the national and European level.

The ultimate purpose of the research is to define strategies for achieving cohesion in Europe through shortsea shipping.

The Conference is supported by the International Committee, and financially by Sponsors, and organised by the Organising Committee. The members are shown on the following pages.

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The role of this Committee is to select the research papers and to recommend policymakers. The Committee also forms the core of the maritime research network which the Conference has established.

The Organising Committee is composed of the following members:

* Assoc. Prof.dr. A. Goulielmos - University of Piraeus
* Prof. dr. H.N. Psaraftis - National Technical University of Athens
* Drs. P. Liebman - Van Ommeren Tankers, Paris
* Dr. P.B. Marlow - University of Wales, Cardiff
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The day-to-day organisation of this Conference was in the hands of: Assoc. Prof. A. Goulielmos, Prof. C. Peeters, Prof. H.N. Psaraftis, Prof. N. Wijnolst

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PHOTOGRAPHIC IMPRESSIONS

The executive committee of the Third Conference, June 1996, Bergen, Norway: Prof. Chris Peeters, Prof. Tor Wergeland, Prof. Niko Wijnolst

OPENING SPEECH

By Mr. G. Katsifaras

Minister of Mercantile Marine

Ladies and Gentlemen,

I wish first to welcome you and wish to all of you a pleasant stay which I am sure will be very much helped by the climate of our country as well as by the setting in which this Conference takes place.

It is true that Greece is the ideal place to discuss about short sea shipping, since in our country this specific sector of shipping is of paramount importance; Greece has 3000 islands of big and small size and the total length of Greece coastline almost equals that of all other countries of European Union.

Due to this particular geography, short sea shipping is the one modality which provides regular transportation between distant and isolated islands with the mainland of the country and links them either with the mainland or directly with the rest of the European countries.

In any case, short sea shipping development is not merely a question involving Greece. It involves all countries of European Union, the rest of the European countries as well as those at Near and Middle East and North and West Africa. Short sea shipping is also covered by the fact that sea transport, covering either a short or a long distance, has been and still is of major importance for the European and the international economy.

We should not forget that the Community has a share of 1/5 of total world trade and also that more that 90% of her import and exports is transported by sea.

Short sea shipping helps to eliminate congestion in land transport routes in road and railroad lines and protects the environment, these associated with the fact that Short sea Shipping has a better cost benefit ratio and is more economic due to ship's low energy consumption.

All this leads to the conclusion that short sea shipping is of crucial importance for the development of international trade in particular for the development of community's trade.

Ladies and Gentlemen,

In my view, when I speak about transport in the European Continent, I'd like to take into account certain special characteristics such as the great number of states having access to the sea, the existence of a wide waterway network and the fact, that a vast majority of industrial areas are located relatively close to the sea. The overall approach proposed for transport development in the Community's "White Book", as you all know, takes into consideration these parameters.

What is left is to consider possible solutions to problems which, no doubt, exist. These solutions should aim at, inter alia, the integration of important European ports in the Transeuropean Transport Networks, the increase of ports operational efficiency by carrying out port infrastructure development projects, which should be financed and by Community sources, the gradual elimination of all such bureaucratic procedures that prolong ships stay at ports, the development of electronic data interchange systems and last but not last the fullest possible integration of the maritime carriage of goods into combined transport.

If above mentioned objectives are accomplished and appropriate measures are taken to improve the quality of pilotage and towage services, and search and rescue services provided by coastal states, the reliability of short sea shipping system will be strengthened, and I believe, this will consequently lead to a much greater increase in cargo shipments, justifying new large scale investments in the field of transport.

I am confident that this Conference, which I open today, will contribute greatly to the appropriate way of finding solutions, and I like to wish you every success.

KEY-NOTE ADDRESS

By Prof. H.N. Psaraftis

National Technical University of Athens

Ladies and Gentlemen,

On behalf of the National Technical University of Athens, let me add my own greetings in welcoming you to Greece.

Taking a look at the program, this conference promises to be even better than the previous one, not only in terms of contents and quality of the papers, but also in terms of the interaction between maritime researchers and maritime policymakers that will take place. But this is something you will be able to judge for yourselves in the course of the next two days.

What I would like to do in my speech is to attempt to highlight some of the challenges for European shortsea shipping in the years ahead.

I think it's fair to say that shortsea shipping is emerging as an important focal point of the transport policy of the European Union.
For one thing, it has become evident that this mode of transport is one of the principal means for alleviating the severe congestion, caused by freight moving on the European road and rail networks.
In addition, as intra-European borders are rapidly being dismantled, and Eastern Europe is gradually becoming more open, shortsea shipping's significance gains an even more prominent role, and its potential in enhancing the EU's competitiveness, economic and social cohesion, and sustained mobility is very real.
Developments in information technologies and telecommunications have significantly increased the potential for efficient intermodal transport, which opens new horizons for shortsea shipping.
A number of official documents (such as the Maastricht Treaty, the Commission's White Paper on a common transport policy, and the Maritime Industries Forum report to the Commission, among others) highlight, either directly or indirectly, the importance of shortsea shipping as an instrument to achieve some of the broad policy goals of the European Union.

The role of shortsea shipping is multi-dimensional, and may include any or all of the following functions:

1. Relieving the European land-based networks (especially road) from congestion;

2. Decreasing the average unit cost of intra-European transport;

3. Promoting the overall European trade competitiveness;

4. Maintaining vital transport links for passengers and freight in Europe's peripheral and less developed regions;

5. Facilitating the integration of the Easter European transport systems within the broader European economy; and

6. (last but not least) Providing an environmentally friendlier form of transport for passengers and freight.

And yet, today European shortsea shipping is not yet ready to take on the challenges implied by the recent developments and by the ambitious goals set forth by the European Union. Here is a random list of problem areas that await solutions and constitute challenges.

1. Inadequate infrastructures (particularly in ports and hinterland connections) are serious impediments to shortsea shipping growth.

2. The precise role of shortsea shipping within an integrated Trans-European Network structure is not yet well understood.

3. We don't know very well which cargoes have the greatest potential to be shifted from land to sea, either geographically, or commodity-wise.

4. The potential role of fast ships in shortsea shipping is not well fathomed, either for passengers or for freight.

5. It is still not clear exactly how shortsea shipping can influence the development of Eastern Europe.

6. In many areas, providing competitive shortsea transport while maintaining adequate level of service to less developed regions is a difficult problem to solve.

In Greece, and as our coastal shipping market becomes deregulated in 2004, the last problem is one of the main challenges of the next decade.

The list of problem areas in shortsea shipping is really open. Notice that although some of these problems are "new problems", (such as for instance the

whole issue of Trans-European Networks, or the issue of fast ships), there are also "older" problems (such as the infrastructure problem) that have been here for some time, and are likely to be with us for some time to come.

The interesting fact is that the appearance of the new problems has made the older problems more complex. The new European environment and the latest technological advances have certainly added to the complexity of the more traditional problems. The new world is more exciting, but also more complicated.

All the problem areas described earlier are diverse, but they have some common features: Many of them are new problems, many are not well defined, and most of the problems are interconnected. In addition, it's clear the new game will be played with more players: Shortsea shipping will have to interact effectively with the other modes of transport and with telecommunications networks if the very concept of a Trans-European Network is to succeed.

Unfortunately, there are no obvious solutions to all these problems. If there were, life would be so much easier (and less exciting). So the determination of viable solutions will be a very challenging task.

It would be unfair to expect that the shortsea shipping community should have "off-the-shelf" solutions for all these challenges. It will definitely take some time to *formulate* these problems, let alone solve them.

Addressing the entire spectrum of challenges in shortsea shipping is a monumental task. It calls for (among other things) significant R&D to determine policy priorities in this area. For such as the MIF and various conferences (such as this one) are dealing with many of the relevant issues. Much of the necessary R&D will be sponsored by the Commission, within the 4th Framework Programme. Individual member states are also sponsoring related programs.

Speaking of "problems" (or challenges), I want to mention one additional issue that is specifically related to R&D in shortsea shipping. This is very serious and concerns the general lack of reliable and standardized data. In order to do any serious analysis, one needs data that is readily available and is dependable.

Unfortunately, and although a lot of shortsea shipping data *is* available, the sources are diverse, some of the data is not in the form needed, databases are heterogeneous, and a lot of data simply does not exist. The unenviable task of collecting good data for R&D is usually left to the analyst himself.

Since the GIGO principle (garbage in, garbage out) is always true, it seems to me that in view of the significance of the R&D that will address problems in European shortsea shipping, establishing reliable databases should be viewed as an issue of top priority. The cost of doing so many be significant, but I submit that the cost in inaction (that is, having the wrong conclusions because of bad data, or no conclusions because of no data) must be several orders of magnitude more. Europe cannot afford such an outcome.

The theme of this conference is "strategies for achieving cohesion in Europe through shortsea shipping". In several official documents (most notably the Maastricht Treaty) the term "cohesion" is viewed in its social and economic meaning.

Cohesion will make sure all parts of the European Union are efficiently and effectively connected, so that sustainable mobility can be achieved. This issue is important enough for the less developed regions of the Union, that special funds are earmarked to help achieve this goal. Shortsea shipping is expected to play a big role in that regard, as many papers in the conference will point out.

Now if instead of a physical transport network we consider a different kind of network, and more precisely, the *maritime research and policy network*, the world "cohesion" obtains a different (and rather interesting) meaning.

Cohesion in this new network means that ideas from all parts of the network can be exchanged effectively, that discussions can have fruitful results, and that research is not done for its own sake, but in connection to specific policy priorities.

It also means that a cross-fertilization of ideas will take place, and that joint efforts will be undertaken.

This is, after all, what the purpose of a forum such as this is about. To move away from the fragmented, isolated practices of the past, and toward a cooperative and multi-dimensional process, encouraging interaction and discussion.

Our generation of maritime researchers and policymakers has a unique blessing. We live in a period of profound change, unheard of several years ago. As we are off to move into uncharted territory, we will have the distinct privilege of actively participating in the metamorphosis of the system.

The shortsea shipping community must seize this rare opportunity with determination, and a sense of historic responsibility.

I hope you enjoy the conference.

Thank you very much.

CLOSING SPEECH

PROSPECTS AND CHALLENGES OF SHORTSEA SHIPPING

By Dr W. Blonk

Director, Maritime Transport and Ports, Directorate-General for Transport,
European Commision

Mr. Chairman,
Ladies and Gentlemen,

It was for me a pleasure to accept your invitation to speak to you on this oc-
casion. I have witnessed the success of the 1st of these Research Roundtables
in 1992. One can never stress too much the important role that conferences
bringing researchers, industries and policy-makers together play in helping the
development of maritime transport. The Commission therefore reiterates its
support for events aimed at discussing the potential for the development of
short sea shipping.

Before I turn to the subject of my address, "Prospects and Challenges of Short
Sea Shipping", I would like to stress that the timing of this conference is ex-
tremely appropriate. Important decisions at Community level concerning
research and development matters are being taken and priorities established.
The 4th Framework Programme of R & D will hopefully give a boost to the
development of new maritime transport technologies. In comparison with the
needs the resources are scarce and must therefore be used in an optimal man-
ner. This implies:

* Discussion with researchers and the industries to establish the right
  priority areas for research; and

* Guidance by policy-makers in order to avoid overlapping in research
  projects and waste of resources.

In more general terms, transport has, over the last few years increasingly been
considered as an important aspect of the European Community's economic
policy. The Community transport policy, and in particular maritime transport, is
indeed at a crucial turning point.

One of the recurrent themes of conferences and workshops held in the last few years has been the need to have strong European Community guidance in transport matters. Many efforts have been made by the Commission to establish a comprehensive Common Transport Policy. A further boost was recently provided by, on the one hand the Maastricht Treaty, and on the other the completion of the internal market.

The main guidelines laid down in the Treaty on European Union as far as transport is concerned can be summarized as follows:

* The Commission to assist the Member States in establishing trans-European transport infrastructure networks;
* Transport policy to contribute to economic and social cohesion and to provide for increased industrial competitiveness;
* Contribution to sustainable mobility;
* Commitment to integrate environment protection objectives into transport policy and to favour the development of environmentally friendly modes of transport; and
* The principle of subsidiarity to be fully taken into account.

In December 1992, the Commission issued its White Paper on "The Future Development of the Common Transport Policy". The White Paper's analysis derives from three strong trends:

* The growing demand for transport services (both freight and Passengers);
* The increasing imbalance between the different modes (road transport has doubled its market share in the last 20 years);
* The stagnation of investment in transport infrastructure (which has fallen from 1.5% of GDP to 1%).

The convergence of these trends resulted in congestion and environmental damage, especially in the central regions of the Community. These problems shall be tackled through a strategy of "sustainable mobility". This implies making transport services safer, more efficient and more environmentally friendly.

Therefore, the White Paper clearly indicates the need for promoting *short sea shipping* and thus the shift of cargo from the land modes to the maritime mode, in a non-mandatory and non-artificial way. The general principle will be that the initiatives or actions to be taken should not lead to artificial advantages for short sea transport compared to the other modes of transport. Distortions of competition should be prevented as much as possible.

The European Maritime Industries, brought together in the framework of the Maritime Industries Forum, also recommended the establishment of a clear-cut policy strategy at Community level for promoting short sea shipping. The Com-

mission has, on several occasions, welcomed the constructive work carried out by the Forum, especially its short sea shipping panel.

My presentation today will therefore focus mainly on the prospects and challenges of short sea shipping as we see them in Brussels.

INTRODUCTION

Short sea shipping has a number of advantages, well known to all of you, as compared to other modes of transport:

* A relatively good safety record despite the publicity given to recent accidents;
* It is, along with inland waterway transport, more environmentally friendly and energy-efficient than the other modes;
* There is spare capacity available in shipping and, generally speaking, in most ports it would not be necessary to invest substantially in infrastructure in order to accommodate increased demand;
* Its further growth could stimulate the development of remote and peripheral regions;
* It indirectly also contributes significantly to the development of the European shipbuilding sector.

There are, however, a number of obstacles which are hindering the further development of short sea shipping, which you are also certainly aware of:

* There are a number of problems in some ports which create delays. These include the lack of infrastructure and connecting links to the hinterland, cumbersome documentary and procedural requirements and restrictive labour practices and labour disputes;
* Port charges are quite high in some ports, particularly in southern Europe;
* There is insufficient integration with other modes in the transport chain and short sea shipping can have difficulty in meeting "just-in-time" requirements;
* Transit times also tend to be longer than those of other modes of transport;
* Short sea shipping also suffers from a somewhat old-fashioned image as short sea services have not been marketed very efficiently and shippers are often not aware of the full range of services available;
* The lack of reliable statistics is a barrier to effective policy-making and the identification of potential new markets.

The combined effect of these and other obstacles and competitive disadvantages discourages the use of short sea shipping. It is, however, essential to achieve a more appropriate modal split in line with the principle of sustainable

mobility. This means helping, in a non-artificial way, short sea transport to compete for traffic held at present by congested land modes. It also means favouring a market-oriented allocation of new traffic originated by a foreseeable increase in transport services expected in the coming decade.

THE COMMISSION'S POLICY LINE.

The Commission will in the near future present a Communication on short sea shipping to the Council and the European Parliament. This will incorporate an action programme of recommendations addressed to the Member States and the maritime industries, along with proposals for actions which can best be undertaken at Community level in respect of the principle of subsidiarity. Some of the initiatives which are intended to favour short sea transport relate to subjects such as those which I will now address as comprehensively as possible.

ROLE OF PORTS IN TRANS-EUROPEAN NETWORKS.

More than 90% of the Community's external trade and approximately one third of the trade between Member States is carried by maritime transport. Between 1980 and 1990, seaborne world trade increased from 2.6 billion tonnes to 4 billion tonnes. The amount of goods loaded at EC maritime ports rose from 1.6 billion tonnes to 1.8 billion tonnes.

Ports provide maritime transport with access to land networks and vice-versa. No other points in the transport chain have to operate at the same time with so many interfaces and with so many different modes.

Maritime shipping is an important part of the common transport system in its own right. It constitutes in many cases the main section of the total journey and helps cohesion by providing the links to islands and remote regions. This is why the inclusion of maritime and sea-river ports in the trans-European network guidelines is vital.

The Commission has recently submitted to the Council and the European Parliament a proposal for a Decision on the development of a trans-European transport network. This envisages the development of a single transport infrastructure network integrating individual modal networks according to their comparative advantages. In so far as it relates to maritime transport it concentrates largely on ports. However, the draft Decision does not provide for a network of ports. Instead, it focuses on port and port-related projects of common interest conforming to a set of specific criteria established by the Commission.

THE PROJECTS COVER:

* Improvements in access to the port from the sea or inland waterway, e.g. arrangements for maritime access channels, dredging programmes, navigational aids;
* Improvements in port infrastructure inside the port areas, e.g. new quays;
* Improvements in inland transport infrastructure within the port area, e.g. new roads, railways, bridges and tunnels, or better inland navigation arrangements; and
* Better inland transport infrastructure to sections of the trans-European transport networks.

The criteria provide that the projects should in general aim at:

* Facilitating trade;
* Helping to relieve congested land corridors and reducing the external costs of European transport; and
* Improving accessibility and strengthening economic and social cohesion in the Community.

The Maastricht Treaty provides for Community support for projects of "common interest" financed by Member States. This will be done by way of loan guarantees, interest rate subsidies or support for feasibility studies. Any support for port projects from the trans-European network budget line will be limited to *exceptional* cases only. Specific projects may be co-financed, if funding is requested, under the Cohesion Fund in the 4 eligible countries (Greece, Ireland, Portugal and Spain). Financial support from the Regional Funds can also be made available for the implementation of port projects.

These type of port and port-related projects can often be identified and carried out in less time than is generally the case for major projects associated with other modes of transport. Relatively small projects can often have a disproportionately large impact on transport development.

We therefore firmly believe that the implementation of port projects considered of common interest will stimulate a greater use of short sea shipping in Europe. It will without any doubt improve the efficient flow of goods through the ports. It will also enable ports to compete more effectively for hinterland traffic and so help reducing land journeys.

In this context, the Commission intends to extend the port element of the transport network guidelines concept to sea-river ports. Community financial assistance will be made available for sea-river port projects on the same basis as for sea ports.

ACTION ON PORTS

Port tariffs are sometimes set artificially high. They are not always transparent. Port authorities should ensure that tariffs charge only for services actually required and rendered. They should also follow a "user pays' principle with all tariffs clearly identified and transparent. This lack of transparency could hide the granting of state aids, which may distort competition.

The Commission launched a study on transparency of financial relationships between public authorities and ports. It provides recommendations on how these relationships can be clearly identified in port accounts and compared between ports. Consultations on these recommendations are now taking place.

As far as state aids to ports are concerned the Commission has its own responsibility. It is currently drafting guidelines specifically on this sector. These will allow the Commission to decide clearly which state aids are in the common interest and which are not. Before adopting these guidelines the Commission services will consult the industry (mainly port representatives) and Member States.

In some ports a number of restrictive practices do not favour the improvement of efficiency. Apart from that, they are contrary to the principles of the freedom to provide services and of free and fair competition. The Community has legal possibilities open to it for redressing situations of restrictive practices in ports. A study on port operators monopolies now nearing completion will assist the Commission in developing its views in this area.

A significant obstacle to the further development of short sea shipping is the complex documentary and administrative procedures in the ports. We believe that requirements should be restricted to the minimum necessary, be the same everywhere in the Community and not discriminate unfairly between modes of transport. The Commission intends to launch a fact-finding study on this subject in order to determine precisely what the requirements are and propose changes where appropriate.

It is obvious that improving the efficiency of ports is of vital importance to the reliability of short sea shipping. To start with, an identification of the specific problems in ports may best be undertaken through informal structures, such as "round tables". These "round tables" should be set up, in the first instance at local or regional level and, where appropriate, be extended to the national level. They would bring together port authorities, customs, shipping agents, stevedores and terminal operators, shipowners, shippers, etc.

The Commission will also help the industries by supporting experts visits to ports in peripheral regions aiming at identifying problems arising in ports and

proposing solutions. It will also support training programmes for managers of ports in less favoured regions to gain experience of port management in highly developed ports in other parts of the Community.

NEW MARITIME TRANSPORT TECHNOLOGIES

Here we are thinking of facilitating the interchange between short sea shipping and other transport modes, which will raise the level of efficiency of short sea transport. This may require better ship designs, including self-loading and self-unloading vessels, automated cargo handling, etc. The acceleration of berthing and unberthing operations is of course another element which can lead to time-saving. Technical innovation could allow short sea shipping to respond in an adequate manner to the "just-in-time" concept. It could also further improve its environmental advantages, by means of work directed to energy savings, waste management systems, new materials for shipbuilding, alternative sources of energy, etc.

These are of course areas of activity in which most of you are experts. I hope that the Commission will be able to assist in developing the research projects which I believe some of you already have in the pipeline.

To be effective, R & D should be directly linked to clear policy aims. As far as the maritime sector is concerned, these policy aims have been defined in the White Paper:

* Enhancement of the competitiveness of the European shipping sector;
* Development of short sea shipping;
* Improvement of safety; and
* Increase in ports efficiency.

A major focus of the specific transport programme part of the 4th Framework Programme of R & D will be on the needs of short sea shipping. A total budget of 240 million ECU will be allocated to research in transport matters. Of these, approximately 50 million ECU will be made for maritime transport.

In this context, the Commission organized a maritime transport workshop in October 1993. The aim was to identify priority research areas for waterborne transport in the context of the 4th Framework Programme. The working group on short sea shipping identified a set of areas where research could play an important role in stimulating the development of this mode of transport. The Commission will to a very large extent take into account the results of the workshop.

The specialized Panel on short sea shipping of the Maritime Industries Forum has also recently put forward recommendations for action on technical concepts in the area of short sea transport. These include the following areas:

* The adaptation of the various types of cargo carrying units to the necessities of their optimal intermodal utilization;
* Optimization of berthing/unberthing procedures in terms of automation and time saving;
* Optimization of loading/unloading procedures in terms of automation and time saving with the emphasis on the most widely used cargo carrying units;
* Design of suitable vessels fulfilling the specified requirements; and
* Development of port equipment and infrastructures and of Information Technology-based logistic systems.

Research and development projects in these areas will start being developed as shared-cost actions in the very near future.

The Community has recently approved a specific budget line to bridge the period between the EURET programme and the forthcoming transport actions to be supported under the 4th Framework Programme. Calls for tender concerning a set of planned waterborne transport studies have recently been launched. The studies will be initiated in the course of this year. They concern the following issues:

* Vessel Traffic Management and Information Systems (VTMIS);
* Human resources;
* Structure and organisation of maritime transport;
* The supply and demand sides of short sea shipping;
* The impact of changing logistics on maritime transport;
* The relevance of information and communication technologies for shipping;
* Inland waterway transport system.

DEVELOPMENT OF SEA/RIVER POTENTIAL

Sea/river vessels enlarge the range of coastal shipping considerably and give a number of industrial centres located inland direct access to maritime transport. The Commission has recently initiated a study to examine the market structure of sea/river transport on the main European inland waterways. As I mentioned before, the Commission will include projects of common interest relating to sea/river ports in the trans-European transport network exercise.

ELECTRONIC DATA INTERCHANGE (EDI)

It is widely recognized that EDI can play an important role in improving the efficiency of customs and administrative procedures. It facilitates the flow of cargo, promoting the efficiency and reliability of short sea shipping and its links to other modes. It can also assist in providing fast and accurate information and so contribute to maritime safety by way of speedy notification of dangerous goods.

The MIF decided to set up a specialized panel on EDI starting in January 1994. The panel will conclude its work by the end of the year with the submission of a final report which will include recommendations to all parties involved. The Commission has already launched a number of studies in this area and will undertake further initiatives in the near future with the aim of promoting EDI within the maritime industries.

PILOT SCHEMES AS A MEANS OF PROMOTING SHORT SEA TRANSPORT

The setting up of new short sea shipping or new land/sea services involving long sea journeys may require studies to establish their potential viability. Other forms of pilot actions may also be efficient tools for promoting short sea transport. The Commission therefore intends to make funding available, on a co-financing basis (preferably 50-50%), to support such pilot schemes. These would include inter alia feasibility studies on specific routes, promotion of the transfer of know-how between ports, promotion of cooperation between small and medium-sized short sea shipping companies and assistance in implementing EDI systems in ports. Two projects have already been supported in the past on an ad-hoc basis.

STATISTICAL DATA

It is generally considered necessary to assess the market potential of short sea shipping. One of the main tools for this are comprehensive and reliable statistics. The Commission is at present preparing a proposal for a Council Directive to improve the provision of statistical data concerning maritime transport in general. The adoption of the proposed Directive should provide for an improvement of both the quality and the availability of statistics on short sea shipping. A study concerning statistical information on intra-Community seaborne trade will be launched soon.

SUPPORT FOR MARITIME TRANSPORT IN CERTAIN THIRD COUNTRIES

The Commission believes it is important to promote short sea transport links with Central and Eastern European States and with other countries such as Mediterranean or Black Sea countries. At a time when fundamental decisions concerning transport policy in these countries can be expected, it is essential that short sea shipping is fully taken into account.

The Ministerial Conference on transport matters in South-Eastern Europe (Black Sea) held in October 1993 agreed on the creation of a working group on waterborne transport. The aim is to debate pragmatic solutions for problems in this sector arising in the Black Sea countries. The group will possibly start its work in the course of 1994. In the near future similar working groups for the Mediterranean and Baltic Sea areas could also be established.

In April this year, the Commission organised a workshop for high level decision-makers from the 11 countries forming the Black Sea Economic Cooperation. This was a first concrete step to help establishing sound relations with policy-makers from these countries. It aimed at discussing the Community's maritime transport policy and the functioning of ports and the maritime industries in a free-market environment. The workshop proved to be very successful and the appropriate follow-up is being considered. Another workshop will possibly take place in Romania in September 1994.

In this context, the Commission will have in mind the promotion of short sea transport when these countries request support for transport projects or studies. Community support for feasibility studies and port master plans will take account of the importance of developing short sea links with the Community.

The Commission will launch a comprehensive study on port development in the Black Sea area. This will include an assessment of the shipping and port facilities of the countries concerned. Similar initiatives could be launched in the Mediterranean and Baltic Sea areas.

CONCLUSION

We have recently witnessed a number of important interrelated events:

* The completion of the internal market
* The agreement creating the European Economic Area; and
* The transformation of Central and Eastern European countries into market economies.

These developments will promote intra-European exchanges: within the EC, within the EEA and with the rest of Europe. There is no doubt that this will increase the demand for transport services and therefore provide a stimulus for the waterborne modes of transport. The Commission is therefore convinced that short sea shipping will play an important role in the achieving of an integrated transport system.

All transport users should nevertheless realize the need to adopt a new approach towards the waterborne modes of transport. We in the European Commission are making our best endeavours to also favour a more efficient integration of all modes of transport.

Efforts have already been made to broaden the concept of combined transport, but we realise that a more practical approach is necessary. It should not be forgotten, in particular by policy-makers, that combined transport was invented by liner shipping. Maritime transport operators are indeed great users of road, rail, inland waterways as well as combinations of these modes.

In conclusion, I would like to reaffirm the determination of the Commission to help promote the further development of short sea shipping. This derives from its conviction that this mode will play a significant role in the Community strategy of sustainable mobility. It is the Commission's desire to take practical measures to this end.

Mr. Chairman,
Ladies and Gentlemen,

Please allow me to say that I found the papers presented at this conference and the resulting discussions extremely interesting. This event has been another significant stepping-stone in the on-going process of elaborating a strategy for the promotion of shortsea shipping.

Thank you very much for your kind attention.

SUMMARY AND RECOMMENDATIONS

EUROPEAN SHORTSEA SHIPPING:
TOWARDS THE 21st CENTURY

By Prof. C. Peeters, Prof. A. Verbeke and Drs. E. Declercq

1   INTRODUCTION

The first European Research Roundtable, Conference on Short Sea Shipping (Delft, 26-27 nov. 1992) identified the requirements to be fulfilled for the efficient integration of Short Sea Shipping (SSS) into the European transport network. The Delft Conference focussed primarily on the technical characteristics of SSS. It led to a paradoxical policy conclusion which has since then been called the 'Delft Paradox'. On the one hand, many experts expressed the need to achieve economies of scale in terms of larger SSS vessels, higher capital investments in ports and a concentration of traffic flows on a limited number of routes within the major European transport corridors. Simultaneously, a number of other experts expressed their concerns regarding the hinterland transportation problems that would arise if such a concentration of SSS-traffic would actually take place. These experts also argued that a concentration within a limited number of ports would exacerbate the major weaknesses of SSS as compared to road haulage, namely its long transportation time, insufficient frequency and unsatisfactory reliability.

The latter view was shared implicitly by the European Commission and expressed in the European Union's (EU) white paper on 'The future development of the Common Transport Policy - A global approach to the construction of a Community framework for sustainable mobility' (1992)[1].

Nineteen hundred ninety two has been a milestone in the development of a Common Transport Policy (CTP) in the EU. The main goals of the renewed CTP

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[1]Commission of the European Communities: *The future development of the common transport policy: A global approach to the construction of a Community framework for sustainable mobility*; Bulletin of the European Communities, Supplement 3/93. This document was based on COM(92) 494 final.

are related to the pursuit of sustainable mobility and include the following elements:

* The continued promotion of efficiency of the internal market, in which a free movement of goods and persons is assured throughout the Union;
* The removal of existing (artificial) barriers, to achieve an integrated and coherent transport system, making use of the best available technology;
* The strengthening of economic and social cohesion; the CTP aims to reduce disparities between the different regions and to link islands and peripheral regions with the more central regions of the Union;
* The development of a CTP that takes into account the impact of transport on the environment by minimizing related negative effects and/or by focussing on environment friendly transport modes such as SSS and Inland Water Transport (IWT);
* The development of good relations with third countries and efficient connections with the East European and the EFTA-countries; as was clearly stated in the Commission's Proposal to the European Parliament and Council (COM(94) 106 final), one of the objectives of the CTP is to allow the extension of the trans-European networks to the networks of the EFTA Member States, Eastern Europe and the Mediterranean countries, while simultaneously promoting inter-operability and easy access to these networks (Decision Section 1: Article 2.2).

Policy concerns regarding the protection of the environment will lead to both a relative reduction of road haulage and the promotion of environment friendly transport modes to absorb the expected increase of commercial transport in the Union[2]. Environment friendly modes of transport such as SSS and IWT have only recently been fully recognized as a useful alternative for commercial transport given a number of logistical constraints related to time, efficiency and transportation costs. Within the framework of a European Transport policy, the expansion of SSS should therefore not be limited to the main traffic corridors in the EU. The integration of SSS and IWT into existing transportation chains is a very important condition for their further development. This integration is required to fully exploit the potential of both modes as regards 'just-in-time' (JIT) and 'in-time' (IT) concepts.

However, this urgently needed integration requires more than the mere introduction of innovative ship designs or new on-board techniques for transhipment[3].

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[2]See for example: COM(90) 218 final, June 27, 1990: *Green Paper on the Urban Environment*; COM(92) 46 final, February 20, 1992: *Green Paper on the Impact of Transport on the Environment*.

[3]See e.g. N. Wijnolst, H.B. van der Hoeven, C.J. Kleijwegt & A. Sjöbris : *Innovation in SSS : Self-loading and -unloading unitload Shipsystems, S-Curve Shifts in the Handling of Unitloads*, Delft University Press, Delft, The Netherlands 1993 ; See also several articles in N. Wijnolst, C. Peeters & P. Liebman: *European SSS: Proceedings from the First European Research Roundtable Conference*

Ports and inland terminals for the transhipment of goods also play a major role in the development of an integrated 'water-based' transportation network that is competitive with road haulage.

2   THE ROLE OF PORTS IN THE DEVELOPMENT OF EUROPEAN SSS: RESOLVING THE DELFT PARADOX

Ports are important parts of the TEN, and are vital to the operation and prosperity of all parts of the Union. They provide the essential interface between land and maritime transport[4]. Maritime transport carries over 90% of the Union's trade with the rest of the world (deepsea), some 35% of the trade between Member States and a substantial amount of domestic trade. In 1987, ports in Western Europe handled more than 2.800 million tons. The deepsea traffic (transoceanic) represented 43% and shortsea shipping, 31% between Member States and 26% within Member States[5]. Port traffic is expected to increase with 23% over the 1993 figures by 2010, and the increase of container traffic could amount to 160% over that same period.

Ports also play an important role in the further development of intra-European (SSS) cargo flows. Each port, independent of its size, should be considered a possible transboarding point that can assist in the further expansion of SSS in European transport. Although it is not considered advisable, within the framework of the TENs, to focus explicitly on a limited number of larger ports for the further development of SSS, the role of these mainports should not be underestimated either. In a number of cases, a concentration of SSS-traffic in the mainports could lead to additional or new bottlenecks in their hinterland connections, and thus reduce the potential of the SSS-operators to provide reliable door-to-door services, competitive with road haulage. Nevertheless, mainports remain the most important linkages between the Union and the rest of the world. They have a substantial potential to develop new SSS-feeder services.

The role of specific ports in the Union can be important for the functioning of both shipping and the land-based transport modes, see **Figure 1**. The mainports

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on SSS, 26-27 November 1992, Technical University Delft, The Netherlands, Lloyd's of London Press, London, 1993.

[4]European Commission, COM(94) 106 final, p 24.

[5]European Commission, COM(94) 106 final, p 24; The Future Development of the Common Transport Policy, Bulletin of the European Communities, 3/93, p 6; Mr. F. Morales, Head of Unit, European Commission, DGVII - Transport Ports and Common Transport Policy in: St Petersburg Report (1993), Special Issue on Transport and Communications, Ministry of Transport and Communications of Finland, Documents and Commentaries for Business 2:1994 p 19-21.

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in *quadrant 1*. They all contribute substantially to the efficient development of both shortsea and deepsea traffic, and to the efficient functioning of the land-based transport modes. Although no 'Ports of Community Interest' have been identified so far by the EU, it is clear that mainports are crucial as starting and end points of the major routes in the framework of land-based transport networks, given their economic efficiency, i.e. their scale, scope and clustering advantages. Many medium-sized seaports too could play an important role as champions for the development of shortsea shipping networks within the EU. In many cases they also handle some deepsea cargo. Nevertheless, they are located closer to *quadrant 3*, given the lower absolute volumes of cargo that pass through them and that must be transported from and to their hinterland, which is mostly much more restricted than that of the mainports. In contrast, a number of other smaller ports could be placed in *quadrant 2*, to the extent that they could play the role of 'hinterland decongestion champions', i.e. fulfilling the role of a 'mainport' for specialized traffic categories that need to be transported relatively deep into the hinterland. The main contribution of such ports in terms of economic efficiency is precisely in the area of the land-based transport modes.

Figure 1: The role of ports in European transport

Finally, ports in *quadrant 4* cannot contribute to an increased efficiency neither in the maritime nor in the land-based component of logistic chains in the EU, because they are ports sheltered from competitive pressures by domestic support or because of the choice of their niche (e.g., fishing industry, leisure).

The development of SSS services on smaller routes requires the existence of ports that could simultaneously act as SSS traffic development champions and hinterland decongestion champions. As a result these ports would also be positioned in quadrant 1 in spite of their smaller size. These ports should cooperate closely among each other to provide SSS services, competitive with long dis-

closely among each other to provide SSS services, competitive with long distance road haulage. In most cases, ship operators in these smaller ports do not have the necessary resources or the entrepreneurial drive to fundamentally alter the relative competitive position of SSS. The focus of these smaller operators is mostly limited to the shipping part of the transport service, i.e., the port-to-port link. Given this limited interest in extending their services in order to provide full door-to-door services, initiatives need to be taken at the port level. The analysis above explains the existence of the 'Delft Paradox': in the present institutional context, only the mainports, large shipping companies and major decision makers in the industrial and commercial world, who decide upon the structure of logistical chains, can fundamentally improve the competitive position of SSS in Europe. In this view, only a minimum efficient scale can guarantee economic success. However, if the institutional context is altered, e.g., by support of the EU for establishing consortia of smaller ports to act as SSS-development and hinterland decongestion champions, then this may also greatly improve the role of SSS. The Delft Paradox thus reflects the need for a 'dual track' approach towards the expansion of SSS.

In that context, several authors at the Second European Research Roundtable, Conference on SSS (Vouliagmeni, Athens, 2-3 June 1994) proposed measures to stimulate entrepreneurial schemes by smaller operators and ports. A. Wierikx and J. Van Riet[6] argued in that respect that 'system SSS'- services have a promising future and suggested that '... a move towards more dedicated services for a smaller number of customers seems to be the best strategy.' (p 357) The authors suggested, however, that the best perspectives for smaller ports will be offered by a new segment, which they called the 'dedicated-system segment'. This segment would include ' ... vessel operating companies [that] operate networks of shipping services with additional logistic activities.... The service the operators sell to the shippers is not based on a port to port vessel operating service but on a door-to-door logistic service' (p 358). R.J. Martens[7] argued in his paper for the creation of a 'Bureau SSS' which '... could play an active role in conveying the right messages...' (p 201). This 'right message' is, according to this author, a corridor organization with offices on both sides of the transport corridor, assuming responsibility for the total door-to-door transport process (p 199).

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[6]A.A.C.M. Wierikx & J. van Riet *Strategic Profiles for Transport Companies: The case for Dutch Forest Product Carriers*, Conference Papers pp 337-360.

[7]R.J. Martens *SSS: Via Optima*, Conference Papers pp 189-203.

C. Peeters, A. Verbeke & E. Declercq[8] proposed in one of their policy recommendations, the creation of port pairs as SSS traffic development champions. These 'port pairs' should set up a local consortium of interested partners. The local consortium at each end could then form an international, internodal network (p 420). A very important function of these 'port pairs' would be to set up an appropriate standardized EDI system in order to efficiently link the different economic actors involved in international transportation, e.g., cargo owners, export agents, export haulers, shipping companies, counterpart agents, import haulers, receivers of goods, financing institutions etc (p 421). The authors therefore suggested the creation of homogeneous EDI-standards through an EDI-development package for ports and multimodal terminals. Their idea is that feasibility studies and other research projects supported by the EU to stimulate SSS on specific routes should be funded in cases where two (or more) port authorities are involved at the outset of the project (p 420).

However, during the Second Research Roundtable, the issue of government support for stimulating SSS-development in Europe led to a new paradox, which has been named the Vouliagmeni Paradox.

3   THE VOULIAGMENI PARADOX

The Vouliagmeni conference on SSS led to the conclusion that feasibility studies and pilot projects could contribute greatly to an expansion and increased efficiency of SSS, but that all these projects should be economically viable in the long run. This view was made explicit by Dr. W. Blonk, Director of DG VII.

In his closing speech, Dr. Blonk expressed the hope that the 4th Framework Programme will stimulate the development of new maritime transport technologies[9]. In order to effectively allocate the scarce financial resources[10], the research programme should be carefully monitored in order to avoid over-

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[8]C. Peeters, A. Verbeke & E. Declercq: *The Future of European Policies for SSS*, Conference Papers, pp 409-431.

[9]Dr. Wim A.G. Blonk *Prospects and Challenges of Short Sea Shipping*; keynote address at the Second European Research Roundtable Conference on Short Sea Shipping, 2-3 June 1994, Athens/Vouliagmeni.

[10]Within the Framework of the 4th Research Programme, a total budget of approximately 240 million ECU is foreseen for transport-related research, of which 50 million ECU will be allocated to maritime transport.

lapping research projects. A discussion with both researchers and the SSS-industry should be conducted in order to identify priorities[11].

The White Paper on 'The Future Development of the Common Transport Policy', already clearly indicated the need for promoting SSS and stimulating a shift of cargo from the road to the sea. The guiding principle is, however, that policy initiatives should not lead to artificial advantages for SSS as compared to the other transport modes. Distortions of competition should be avoided as much as possible. A similar view was put forward by the European Community Shipowners' Association[12]. Drs. T. de Meester emphasized that R&D '... should have a clear *practical aim* and should certainly not become an aim in itself' (*his emphasis*).

The emphasis on the economic viability of projects and the discussion on the role of public policy makers, in particular the Commission, in promoting SSS generated a new paradox at the second conference: the Vouliagmeni Paradox. This new paradox reflects two opposing views which emerged during the con-ference. The opposing views are related to the role of government in the future development of SSS in Europe. A first group of experts argued that a fully liberalized market and free competition would constitute the optimal environ-ment for the further development of SSS activities. They expressed the view that governments had failed and that market forces would provide opportunities for SSS operators to expand their activities and to become more competitive. These experts argued that sufficient research had already been undertaken in the past and that the time had come to act.

According to these experts, SSS already offers door-to-door services, multi-modal and intermodal transport services, but the main problem is that SSS operators do not actively market these services (R.J. Martens, p 196). SSS could therefore be described as re-active, although it is confronted with very active competitors, namely the road mode and in some cases the rail mode. The lack of efficient marketing also contributes to the negative perception amongst shippers and consignees on the maritime sector. Hence, these experts feel that a liberalized market without government intervention would force the SSS-operators to promote their mode more effectively and efficiently. The liberalized market would also improve the service level of SSS in order to compete effi-ciently with the other modes. The ports would play a dominant role in this future development as they would be the first beneficiaries of an increase in

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[11]See also the keynote address of the Flemish Minister of Transport and Telecommunications, Mr. Kelchtermans at the Second European Research Roundtable Conference on Short Sea Shipping, 2-3 June 1994, Athens/Vouliagmeni.

[12]Drs. Th. H. de Meester *Maritime Research Priorities for Europe*; speech at the 2nd European Research Roundtable Conference on Short Sea Shipping, 2-3 June 1994, Athens,/Vouliagmeni.

maritime traffic. In this context, the Maritime Industries Forum (MIF) identified a number of port and port-related commercial prerequisites[13]:

* Easy and safe port access (including availability of navigational aides)
* Round the clock availability of services
* Adaptation and design of ports in order to meet the specific requirements of SSS
* Smooth interface with other transport modes
* Increase of competition within ports
* Greater use of EDI
* Transparency of tariffs
* Establishment of marpol (maritime policy)-reception facilities

According to F.M. Everard and C.P. Boyle, the recent port privatization in the U.K. has led to greater flexibility and a stimulus for ports to use their commercial freedom and entrepreneurship for seeking new trade and implementing new methods. They argue that a liberalized market environment would provide sufficient incentives to overcome obstacles to further growth.

However, the introduction of market driven incentives as the only policy tool to promote the development of SSS was disputed by a number of other experts, who expressed their concerns about the capabilities of smaller SSS-operators, shippers, and ports to develop such entrepreneurial initiatives. This problem was clearly identified in the Corridor Study[14]. In the course of this study, *Policy Research* held informal meetings with a variety of business level policy makers, both from the shipping industry and the ports. The conclusion of these meetings was that neither individual small shipping operators, nor the actors functioning in individual small and medium-sized ports have the necessary resources to initiate innovative SSS-projects. Shipping operators may be very active in providing port-to-port transportation, but mostly show no interest in expanding their services towards fully integrated door-to-door services. In addition, port authorities are mostly only interested in providing services demanded by their own port customers, not in providing new (international) door-to-door services which could be sold to commercial and industrial customers that presently use other transport modes such as road and rail.

Hence, there is a strong need for a strategic master plan for SSS at the level of the EU. Such a masterplan was proposed at the Vouliagmeni Conference in the

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[13]F.M. Everard and C.P. Boyle *The Single Market and the Removal of Obstacles to the greater use of SSS*, Conference Papers, pp 309-315.

[14]Policy Research Corporation N.V.: *Analysis of the Competitive position of SSS: Development of Policy Measures*; 1993, Study Commissioned by DG VII & the Flemish Government, Department of the Environment and Infrastructure.

paper of C. Peeters, A. Verbeke and E. Declercq[15]. This strategic masterplan includes 10 detailed policy recommendations to the EU without which, the competitive position of SSS will not drastically improve.

The Vouliagmeni-paradox is relatively easy to explain: in many cases, there is undoubtedly a need for deregulation and elimination of ineffective and inefficient public intervention at the local, regional, national and perhaps even the European level. On the other hand, public intervention and public signalling are very important, especially on smaller and embryonic SSS-routes.

4 THE FUTURE DEVELOPMENT OF EUROPEAN SSS

The 'Delft Paradox' emerged from the first SSS conference. This paradox reflected the 'dual track' approach required for the strengthening of SSS through both the achievement of economies of scale and the development of smaller ports as SSS-traffic development and hinterland decongestion champions.

The second SSS conference generated the 'Vouliagmeni paradox'. The opposing views reflected in this paradox argued on the one hand that government had failed to stimulate the development of SSS and that it was now time for market forces to take over, and on the other hand that public authorities should intervene to correct market failures. The combination of the different views articulated in the Delft paradox and the Vouliagmeni paradox lead to four possible options to guide the future development of SSS in Europe, as visualized in **Figure 2**.

The first option (quadrant 1) focusses on entrepreneurial, small scale developments within a liberalized market environment. This option seems to be consistent with European policies which promote the integration of small(er) ports and SSS operators into the trans European Networks. This option also reflects the current trend towards liberalization and the principle of free and fair competition[16].

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[15]C. Peeters, A. Verbeke & E. Declercq: *The Future of European Policies for SSS*, Conference Papers, pp 409-431.

[16]See also, e.g. Fernando Aragon Morales, Head of Unit, European Commission DGVII - Transport: *Ports and Common Transport Policy*, St Petersburg Report (1993), Special Issue on Transport and Communications, Ministry of Transport and Communications of Finland, Documents and Commentaries for Business 2:1994, p 19-21.

The DELFT Paradox : SOURCES OF
SUSTAINABLE SSS DEVELOPMENT

The VOULIAGMENI
Paradox : OPTIMAL
GOVERNMENT
POLICY

	SSS - TRAFFIC DEVELOPMENT CHAMPIONS	ECONOMIES OF SCALE
DEREGULATION	1	3
SELECTIVE INTERVENTION	2	4
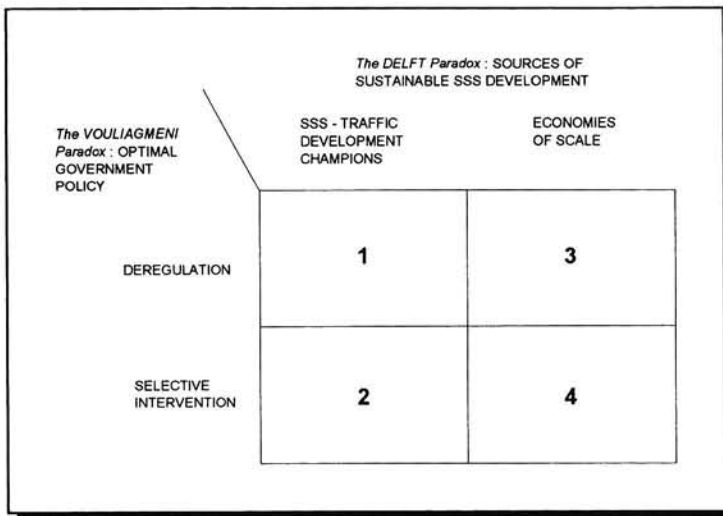
Figure 2: Four options for the development of European SSS

However, the viability of this option is doubtful. It is unlikely that smaller ports and SSS-operators would be able to generate sufficient resources and possess the required entrepreneurial skills for the development of new SSS-services in competition with long distance road haulage. The latter mode mostly benefits from the advantages of being faster, more frequent, more reliable, and certainly more flexible in meeting specific logistical requirements. A market-driven evolution would also be hindered because high quality services would be difficult to maintain in the case of limited cargo volumes on small routes. The requirement to provide door-to-door services, although technically feasible, could possibly increase costs to a level that would force SSS-operators out of a fully liberalized and highly competitive market.

In the second option, government intervention in support of small scale initiatives (quadrant 2) can be either by direct or indirect. Indirect intervention reflects, e.g., a reduction of the competitive advantages of road haulage, such as speed and reliability through traffic restrictions which increase total transportation time (e.g., a ban on weekend-driving or restrictions on access to highways). Direct intervention may include financial support to the SSS-sector. Unfortunately, this option is also faced with substantial implementation difficulties, especially as regards the support of SSS-initiatives. For example, there is a consensus amongst experts that one major bottleneck for the further develop-

ment of SSS is formed by the transhipment activities in ports and terminals[17]. However, '[a]ctive intervention by Member States/Commission to require a modal shift have been unacceptable because of possible distortions of competition. The shipping industry itself is as wary of such intervention as governments' (Everard & Boyle p 311). In many cases, almost 50 % of total costs for maritime shipping activities are port-related so that port efficiency is a key-factor to increase the competitive position of the maritime mode as compared to long distance road haulage. The authors cited above argue that no subsidies should be given but government should provide the necessary regulatory framework in which ports can provide better and more efficient services (p 311). Selective government intervention thus seems to be the optimal solution to stimulate small scale SSS-developments, but taking into account that distortions of competition should be avoided as much as possible.

The third option reflects a focus on economies of scale to be exploited within a liberalized market environment (quadrant 3). Here, it is the responsibility of market actors to provide the necessary resources to stimulate SSS-functioning on the main SSS-routes. In this context, the role of mainports (such as Rotterdam, Antwerp, Hamburg and Le Havre) should not be underestimated. For example, in several mainports, there is still substantial potential for improving hinterland transportation with SSS. It is precisely the combination of deepsea and shortsea activities that should provide the status of 'transeuropean network nodes' to mainports. A limited number of ports handle a high volume of traffic. In the Northern range, these ports are Antwerp and Zeebrugge in Belgium, Rotterdam and Amsterdam in the Netherlands, Hamburg and Bremen/Bremerhaven in Germany and Le Havre in France. In the Southern range, the dominant ports are Barcelona in Spain, Marseilles-Fos in France, Genoa, La Spezia and Trieste in Italy. These ports account for 34% of the Union's total port activities[18]. The port of Rotterdam is an exceptional case because it accounts in itself for 12.5% of total volume and for 34% of the volume of the most important ports.

The dominant ports in the Union are thus central nodes for both shortsea shipping and deepsea traffic flows. They can all contribute significantly to the development of both shortsea and deepsea traffic. Therefore, the third option, with a focus on mainports in a liberalized market environment is undoubtedly a

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[17]See, e.g., T. de Raymond *The setting up of Feedering/ Coastal Services, a solution for the medium sized ports of the Atlantic Arc*, Conference Papers, p 23 (2.4), where highly competitive ports were selected for projects to limit the possible negative impact; R.J. Martens, *SSS, Via Optima?*, Conference Papers pp 202-203; C. Peeters, A. Verbeke & E. Declercq, *The Future of European Policies for SSS*, Conference Papers, pp 419-420 & 427.

[18]*European Seaport Policy*, Marconsult & Ocean Shipping Consultants, Brussels, February 1993, p 74.

viable policy option. Most mainports would reject governmental policies in their commercial activities in any case, which also implies that the fourth option (quadrant 4 in **Figure 2**) is not viable.

The analysis above explains why a selective dual track policy approach is required and why the Delft and Vouliagmeni paradoxes exist. Of the four options identified in **Figure 2**, only options 2 and 3 are viable.

The second option calls for selective government intervention in the case of smaller or embryonic routes. Here, public policy measures, such as the ones described in the paper by C. Peeters, A. Verbeke and E. Declercq[19] can have a major impact on the development of SSS. In addition, the third option is valid for the case of mainports, where deepsea and shortsea cargo flows are concentrated. Here, liberalization and the functioning of market forces should prevail, perhaps only corrected for externalities such as pollution, congestion and lack of safety. It could be argued of course that many intermediate cases may exist, namely in corridors where substantial SSS cargo flows exist or could be generated, but where no actors are operating with the resources and capabilities typical for mainport activities and deepsea transportation. It is precisely here that pilot studies should answer the dual question on the optimal balance between on the one hand scale economies versus entrepreneurial mushrooming, and on the other hand liberalization versus selective government intervention.[20]

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[19]C. Peeters, A. Verbeke & E. Declercq: *The Future of European Policies for SSS*, Conference Papers, pp 409-431.

[20]Various papers at the Vouliagmeni conference discussed either the results of specific SSS pilot projects or suggested alternatives and/or pre-requisites for setting up SSS-initiatives (see, e.g., T. de Raymond: *The setting-up of feedering/coastal services, a solution for the medium-sized ports of the Atlantic Arc*, Conference Papers, pp 12-37; W. Förster, B. Zigic & W. Simon: *Prerequisites for improvements of the shipping in South-East European regions*, Conference Papers, pp 38-55; J. Truau: *Metro-coastal shipping*, Conference Papers, pp 56-74; A. Sjöbris, N. Wijnolst & C. Peeters: *Fast selfloading and unloading unitload shipsystems for coastal and shortsea shipping: potential in North-East Europe*; and G. Trincas, C. Closca , R. Nabergoj & J.S. Papovici: *Futura - a fast ro-ro ship for mediterranean coastal trade*, Conference Papers, pp 253-285).

A number of papers focussed on the development of the optimal environment for developing new SSS initiatives, with a focus either on strategic elements (see, e.g., F.M. Everard & C.P. Boyle: *The single market and the removal of obstacles to the greater use of shortsea shipping*, Conference Papers, pp 309-315; R.J. Martens: *Shortsea Shipping: Via Optima*, Conference Papers, pp 189-203; and J.L.J. Marchal: *Shortsea shipping from hinterland ports by sea-river going vessels: study of the influence of free cabotage policy*, Conference Papers, pp 114-135) or elements which improve SSS operations and multimodal integration (see, e.g., E.G. Frankel: *Integrated tug-barge systems for shortsea shipping in Europe*, Conference Papers, pp 361-377; and L. Clinckers, E. Declercq; C. Peeters & A. Verbeke: *Water-based multimodal terminals: an eclectic site evaluation model*, Conference Papers, pp 204-227).

5 CONCERTED ACTION FOR THE FURTHER DEVELOPMENT OF SSS IN EUROPE

The SSS conference argued that substantial research was necessary to identify the bottlenecks that hinder the effective development of SSS in Europe. A consensus existed among the participants that immediate action should be taken to develop unified database systems (and consequently EDI-applications), and to provide the necessary infrastructure for port-related SSS activities. During this first conference, considerable attention was also devoted to innovations as a means to promote SSS.

In the period 1992-1994 several interesting studies were conducted which could be considered as building blocks for a future European SSS policy. These research projects include inter alia:

* U.K. Department of Transport/ J.L. Packer: *U.K. roads to water initiative* (1991);
* Policy Research Corporation N.V.: *Analysis of the Competitive position of SSS: Development of Policy Measures* (1993);
* Institut Français de la Mer and Associates; *Transports de Marchandises sur les grands Axes Européens-Recherche des Routes Alternatives Terre-Mer* (1993);
* N. Wijnolst, H.B. van der Hoeven, C.J. Kleijwegt, A. Sjöbris *Innovation in Shortsea Shipping: self-loading and -unloading unitload systems. S-Curve shift in the handling of Unitloads*; Delft University Press, the Netherlands (1993);
* N. Wijnolst, A. Sjöbris, C. Peeters, A. Verbeke, E. Declercq, T.J.N. Schmitter *Multimodal Shortsea Transport: Coastal Superhighway. Indispensable and free link in the European Transport Network*; Delft University Press, the Netherlands (1994);
* Esturiales/Catram, Identification of the market potential for the transport of containerized goods in the Atlantic Arc (1993) & feasibility study (1994).

In the study of *Policy Research*, a number of specific policy recommendations to the EU were presented, which also summarize the majority of the recommenda-

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One set of papers dealt with selective policy measures to stimulate the future development of SSS in Europe (see, e.g., T. Kelchtermans: *Introduction to the corridor study*; C. Peeters, A. Verbeke & E. Declercq: *The future of European policies for shortsea shipping*, Conference Papers, pp 409-431; Th. de Meester: *Maritime research priorities for Europe*; and the status report of W. Blonk, Director of the European Commission, DG VII).

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tions, formulated in other studies and papers. They are especially appropriate within the context of the second option (small scale entrepreneurship - selective policy intervention) described in the previous section. The focus is largely on stimulating (private) commercial SSS initiatives, e.g., through pilot projects in which both private and public parties are engaged, preferably on a 50/50 basis, as advocated by Dr. Blonk.

The creation of a positive external environment for SSS could be obtained by implementing several stimulating measures. These measures would facilitate both SSS operations themselves and their integration into broader logistical chains. A first measure is related to the development of European EDI - standards, to be implemented in European ports and (multimodal) terminals. The application of EDI - standards also requires homogeneity of existing market data related to cargo flows, market sizes and trade patterns. The EFTA countries and the East European countries should be involved in this development in order to facilitate the creation of port-to-port origin/destination matrices. This would simultaneously improve traffic flow management and the development of inter-modal transport chains[21].

The use of standardized data and homogeneous EDI-applications will also facilitate the creation of port-pairs as SSS traffic development champions. Port pairs could play a major role in the transfer of cargo volumes from the road to the sea. They should stimulate the establishment of fully integrated door-to-door services in close cooperation with operators from the various modes, forwarders and the industry[22]. Although the focus presently seems to be on the creation of networks of smaller ports, medium sized and large ports should not be excluded

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[21]Similar requirements were also formulated in the papers of e.g., A. Pardali-Lainou and E. Tzannatos: *The port of Piraeus and its shortsea shipping potential for the promotion of European cohesion*, Conference Papers, pp 516-541; J. Packer: *UK roads to water initiative: a focusing study*, Conference Papers, pp 457-467; A.A.C.M. Wierikx and J. Van Riet: *Strategic profiles for transport companies: The case for Dutch forest product carriers*, Conference Papers, pp 337-360; F.M. Everard and C.P. Boyle, *The single market and the removal of obstacles to the greater use of shortsea shipping*, Conference Papers, pp 309-315; and L. Maertens: *Competitiveness of shortsea shipping ports: The case of Zeebrugge*, Conference Papers, pp 398-407.

[22]Similar concepts were proposed in papers presented by, e.g., J. Truau: *Metro-coastal shipping*, Conference Papers, pp 56-73; J.L.J. Marchal: *Shortsea shipping from hinterland ports by sea-river going vessels: study of the influence of free a cabotage policy*, Conference Papers, pp 114-135; R.J. Martens: *Shortsea shipping: Via optima?*, Conference Papers, pp 189-203; A.A.C.L.Wierikx and J. van Riet: *Strategic profiles for transport companies: The case for Dutch forest product carriers*, Conference Papers, pp 337-360; or A. Sjöbris, N. Wijnolst and C. Peeters: *Fast selfloading and unlaoding unitload shipsystems for coastal and shortsea shipping: potential in North-East Europe*.

as potential partners in a specific network. Integrating larger ports in specific SSS networks could stimulate the development of SSS feeder services[23/24].

The port pair-concept could also involve parties from a variety of industrial sectors and other actors in the multimodal transport chains. Their incentive to use SSS could be increased through stimulating the diffusion of 'entry barrier eliminating vessels' (EBE). Especially the use of self-loading and unloading bulk carriers and unit load-ships could substantially increase the accessibility of new industries to the low-cost and environment friendly SSS transport mode[25]. These EBE-vessels could also be used on large canals and rivers and thus access private mooring facilities of industrial firms, transhipment centers, multimodal terminals and smaller inland ports[26].

The development of inland multimodal terminals and the resulting increased use of sea-river vessels could improve the quality of SSS services vis-à-vis the road mode in terms of time, frequency and reliability. These improvements could simultaneously re-define the role of road haulage. Long distance road haulage could then be replaced by efficient SSS/ coastal connections, while road haulage over shorter distances could become a link at the origin and the end of the transportation chain (final distribution function)[27]. This development could

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[23]See, e.g., T. de Raymond: *The setting-up of feedering/coastal servicez, a solution for the medium sized ports of the Atlantic Arc*, Conference Papers, pp 12-37.

[24]At the first conference in Delft, several authors already emphasized the important role of SSS in feeder traffic, see, e.g., R.C. Bagchu/ and B. Kuipers *Autostrada del Mare*, European Shortsea Shipping, pp 52-66; M. Zachcial: *Assessment of Land/ Sea Feeder Traffic Flows in Europe*, European Shortsea Shipping, pp 316-327; and C. Cheetham, P. Hornby and R. Papenhuyzen: *Recent Developments in Feeder Transport by Coasters*, European Shortsea Shipping, pp 364-378.

[25]A number of related initiatives was presented at the Second Conference in Vouliagmeni by J. Igielska: *An alternative system for shortsea shipping of road vehicles*, Conference Papers pp 136-154; W. Förster, B. Zegic and W. Simon: *Prerequisites for improvements of the shipping in South-East European regions*, Conference Papers pp 38-55; J.P. Dobler: *Growth prospects of high-speed car-ferries utilization on European shortsea routes*, Conference Papers pp 228-252; and A. Sjöbris, N. Wijnolst and C. Peeters: *Fast selfloading and unloading unitload shipsystems for coastal and shortsea shipping: potential in North-East Europe.*

[26]See e.g., the papers of J.L.J. Marchal: *Shortsea shipping from hinterland ports by sea-river going vessels: study of the influence of a free cabotage policy*, Conference Papers pp 114-135; and L. Clinckers, E. Declercq, C. Peeters and A. Verbeke: *Water-based multimodal terminals: an eclectic site evaluation model*, Conference Papers pp 204-227.

[27]The concept of environment friendly long distance haulage (inland navigation, SSS, train) to connect local multimodal transhipment centers for final distribution (by road) has already been applied successfully in several cases, e.g., Honda is redesigning its logistics on the basis of this principle.

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be further stimulated by internalizing the external costs of road transport suggested by several experts during the second conference.

Efforts to promote SSS and to reduce long distance road haulage should not be limited to the most active Member States. Further planning should include, and in several cases emphasize, initiatives in the four Cohesion Fund countries, the EFTA and non-European countries (e.g. the Baltic States, Magreb countries and the Middle East). These planning activities, both strategic and operational, should be coordinated at the European level in order to avoid fragmentation and/or duplication of activities. The establishment of a 'European SSS Promotion Service' (ESPS) could substantially contribute to the realization of this objective. The development of such a coordinating organization was also suggested by other experts, see, e.g., J.L.J. Marchal and R.J. Martens who suggested the creation of a Bureau SSS. Such a European organization should be a non-profit organization which would pursue four main goals:

1. Stimulation of alliances among SSS-operators on specific routes, in terms of both groupage and marketing, in order to improve the total service quality of SSS vis-à-vis other modes;

2. Stimulation of cooperation with other modes in order to improve the intermodal capabilities of SSS, especially in the area of EDI and VTS;

3. Stimulation of innovation, especially in vessel design to overcome existing competitive and technical weaknesses of SSS. This third goal is very important as many SSS-operators and representative organizations are conservative in terms of adopting innovations; this attitude may sometimes be beneficial to the sector as regards, e.g., safety standards, but it is detrimental to the diffusion of innovations. Hence, it is very important that the ESPS should act as a catalyst for the diffusion of knowledge on innovations among the many conservative and individualistic actors in the SSS-sector;

4. Strategic interaction with public and business level policy makers to implement both general policy measures and specific policy measures for specific routes. The ESPS could perform a key role in the intra-E.U. coordination of activities related to SSS and act as the main coordinating body in this area.

6 CONCLUSIONS

Since the first European Research Roundtable on SSS in Delft in 1991, substantial progress has been made on the development of a coherent SSS-strategy at the level of the European Commission. It is now the responsibility of private entrepreneurs to take initiatives and to propose (pilot) projects to the European Commission. These proposals should include real world SSS applications to be implemented if proven economically viable. If private industry demonstrates sufficient commitment to implement projects, such proposals may be eligible for matching support by the European Commission (50/50 rule). Such a dual support would allow to avoid the problem of government failure as identified in the Vouliagmeni paradox.

In this case, some type of market failure would constitute the reason for EU-support in the first place, but government failure could be avoided through a focus on short term implementation potential and long term commercial viability of the projects. The management of these projects, especially as regards the required dual focus on business and government objectives, should obviously be delegated to competent 'pilot project navigators'. This would avoid contradictory decision making and the ineffective and inefficient use of resources. It will be the task of these pilot projects navigators to achieve a re-engineering of values in the business community. This constitutes the main pre-condition for the effective growth of European SSS towards the 21st century.

THE SETTING-UP OF FEEDERING/COASTAL SERVICES, A SOLUTION FOR THE MEDIUM SIZED PORTS OF THE ATLANTIC ARC?

By T. de Raymond, A. Taieb

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THE SETTING-UP OF FEEDERING/COASTAL SERVICES, A SOLUTION FOR THE MEDIUM SIZED PORTS OF THE ATLANTIC ARC?

ABSTRACT

The origin of the project: ESTURIALES -1992

Following a discussion about the foreseeable evolutions of maritime transport and their consequences for the ports on the Atlantic seaboard of Europe, the ESTURIALES, a club of European estuaries, decided in 1993 to commission the research consultancy CATRAM to identify the potential market of feedering/coastal services for the transport of containerized goods along the Atlantic Arc.

Promising results ...

This identification survey carried out in 1993 under ESTURIALES and ACEL's supervision and co-financed by the EEC (Exchange of Experience Programme), has led to promising conclusions.
Actually, the feedering/coastal potential traffic along the Atlantic Arc seems high enough to bring into service small container ships linking up the main medium sized ports of the Atlantic Arc.
Three types of services have been considered:

* A *centred* service linking up the ports of the European west Atlantic, excluding any linkage to ports not located on the Atlantic coast. The potential traffic is about 240,000 Tons/year;

* A *disenclavement* service connecting up these ports and linking them to a main hub of Northern Europe. The potential traffic is about 1,150,000 Tons/year. This service seems to be the most viable one;

* A *network* (mixed) service combining two *disenclavement* services and a *centred* service. The potential traffic is about 1,400,000 Tons/year, but the implementation of that service would be more delicate.

The traffics which might be potentially handled by the ports of the Atlantic Arc are impressive, especially when compared to the current containers traffics of these ports

Figure 1:   Centred feedering service

Figure 2: Disenclavement feedering
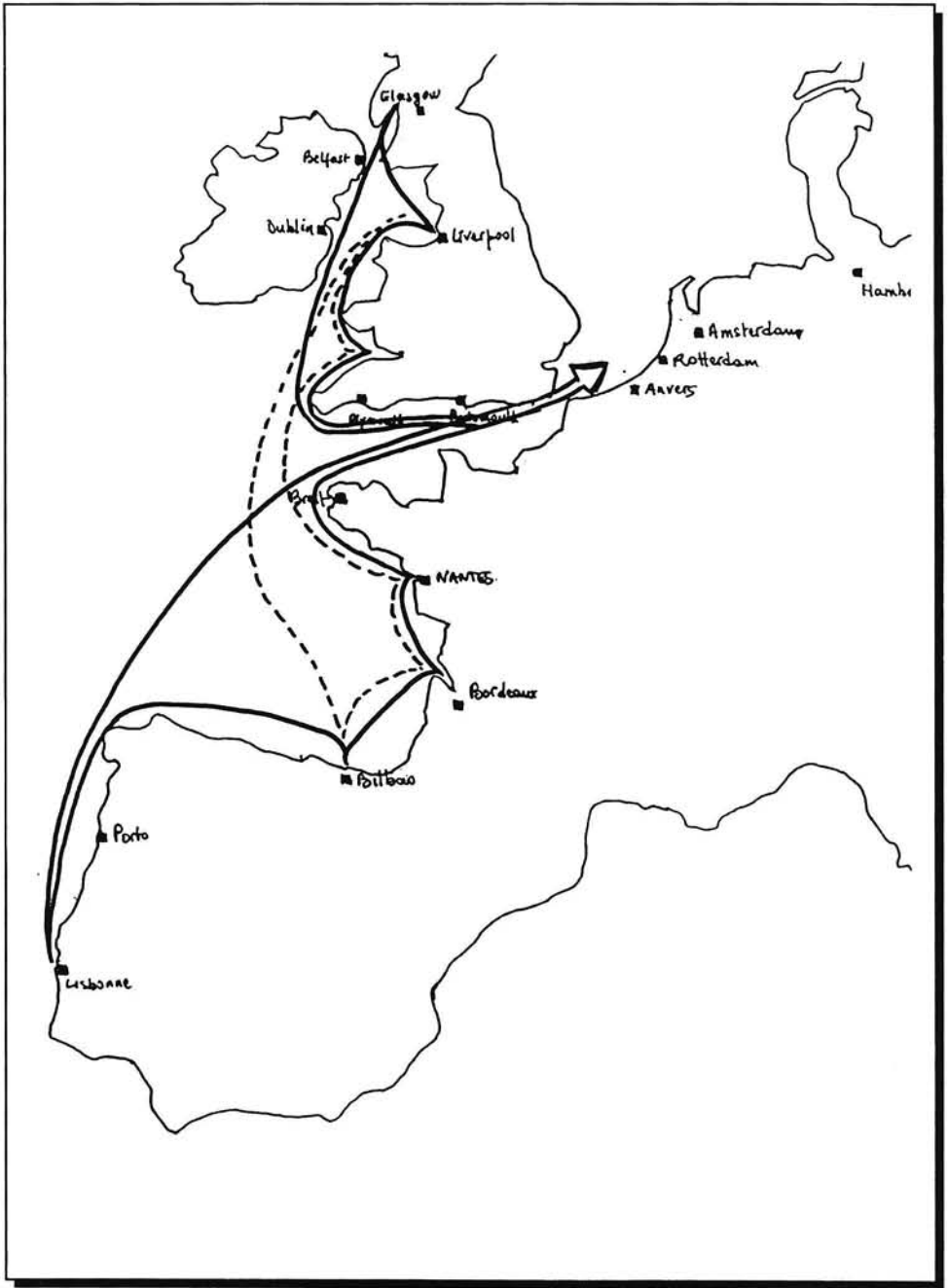
Figure 3: Network (mixed) feedering service

... which need confirmation by the operators in 1994 within the ATLANTIS Programme:

In 1994, following the 1993 survey, a feasibility study will be carried out by CATRAM under ACEL's supervision, within the ATLANTIS Programme. The European union and ten Regions in France, Great Britain, Spain and Portugal, are involved in this project.

The purpose of the project is to test with the operators (shipping companies, large shippers...) the hypothesis of the 1993 survey, and to achieve comprehensive technical and financial files in sight of a later negotiation for the setting up of maritime services.

1   ORIGIN AND OBJECT OF THE STUDY

In 1992, the foreseeable evolutions of maritime transport and their consequences for the ports on the Atlantic seaboard of Europe were discussed within the ESTURIALES Club[1]. One of the main conclusions was that the bringing into operation of bigger and more sophisticated ships, which are more costly, and the concentration of shipowners, would enhance the tendency to concentrate the traffics on a limited number of main ports (hubs) generally located within the north range, to the detriment of the medium sized ports of the Atlantic Arc.
This seemed particularly true for the container traffic which the ports bitterly fight over.
Besides, such a concentration of traffic in a few main ports leads to an increasing saturation of the main overland transport routes to/from these ports.

On this basis, the ESTURIALES decided in 1993 to commission the research consultancy CATRAM to identify the potential market of feedering/coastal services for the transport of containerised goods along the Atlantic Arc, in order to:

* Bring the companies in these regions a more adequate service at better rates, likely to facilitate their import and export activity with the world;
* Give new life to the ports of the Atlantic coast of western Europe by enhancing their complementarity and consolidating the regular ocean-going shipping lines at these ports;
* Increase the integration of the economies of the regions along the Atlantic coast of western Europe amongst each other and with Europe;

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[1]ESTURIALIS is a club of elected Representatives and civil servants of European estuaries in Great Brittain, France and Portugal

* Open up subsequent possibilities for creating new regular ocean-going shipping lines.

Moreover, this reinforcement of the community capacity in the field of maritime transport, would contribute to limiting the saturation of the main overland transport routes and thus to conservation of the environment.
This survey is a direct follow-up to the recommendation concerning transport following the prospective study on the Atlantic regions, carried out for DGXVI in 1991.
It was financed by the members of ESTURIALES, ACEL[2] and the European Community through an Exchange of Experience Programme (EEP).

More precisely, the method chosen consisted of testing ways of developing systems of maritime feedering traffic to service the main regions of the seaboard and to link them up with the closest international shipping lines. It also consisted of an examination of additional traffic likely to be brought in by inter-regional coasting traffic to the feedering services for the intercontinental lines studied.

2   THE METHOD

Two pathways have been used:

* The first was checking whether the development of a shipping route linking up the ports of the seaboard was likely to reinforce the different existing international routes in this, that or another port (by bringing in traffic from other ports on the seaboard not directly connected to these routes). This approach, (known as "*centred*" development) was based on the fact that the existing direct international routes from the ports on the Atlantic seaboard were in each case specific and generally more complementary than competitive[3];
* The second (known as "*disenclavement*") consisted in measuring what the feeder routes connecting the main ports of the seaboard to the large hubs of the North Sea could collect between Lisbon and Montoir (Nantes/St Nazaire) on one hand and between Glasgow and the Severn ports on the other hand;
* Lastly, a survey of a *mixed service* combining the possibilities offered by both of the approaches described above was carried out.

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[2]ACEL is the "Association Communautaire de l'Estuaire de la Loire" (in Nantes). Its members are local Authorities within the Loire estuary

[3]Lisbon with South America and the Eastern Mediterraean, Liverpool with North America, Montoir (Nantes/St. Nazaire) with the Indian Ocean and the Carribean, etc.

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│  │Handling costs      │  │ ALLOCATION   │  │traffic │ │          │
│  │Definition of chains│─►│   MODEL      │  │allocated│ │         │
│  │Costs of chains     │  │              │  └───┬────┘ │          │
│  │Rules for allocating│  └──────┬───────┘      │      │          │
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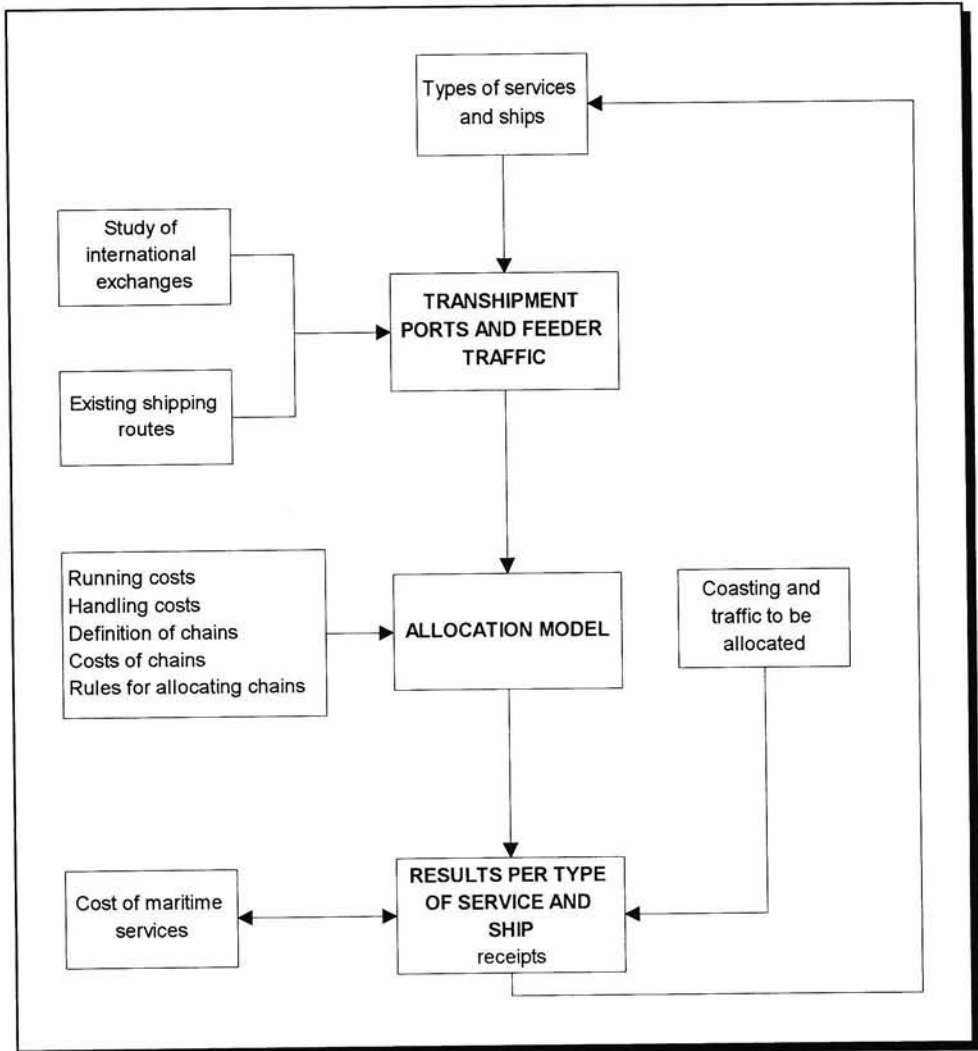
Figure 4: Flowchart of the approach used

To carry out these analyses it was necessary to:

* *Process regional data concerning overseas trade in all the regions* of the five countries concerned (United Kingdom, France, Spain, Portugal and Ireland).[4] As this data was available for detailed categories of products, it was possible to assess the containerisable proportion of products ex-

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[4]But such detailed data was not obtained for Portugal and Ireland which were treated as entities

changed through overseas trade with foreign countries for each Atlantic region.

* *Build a computerised model to compare the different transport chains* required to allow the products from each region to have access to the shipping routes linking them to the different regions of the world. This model, which allows the traffic to be allocated between the different competing transport chains takes into account both cost factors and quality of service factors for each type of transport (enhancing the forwarding time between the various sea "routes" or land routes giving access to the international shipping routes). This work required in particular an analysis of the existing transport offer and cross-checking numerous parameters involved in transport costs (overland or by sea) and handling costs in the ports as well as taxes and port fees in each of the ports concerned.

2.1 STATISTICAL SOURCES:

* *To assess the potential feedering traffic*, the survey mobilised national and european sources (EUROSTAT);
* *The additional volumes of coasting traffic* likely to partly supply the "feeder" ships are those studied by MDS Transmodal in a 1993 survey specifically pertaining to this subject.

2.2 DETERMINATION OF CONTAINERISABLE INTERCONTINENTAL TRAFFIC ACCORDING TO THE TYPE OF PRODUCT AND THE GEOGRAPHICAL AREAS SERVICED

According to the logic of maritime services, the world has been broken down into 31 geographical areas (subsequently grouped together in only 10 regions). At this stage, the containerisable tonnage is calculated from the overall tonnage, by applying a coefficient, the rate of containerisation varies according to:

* The type of product;
* The geographical region of origin or destination.

Corrections have been introduced:

* For the small volumes of goods which originate from or are sent to regions that are far away and highly containerised: this correction leads to a mean increase of about 5% of the containerised volumes to be taken into account, depending on the country;

* For the weight of the different packaging (inner or primary packaging, cardboard, container ...). This is assessed at 20% of the net weight;

* For "hi-jacking" intercontinental traffic, particularly a sizeable proportion of French foreign trade in added value goods which goes through the Belgian ports, or for inter-regional traffic (coasting) between the different regions of the Benelux coastal area.

2.3 TYPES AND SIZE OF VESSEL

For feedering, containers are transported and the ship will be of the Lo/Lo[5] type because of the favourable capital investments for this simple type of specialised vessel.
If the goal involved capturing larger parts of potential coasting, it would be necessary to consider a more multi-purpose ship, capable of embarking several categories of unitised freight: containers, road trailers or complete (trailers). If this were to be the case the "CONRO" option (containers and RO/RO) would better meet the requirements, in spite of significantly higher capital investment than for LO/LO, which would be partly compensated by possible gains in handling costs.

But the fundamental choice of the study is mainly aimed at the potential for feedering, and only takes coasting into account as a possible complement[6]. Thus, the study will be based on the use of LO/LO container ships (nothing but containers).

The size of the ships is submitted to constraints by the traffic potential considered and by technical criteria such as the "time at sea compared to time in port" ratio, by the frequency of services and by cost. The most suitable size of ship with respect to these criteria for "short sea" traffic on the Atlantic seaboard is included between 200 and 400 TEU[7].

However, less productive ships, of a size included between 100 and 180 TEU have been studied for services with a lower potential. Apart from the problems of cost, these smaller ships also have the disadvantage of being much more sensitive to navigation conditions.

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[5]Lo/Lo: Lift On/Lift Off: container ship requiring vertical handling

[6]This restriction is justified by the fact that the main part of inter-regional traffic is currently, and maybe for some time to come, transported in road trailers and not in shipping containers for which constraints are applied with respects to standars. This being so, a Lo/LO ship, which can practically only load containers, is heaviliy penalised.

[7]TEU (Twenty feet Equivalent Units)

The faster ships the market offers for capacities of 250 to 400 TEU have a commercial speed of 16 knots and all the calculations concerning such services are based on this speed. However, some rotations have been studied for smaller ships, ranging from only 100 to 180 TEU. For these ships, an operational speed of only 13 knots was used because of the scarcity or lack of availability of high performance ships in this size range and the difficulty of navigation for smaller sized ships in the Bay of Biscay.

2.4 PORTS SERVICED AND ROTATION

For reasons of cost and length, the number of ports serviced by a feeder shipping line along the Atlantic seaboard is necessarily limited. The main competition such a shipping line will have to face is of course road haulage. To have any chance of conquering a significant market share for this type of clientele, a high level of service must be offered, as close as possible to that offered by road transport.

This quality expected by the shippers means a high degree of frequency (if possible at least twice a week), in addition to short transit time.

The study has only included the estuaries or ports already adequately equipped and accessible at all times with a sufficient potential in unitisable goods available from their hinterland. The ports and estuaries that meet these criteria could be the following: the Clyde, Dublin, Liverpool, the mouth of the Severn, the Loire and Gironde estuaries, Bilbao, Vigo and the Tagus estuary. In spite of this restriction one should also keep in mind that this service will be of the "milkround" type.

2.5 CHOICE OF TRANSHIPMENT PORTS AND SELECTION OF TRAFFIC TO BE ALLOCATED

On the basis of the international flow classified by origin/destination for each of the regions of the Atlantic Arc, we chose to study only those *likely to lead to transport connected to the feeder service on the Atlantic Arc*. These are flows for which pre or post shipping to another location of the Atlantic Arc is possible, as they include at least one direct call at one of the main ports on the Atlantic Arc (self-centred option) or to/from one of the North Sea hub ports, if there is no such link ("disenclavement" option with link to the North sea hub ports). This selection was made on the basis of traffic to or from the ten main maritime regions of the world considered.

The ports of the Atlantic seaboard at which transhipment between mother ship and feeder is possible, that is to say at which there is at least one existing regular, sufficiently frequent shipping route (at least one a week) with the

regions of the world defined, will be referred to as *"transhipment ports"* for this destination.

Using these criteria, two main transhipment ports can be distinguished amongst the ports on the Atlantic Arc: these are *Lisbon* for Africa, the eastern Mediterranean, the south of America and *Liverpool* for North America.

Some other ports (*Montoir* and *Bilbao*) are secondary transhipment ports for certain destinations for some regions of the Atlantic Arc only.

2.6 DEFINITIONS, UNIT COSTS AND VALUES USED FOR PARAMETERS IN THE MODEL

The flows were allocated to the various alternative transport chains according to generalised costs. The criteria of choice used by the transport companies is "total quality", not only price. The "generalised costs" criteria, which determines how the model calculates allocation, is a step forward with respect to the latter, as it not only includes the direct financial cost (price) but also indirect costs due to transport and waiting times.

Thus, the model must be fed all the parameters required to calculate generalised costs, some of which are independent from the definition of the chains themselves: unit costs, distances, ships.

* *The cost of maritime transport* is calculated for defined rotations: it includes time at sea and time in the ports of call (on average 8 hours for a port of call for the services using vessels of 250 TEU or of 180 TEU, and 6 hours only for services operating small ships of 100 TEU).

* *Unit costs for maritime transport (cost of TEU/mile)*
  The cost evaluation of maritime transport between ports of the Atlantic seaboard by various types of Lo/Lo feeder ships carried out by the consultant shows the mean cost of a TEU per mile at *0.11 ecu* for 250 TEU ships for a mean filling rate of 66%.
  This assessment is based on a breakdown of maritime costs into *chartering costs*, including capital costs and crew costs, and *hold* costs which are broken down into propulsion costs for the vessel itself and auxiliary costs.

* *Cost of overland transport*
  This cost is equal to the product of an overland distance multiplied by the unit cost of TEU/km covered.
  Numerous polls and surveys carried out amongst the road transport companies showed that the current cost of a km. covered for a truck (a transport capacity of 2 TEU) is generally between 0.68 ecu and 1 ecu. The mean cost used for calculation is 0.8 ECU/ truck/Km. covered, that is to say, *0.4 ecu/TEU/km. covered.*

* *The cost of ferry crossing* for road links between the United Kingdom and the continent, based on information supplied by the road hauliers, is taken into account as a "fictitious distance in kilometres" added to the real distance and adjusted on the cost of maritime transport.

* *Pre and post-shipping distances*
These are calculated according to the radius of the hinterland for each of the ten ports. Two distances were used: *the near hinterland* defined for each estuary as its privileged area of supply where the ports captive market is the strongest, and a farther hinterland, the *second belt,* where the port can nevertheless capture a part of the goods exchanged.

For the near hinterland, the average estimated pre-shipping distance is about one third of the radius of this hinterland. For the second belt it is the average distance for access to the heart of this region from the port.

* *Handling costs and harbour dues on goods*
To recapitulate harbour dues, multiple sources were therefore required: estimates from the main handlers in the European ports (Great Britain, Ireland, France, Spain and Portugal), and also commercial documentation giving the tariffs of the main ports in Europe (ports of the Atlantic regions, but also Felixstowe, Marseille, Barcelona, Le Havre, Antwerp and Rotterdam ...), the magazine "Containerisation International" and "Le Marin" (particularly the comparative study on harbour fees, March 1992).

Harbour fees used for the model are those concerning containers or containerisable goods. With respect to handling, the consultant has tried to obtain full details of costs in all their complexity whenever possible: receiving/delivering, loading/discharging, overtime ..., for containers of 20 and 40, full and empty, and for trailers.

* *Commercial expenses*
The consultant took into account the shipping companies' commercial expenses by applying a coefficient of + 15% to maritime transport and a coefficient of + 10% to the handling costs. The latter rate reflects the fact that the overall cost of handling cannot be dissociated from the shipowner's share (handling on board). The handlers' commercial expenses are taken into account at their source (they are included in the tariffs supplied by the handlers).

* *Enhancement of time*
The comparison between the chains of transport for the purposes of allocating traffic means taking into account transit time since the shippers are very sensitive to the quality of service which is judged mainly on the time required for transport. To achieve this result, the consultant calcu-

lated the enhancement of the time parameter by overland or maritime route. *The unit cost of time is one of the most important adjustment parameters in the model.*

After several sensitivity analyses, the final value selected was a unit cost of time at a rate of 30.5 ECU per day for the feedering chains and 45.5 ECU for the coasting chains[8].

The values selected, which were substantially higher than the strict financial costs of immobilisation of the goods, had a non-negligible impact on the allocations, insofar as the time cost may represent a high fraction of the total cost of the maritime chains, whereas by its very definition it bears very little weight on alternative road chains.

For the types of feeder/coaster ships considered, the speed used was fixed at 16 knots for the most productive vessels (250 TEU) and 13 knots only for ships of smaller size.

For road haulage, the *mean speed* selected, based on the information supplied by the road hauliers is 45 km/hour (taking into account the compulsory resting time).

The model for transit time also takes into account inevitable *waiting time for the good at the port* (waiting for the feeder, or waiting for the mother ship). The values selected as parameters for the model are an average of two days waiting time for the "self-centred" type of circuit and one day only for the "disenclavement" type of service as the frequency of feeders and mother ships is generally higher in this case.

* *"Hub effect"*
Another adjustment parameter used in the model is a "bonus" or "malus" system for certain transport chains, to take into account factors concerning the competitive aspects of these chains which is known, but which the basic structure of the model cannot account for.

This is true for the "Hub" effect which is characteristic for the feedering chains which transit through the ports in Northern Europe.

On one hand, the high frequency of transoceanic services which can be found in such ports (Le Havre, Antwerp and Rotterdam), and more particularly Rotterdam, minimises waiting time for goods in these ports. On the other hand, fierce competition between shipping companies which is the general rule between shipping companies on ocean-going routes,

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[8]Coasting chains are relatively short from door to door; any variation in one of the segments has a relatively high impact on the whole chain. Conversely, the international chains taken as a whole (including the transoceanic link) are long and thus less sensitive to a vatiation in the time factor in one of the feedering links

allows the shippers to obtain conditions which are exceptionally favourable for ocean-going transport.

This is why the chains using the hubs in the north have been favoured by the allocation of a bonus of 175 ECU, so that the model restores the attractiveness which these hubs represent in reality.

On the contrary, the port of Algésiras, to the south of the Arc is only a hub for two shipping companies, practically speaking, who operate private terminals there Maersk and Sea Land. This port is not as open as the others and accessible to all traffic. The chains of traffic which involve calling at this port have therefore been penalised by applying a malus of 100 ECU.

* *Storage*
In most ports there is a storage period free of charge. The feeder/coaster service proposed is frequent and we have based it on the hypothesis that the storage time for the goods will not exceed the period that is free of charge.

2.7 COST OF COMPLETE CHAINS OF FULL CONTAINERS

The total cost of the complete chains can be broken down as follows:

Coasting chain:

- Pre-shipping overland;
- Handling from overland to maritime mode in the port of boarding;
- Harbour dues on the goods in the port of boarding;
- Maritime transport (freight);
- Handling from maritime to overland mode in the port of discharge;
- Harbour dues on the goods in the port of discharge;
- Enhancement of transit time (including stops).

Feeder chain:

- Pre-shipping overland;
- Handling from overland to maritime mode in the port serviced by the feeder (connected port);
- Harbour dues on the goods in the connected port;
- Maritime transport (freight);
- Handling from one ship to another in the transhipment port (master port);
- Harbour dues for the goods in the transhipment-shipment port;
- Enhancement of transit time (including stops).

Road haulage chain:

- Overland transport;
- Handling from overland to maritime mode in the boarding port;
- Enhancement of transit time (including stops).

2.8 ALLOCATION OF THE FLOW BETWEEN THE CHAINS WITH RESPECT TO GENERALISED COSTS OF THE LATTER

At this stage of the modelling, the flows must be broken down amongst the different transport chains according to the generalised costs they incur.
The flows, the transport chains amongst which these flows can be shared and their generalised costs are known.

The *rule of allocation* used will allocate the flows with respect to an *inverse function of generalised costs* of the different chains. More precisely speaking, they will be allocated as an inverse function of generalised costs raised to a factor of a power between 4 and 8. This exponential factor will show up greater or lesser sensitivity to the decision-makers' costs: the higher the factor, the more that allocation will favour lower costs.

It is generally accepted that the most suitable factor of exponentiality for a model for the purposes of goods transport is 6. But sensitivity tests have been carried out to check that the results are dependent on this factor. The final parameters selected for the model did use this value.

Thus, the flows are always shared out amongst all of the alternative chains. But the distribution is very sensitive to generalised costs, and mostly (when there are significant differences in cost, above around 10%, between the alternative chains), the allocations concentrate the main flows on the transport chain which offers the best performance.

2.9 REDUCTION OF THE VOLUMES ALLOCATED TO THE MARITIME FEEDER/COASTING ROUTE CONSIDERED FOR THIS SERVICE

The structure of the model also defines the alternative chains amongst which the flows of transport can be distributed.
For example, in the case of a "self-centred" circuit, for a feedering flux from the hinterland of Lisbon to be sent to the United States, the chains could be:

* Lisbon - Algésiras by road;
* Lisbon - Algésiras by sea;
* Lisbon - Liverpool by sea (the proposed feeder);

* Lisbon - Rotterdam by road;
* Lisbon - Rotterdam by sea.

There would be no problem if there were currently no existing sea link between Lisbon and Liverpool. But if the contrary were true, the volumes allocated to the chain represent the potential which could be allocated to this line, a part of which is already dealt with by the maritime feeder.

The volumes which can be allocated to the new feeder are therefore reduced in the model according to the current maritime offer existing on that link at the rate of their frequency.

This requirement to reduce volumes allocated according to the frequency of competitors obviously appears much more clearly in the "connected" service diagram, because of the large number of feedering and/or coasting services already linking some of the Atlantic ports to the North Sea hubs.

2.10 CALCULATION OF THE NUMBER OF EMPTY CONTAINERS LIKELY TO BE OFFERED TO THE SERVICE FOR REPOSITIONING.

It is generally recognised that maritime transport can be particularly advantageous costwise (especially marginal costs) for repositioning empty containers.

Shipping companies are often faced with a market imbalance which can lead to complex problems to reposition containers. As low cost is a prime factor, the containers are re-located according to needs, but also according to the least expensive occasions to re-position them when these occur.

Empty containers do not necessarily come back to their departure point, but are often repositioned wherever a return freight is found ("triangular" trips). They can also be lent to overland, road or rail operators who have free use of the container for their own transport in exchange for shipping the container to a given place within a given time.

But, when all these resources run out, standard repositioning by road is very expensive as the marginal costs are indistinguishable from the mean cost. However, on the other hand, ships often have an unused capacity which can be negotiated at an advantageous price for both parties.

As the containers are empty, the handling costs are also lower since less sophisticated tools than container gantries are used for handling. These transports do not include harbour dues by definition.

This is a complex item, to which we did not wish to apply the previous model of allocation according to the cost of alternative maritime and overland chains which seemed ill-suited for the purpose.

We preferred to use a rough assessment which had the advantage of being simple and allowing a rough idea to be assessed. We considered that the potential for the service considered was equal to half the volume of the imbalance of direction.

Thus, for example if 10,000 TEU are transported from Lisbon to Liverpool, and only 5,000 come back, the imbalance in direction amounts to 5,000 TEU, and half of this, about 2,500 TEU, will be allocated to the maritime service between Liverpool and Lisbon for repositioning.

3   THE RESULTS

3.1 "CENTRED" SERVICE

Lisbon ---> Bilbao ---> Bordeaux ---> NSN ---> Severn ---> Liverpoo l---> Glasgow ---> Lisbon, and the other way round.

Flows allocated

For a price at a rate of 0.12 ECU/TEU/mile, the feedering flows total 14,735 TEU. The estimated coasting flow capturable would add around 9,100 TEU, which in this particular case is far from being negligible.

As regards feedering, the strongest links are:

*   Bordeaux - Liverpool;
*   Lisbon - Liverpool;
*   Nantes/St Nazaire - Liverpool.

Bilbao offers a lesser potential, and the two other ports, the Severn and Glasgow, bring in very little traffic.
It should be noted that the situation is quite different in the field of coasting, for which Bilbao, the Severn and Glasgow offer high flows of traffic, which justifies maintaining these ports on the rotation.

There is a fairly limited potential for repositioning empty containers, mainly in the direction North - South between Lisbon, Nantes/St Nazaire and Liverpool.
Lastly, it should be noted that although four ports (Lisbon, Bilbao, Nantes/St Nazaire and Liverpool) on the service are transhipment ports for some regions of

the coastal belt, the port which draws the most benefit from the service is undoubtedly Liverpool. Practically all the feedering traffic involving Liverpool is transhipment traffic for the ocean-going shipping lines operating from this port. This is partly explained by the high flow concerning North America, a coastal belt which in this system is only accessible through Liverpool.

Costs, receipts, financial balance of the service

The problem is the relative weakness of the flows allocated, which do not allow the costs of a frequent service to be covered (2 calls per week), which appears to be essential to provide a quality service. The possibility of using smaller ships has its limits as the cost of maritime transport increases in this case.

There is little room to manoeuvre as far as price is concerned, because if the threshold price of 0.13 ECU/TEU/mile is exceeded, the flows allocated to the shipping line will drop sharply, leading to a decrease in receipts.

This is the diagram which seems the most difficult to justify and implement under the current market conditions. The problem is linked to the relatively low flows allocated to the various chains of maritime transport which make up this service; this weakness can be explained by the handicap the ports on the Atlantic seaboard, increasingly deserted by deep-sea shipping companies, have to face, and impose higher cost on the transport chains. This weakness is also linked to the great attractiveness of the Northern ports.

Price	Feeder (international traffics)		Part of European regional traffics		Total		Income	Filling Ratio
ECU/TEU/ mile	TEU	1000' TEU/miles	TEU	1000' TEU/miles	TEU	1000' TEU/miles	1000' ECU	%
0.10	16,977	11,534	9,776	8,053	26,753	19,587	1,959	84.72%
0.11	15,799	10,698	9,423	7,807	25,222	18,505	2,036	80.04%
0.12	14.735	9,938	9,081	7,564	23,816	17,502	2,100	75.70%
0.13	13,729	9,226	8,789	7,321	22,518	16,547	2,151	71.57%

Table I: Self-centred service; Sensitivity of the results to freight rate

3.2 "DISENCLAVEMENT" SERVICE.

Lisbon ---> Bilbao ---> Bdx ---> NSN ---> NH ---> Severn ---> Liverpool ---> Glasgow ---> Lis and the other way round. (NH = North Hub, tipically Rotterdam)

Our belief that a system which offered a link between the ports of the Atlantic seaboard and Europe at one of the North Sea "hubs", with a food quality service, would have no great difficulty in finding a market as a complement to existing services, was founded.
There are many reasons linked to the strong attractiveness of the ports in the North, based on an unbeatable maritime service and also on the needs of the shipping companies implanted there for serving the more remote European regions from their home ports.
These needs have indeed led to the creation of coasting and feedering routes, some of which are integrated into the ocean-going shipping routes and they are always founded on such a logic.

Flows allocated

The competitive nature of the Northern hubs, the all-purpose type of coastal area they offer, allow the projected maritime chains to conquer a large volume of traffic from the competing chains, mainly road haulage, but also some alternative shipping routes.

For a rate fixed at 0.11 ECU/TEU/mile, the feedering flows allocated would amount to 80 000 TEU approximately. The coasting flows would also bring in about 33,700 TEU and would thus represent 29% of the TEU.

Feedering flows:
Apart from the hubs in the North, which of course mobilised the most enormous flows because of their major role in transhipment, the port of Nantes/St Nazaire is clearly a leader, although it plays a minor role compared to Liverpool in the field of transhipment. Although the Severn estuary has a non-negligible level of activity (almost exclusively with the hubs in the North), Glasgow, however, contributes very little to the service (because of competing lines towards Rotterdam and departing from the east of Great Britain, which are much more favourable in terms of distance, time and cost).

Coastal flows:
Apart from the hubs in the North, the Severn estuary, Bilbao, Glasgow and Liverpool play an important role in the coastal flows (although three of these ports contribute very little in terms of feedering). The French ports play a very limited role here.

Costs, receipts, financial balance of the service

For an operational speed of 16 knots, the rotation can be carried out in 14 days. To maintain the frequency judged to desirable of two calls a week in each port, 4 ships will be required. This means that it will not be possible to use 400 TEU ships because the capacity of these would greatly exceed the potential traffic. The most suitable size is about 250 - 300 TEU.

The cost calculations were made on the basis of 250 TEU ships. These costs would easily be covered by the income from traffic for a tariff at 0,11 ECU/TEU/mile. The average filling rate would be very high, around 84%.

A higher tarif (0.12 ECU/TEU/mile) would produce slightly higher income, but for less traffic, at a mean rate of use of 77%, which remains critical.

Thus it would seem that ships of 300 TEU are required, these cost 1 million ECU extra to charter. The total cost would still be covered by the amounts receivable.

Price	Feeder (international traffics)		Part of European regional traffics		Total		Income	Filling Ratio
ECU/TEU/ mile	TEU	1000' TEU/miles	TEU	1000' TEU/miles	TEU	1000' TEU/miles	1000' ECU	%
0.10	88,704	63,845	35,039	25,333	123,743	89,178	8,918	75,40%
0.11	80,783	58,040	33,727	24,379	114,510	82,419	9,066	69,68%
0.12	73,478	52,710	32,450	23,449	105,928	76,159	9,139	64,39%
0.13	66,927	47,927	31,205	22,543	98,132	70,470	9,161	59,58%

Table II: Disenclavement service; Sensitivity of the results to freight rate

3.3 "NETWORK" TYPE SERVICE

Interesting perspectives are opened up by the "disenclavement" system as described above. The feeder could have access to a high volume of traffic with good financial conditions.

However, this system of service does not seem the best because some links are not favoured. In most case these are the links between the French ports (even Bilbao) and the British ports, as the route would be far too long because of transiting through the hubs in the North. Generally speaking, this type of trip includes very few shortsea routes.

The design of the "network" type of service is founded on this point. It is an attempt to optimise the "disenclavement" system, aiming at increasing the volume of traffic capturable to the detriment of making the system more complex and increasing the means required to set it up.

The three services for the "network" system

Whereas the various services examined above were made up of a single "line" both ways, the "network" systems has three distinct "lines".

These lines are as follows:

* *Service* 1: Lisbon - NH (North Hub, tipically Rotterdam):
  Lisbon ---> Bilbao ---> Bordeaux ---> NSN ---> NH ---> Lisbon
* *Service* 2: NH - Glasgow:
  NH ---> Severn ---> Liverpool ---> Glasgow ---> NH
* *Service* 3: Bilbao - Liverpool:
  Bilbao ---> Bordeaux ---> NSN ---> Severn ---> Liverpool ---> Bilbao.

This system multiplies the short links. To optimise the system, we were led to shorten service 3 and separate the link to the hub in the North into two North and South circuits which, unfortunately, does not allow some direct links, such as Lisbon - Liverpool, or Glasgow - Nantes/St Nazaire. The model takes into account these links through a system of transhipment either at Nantes/St Nazaire or in the Northern hub served.
This operation is obviously costly, and will reduce the potential attracted by the service (which is in no way strategic, at least in the field of feedering).

Flows allocated

The overall results immediately appear to be substantially higher than those for the systems previously examined. For a tariff at 0.11 ECU/TEU/mile, it would amount to 99,500 TEU in feedering, plus 39,800 TEU in coasting.
We should thus be able to count on a total of 139,000 TEU.

With respect to feedering, the Northern hub served clearly shows 168,000 movements linked to transhipment. But Liverpool (24,500 TEU entirely linked to transhipment), Nantes/St Nazaire (31,000 TEU with very little connection with transhipment), Lisbon (22,000 TEU), gain large volumes of traffic.

With respect to coasting, apart from the Northern hub served, the Severn estuary comes first with a total potential of 127,000 TEU. The other important ports are Lisbon, Bilbao and Glasgow.

However, as the system includes three independent routes, operated by different ships, one cannot make general statements. The potential for each one of

these routes should be examined in order to dimension the service (ship, frequency).

From this point of view, the three are totally different:

* *Service 1*: Lisbon - NH: this service clearly presents the post potential, with around 56.5 million TEU/miles (55% of the total potential), of which 48.5 M TEU/miles in feedering (86%) and 8 M TEU/miles in coasting (14%);

* *Service 2*: NH - Glasgow: the potential is a good half of that for the above route, with 34.9 M TEU/miles which are equally divided between coasting and feedering;

* *Service 3*: Bilbao - Liverpool: as expected, this route shows the least potential with only 11.4 M TEU/miles, 8.4 M TEU/miles of which are feedering and 2.9 M TEU/miles are coasting.

Cost, receipts, financial balance of the service

Using these parameters, the three services show more or less favourable results, depending on the unequal amount of capturable traffic, and also on the productivity of the type of ship used, which incurs high costs for service 3.

It was necessary to check that the means implemented for each service were cohesive with the flow to be transported. This is shown by the rates of use of the capacity of transport, an overall figure of 65%, which varies according to the services between 76.4 and 62.7%, which is acceptable.

Financially speaking, all three services showed contrasting results: services 1 and 2 are profitable, while service 3 shows a deficit. However the overall result is positive.

Price	Feeder (international traffics)		Part of European regional traffics		Total		Income	Filling Ratio
ECU/TEU/ mile	TEU	1000' TEU/miles	TEU	1000' TEU/miles	TEU	1000' TEU/miles	1000' ECU	%
0.10	107,006	80,076	40,837	28,892	147,843	108,968	10,897	**78.54%**
0.11	99,496	74,666	39,809	28,116	139,305	102,782	11,306	**74.08%**
0.12	92,325	69,473	38,887	27,416	131,212	96,889	11,627	**69.83%**
0.13	85,902	64,810	37,985	26,730	123,887	91,540	11,900	**65.98%**

Table III: Network system (mixed service); Sensitivity of the results to freight rate

	Service 1. Lisbon-Rotterdam	Service 2. Rotterdam-Glasgow	Service 3 Bilbao-Liverpool	All Services
Vessel size (TEU)	250	250	100	
Total distance (miles)	2,739	1,901	1,741	
Number of round trips per year	108	104	104	
Theoretical Capacity (1000' EVP/miles)	73,953	49,426	18,106	141,485
Feedering. International traffics (1000' EVP/miles)	48,491	17,742	8,433	74,666
European regional traffics. (1000' EVP/miles)	8,032	17,145	2,927	28,104
Total traffics (1000' EVP/miles)	56,523	34,887	11,360	102,770
Filling ratio	**76.43%**	**70.58%**	**62.74%**	**72.64%**

Table IV: Network system (mixed service), results by line

4 CONCLUSION

The results of the survey are encouraging. Indeed, the potential feedering/coastal traffic along the Atlantic Arc seems to be sufficient to support the bringing into service of small containerships linking up the main ports of the Atlantic Arc.

The type of service which appears to be most viable is the "disenclavement" one which would link up these Atlantic ports to a hub in the north range, such as Rotterdam.

The potential traffics which might be handled by the main ports of the Atlantic Arc are important, especially when compared to the current containers traffics of these ports.

5 PROSPECT FOR 1994: A FEASIBILITY STUDY

One should keep in mind that this was a "home study", mainly based on the treatment of statistics.

Therefore, it will be necessary to test the hypothesis with the operators (shipping companies, large shippers ...) and to introduce new variant versions.

This is the aim of a feasibility study which has been launched in January 1994, following the 1993 survey.

That feasibility study will be carried out by CATRAM under ACEL's supervision. It is financed by 10 Regions of the Atlantic Arc (in Great Britain, France, Spain, Portugal) and by the European union through the ATLANTIS Programme.

The purpose is to test with the operators (shipping companies, large shippers...) the hypothesis of the 1993 survey, and to achieve comprehensive technical and financial files in sight of a later negociation for the setting up of maritime services.

PREREQUISITES FOR IMPROVEMENTS OF THE SHIPPING IN SOUTH-EAST EUROPEAN REGIONS

By W. Förster, B. Zigic and W. Simon

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PREREQUISITES FOR IMPROVEMENTS OF THE SHIPPING IN SOUTH-EAST EUROPEAN REGIONS

South-east European region that geographically comprises Balkan peninsula together with surrounding seas (Adriatic, Ionian, Aegean, Sea of Marmara, Black Sea) [10], as well as the countries bordering these seas (principally Ukraine, Russia and Turkey), represents one of the traditional routes and an important cross-roads between West and East and North and South of the continent.

The fact that this part of Europe is all-but surrounded on three sides by the sea, means that a high concentration of of shortsea shipping is an unavoidable reality.

The intention here is not to repeat once more the list of advantages of shipping compared to other transport modes, but rather throw some light on the trends of traffic in general and to find the realistic role of shipping, - shortsea and inland navigation - and to contemplate future traffic development in the region.

Traffic is influenced by trade and technology demands, the state of infrastructure, and of course environmental influences, as well as recent political changes in the majority of countries in the region, and indeed, the state of war in some parts of former Yugoslavia. These factors combined to make the problem of finding long-term quality solution for traffic integration between the region and the mid- and west Europe complex.

From one perspective, the expansion of road traffic in the last two or three decades according to all estimates, will not change today or in the near future, because, besides all the weaknesses such as relatively high costs per ton-kilometre, high energy consumption (Wh/tkm), accident risks and environmental pollution through exhaust gases emission and noise [15, 17], the modality of road traffic is the only one that completely matches the "door-to-door" transport concept.

Production, on the other hand, develops in such a way to bring the entire process from raw material to the product suitable for further transport as near as possible to the location of finding place. The logical consequence is that the trend of requirements for huge transport capacities, traditionally linked with the railroad and shipping, will decrease.

The aforementioned factor is of course not applicable to certain strategic raw materials or agricultural products whose finding places and production centres respectively are concentrated only in the particular world regions (crude oil, natural gas, various sorts of cereals). But in the case of the mining sector, either metal or non-metal, due to economical reasons, allows for on-the-spot process-

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	Inland navigation vessel	railway	road truck
Spec. energy comsumption (Wh/tkm)	18-130	85-195	260-350
Total external costs (DM/tkm)	0.0036	0.0115	0.0501
Air pollution (DM/tkm)	0.0034	0.0033	0.0236
Traffic accidents (DM/tkm)	0.0001	0.0012	0.0178
Noise (DM/tkm)	0.0001	0.0070	0.0087

*) the similar values can be expected for coaster

Table I: Specific energy consumption and external costs for inland navigation vessels, railway trains and road trucks

ing at least to the semi-product level, is highly recommended. Thus, further processing to the finished state is possible anywhere because the increased price per mass unit makiing such products or part-products far more convenient for containerisation, and for transportation by road truck.

So what general conclusions can these factors lead to in respect of this European region? It is not irrelevant to hold that the region, given its geographical characteristics and state of infrastructur, potentially represents an ideal field for research of the competition chances of all transport modes, as well as any of their combination. Such investigation calls for knowledge of the current situation in traffic, current and future transport needs (definition of traffic speed, vectors of traffic flows), the kind of goods to be transported, condition of infrastructure (railroad, inland waterways and road), as well as port conditions, capacities and equipment and a host of other details that may have an influence on traffic efficiency. Two practical examples that could be useful to describe the state of the facts and their influences on future prospects of shortsea shipping in the South-east European will now be considered.

* Middle Europe - Ukraine link over the Black Sea;
* Middle Europe - Greece link over the Ionic and Adriatic.

1   MIDDLE EUROPE - UKRAINE LINK OVER THE BLACK SEA

Two of the biggest European rivers, the Danube and the Dnjepr, represent the natural waterway connection between these two regions. Mutual distance between mouth of the Danube by Sulina and the mouth of Dnjepr by Kherson, over the north-western part of the Black Sea, is a distance of about 300 km. Both on Danube and Dnjepr exists relatively busy river traffic. According to the political and economical changes in Ukraine and countries on Balkan along the

lower Danube, both parties are keen to use this natural waterway. The section over the Black Sea is too short to be considered separately as the route of importance for shortsea shipping, but in conjunction with the Danube and the Dnjepr and their role in transportation of these regions, the prospects for shipping on this section become very attractive.

1.1 TRANSPORT NEEDS

Cargo that is usually transported in both directions is mostly the iron ore and scrap. Among other goods that appear in significant amounts are metal semi-products (steel plates, profiles, wire, castings). Coal, timber and non-metal materials are mostly transported in direction East-West, while cereals and different final products are being transported to the East. About 13 mil. tons of all kind of goods have been exported and some 6.4 million tons imported in former USSR (now Ukraine) harbours on Danube alone in the year 1990 [4].
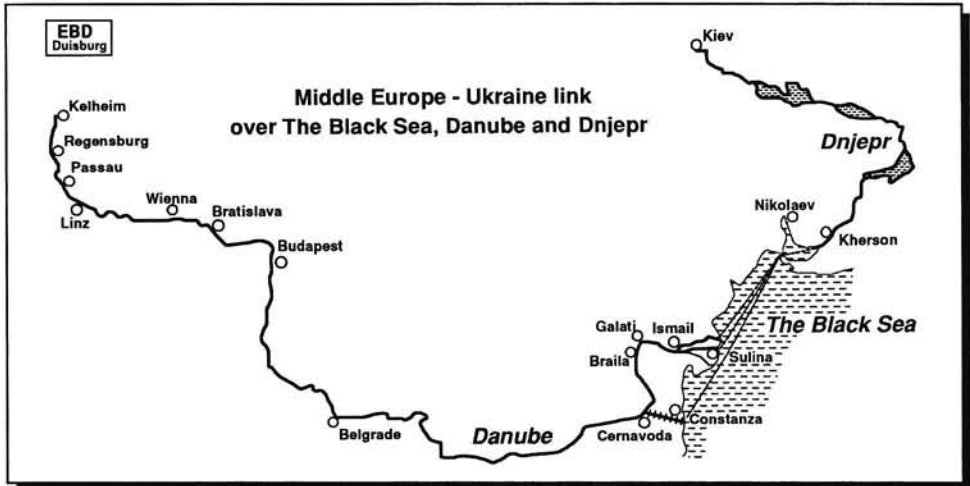
Figure 1: Middle Europe - Ukraine link over the Black Sea, Danube and Dnjepr

In the near future there is to be expected that after recession, the trade shall get the increasing trend, specially in European export to Ukraine. Due to the lack of highways and different railway standards (in former USSR the track span is 1524 mm while European standard span is 1435 mm), river and sea shipping will probably retain a large share of transport in the region. But because of the great discrepancy in kinds of goods (in general, raw materials from east to west and high-tech products suitable for containerisation from west to east) the problem of an exaggerated number of empty containers on the east could involve difficulties. Supposing that this problem will be solved through future investments in Eastern regions economy (to bring their export goods in form

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suitable for container transport) the conclusion is that always more and more shares of container shall be introduced on this traffic route.

1.2 RESTRICTIONS THAT IMPOSE SPECIFIC TRAFFIC SOLUTIONS

1.2.1 Draught restrictions

The Danube is theoretically navigable for sea and river ships up to Kelheim, Danube km 2414, i.e. along the whole length [17]. But practically, because of shallow water on the upper section, economical navigation of coasters (about 2.5 meters draught during at least 90% of the year) can be achieved eventually up to Budapest (Danube km 1647) [2, 7]. For reliable access to ports further upstream, draught must be limited even to 1.5 meters [4, 6, 7] in certain periods of the year when extreme low water level occurs. It can be said that for moderate size coaster, Danube is with 100% probability navigable only up to Braila (170 km from the mouth by Sulina through the main arm), or up to Cernavoda (300 km far from the mouth by Sulina but through the 65 km long Danube-The Black Sea Canal). Upstream of these two points, the traffic is usually uses various types of river barges assembled in pushed trains whose size depends on section of the river [2, 5, 7]. The most frequent barge type is so-called "Danube-Europe II" that differs from standard "Europe II" barge at most in beam - 11.0 m versus 11.4 m. River motor ships are also present but their total carrying capacity is neglectful comparing with that of barge trains.

On the other side, on Dnjepr from the mouth up to Kiev, capital of Ukraine, along about 870 km, guaranteed draught of 3.65 m is always provided [8, 9].

1.2.2 Breadth restrictions

River lock chambers [1, 2, 3] on Danube have a variety of usable widths. Starting from the mouth, on Danube-The Black Sea Canal there are two river lock groups with chamber width of 25 metres. In the Iron Gate area there are another two groups with 34 metres width (one auxiliary chamber has 14 m width). Further upstream in Slovakia the river locks are also 34 m width, and in Austria and Germany there are chambers with a width of 24 m. The narrowest are located upstream of Regensburg (Danube km 2379) and have the width of 12 m, as well as all the other lock chambers along the Main-Danube canal. For a standard "Europe" ship of 11.4 metres beam (that also navigate on the Danube, especially after the opening of the Rhine-Main-Danube canal), river lock chambers of 12 + n x 11.4 metres width seem to be ideal (to allow the transpassing of more ships packed abreast). River locks located on Iron Gate and in Slovakia allow the transpassing of only one 11.4 m packed together with two

11.0 m ships abreast. The chamber lengths do not represent restriction for corresponding ship lengths.

All Dnjepr river locks have the standard dimensions of 270 x 18 metres [9]. The breadth of standard Dnjepr vessels varies between 12 and 16 metres. It is obvious that different standards for ship breadth do not allow the optimal utilisation of lock chambers on both rivers simultaneously.

1.2.3 Air draught restrictions

The bridge heights over high water on the Dnjepr are approximately 10 metres and more. On the middle and upper Danube in periods of high water level, certain bridges have the height of only 6 metres and represent unavoidable obstacles not only for sea going ships but for some types of river motorships and pushboats too. It is not the curiosity that a great number of vessels are gathered on the both sides of e.g. bridge by Novi Sad (Danube km 1255) forced to wait the decrease of water level.

1.2.4 Climatic restrictions

In the last decade the Danube has been navigable practically during the whole year. Only in couple of years the ice appearance that caused certain short lasting restrictions has been reported. But on the Dnjepr the situation differs because the ice period and total stoppage of navigation lasts at least four months per year.

1.2.5 Restrictions for river-going vessels over the Black Sea

The Black Sea [6, 10] is relatively calm, but nevertheless navigational conditions do not allow for the use of standard river-going vessels, especially those designed for Danube. Insufficient freeboard and longitudinal strength, non-suitable deck equipment and the body lines form not convenient for the waves, make Danube motorships not applicable at all. Dnjepr motorships are in general nearer to meet the requirements for navigation over the Black Sea, but their commercial effects specially on the middle and upper Danube appear to be poor. The widely used push technology on Danube (just about 9% of total cargo capacity of Danube fleet is apportioned to self-propelled vessels) [4] can not be applied over the sea. Towing technology is possible, given that the barges are designed and equipped for such area of navigation; however, it rarely happens today.

1.3 POSSIBLE SOLUTIONS

There are three conceptually different solutions for Danube-Dnjepr transportation over the Black Sea.

1.3.1 Using the existing fleet of sea-going ships in traffic between the Port of Kherson on Dnjepr mouth and harbours on Danube delta

In harbours on the Danube delta (Galatz, Braila, Constantza/Cernavoda, Izmail, Reni) and Port of Kherson on the Dnjepr mouth, the cargo should be reloaded on river going barges and proceeded to final destinations upstream Dnjepr and Danube respectively. Such a solution requires two additional loading/unloading procedures and thus the overall transport costs significantly increase. As example it can be mentioned here that reloading of each 20 feet container from one transport carrier onto another, costs about 60 DM in Rhine terminals [17]. Assuming here the reloading prices are two times cheaper than those on Rhine, it is still about 30 DM. The transport price per TEU-kilometre with the river-going ship is on the Danube between 0.15-0.37 DM (stand: 1985, dependable on cargo class and transport direction - down- or upstream) [16]. A similar transport price can be expected on THE Dnjepr too. That means that on the overall distance of e.g. 1000 kilometres, total transport price per TEU is about 300 DM. This rough estimate shows that additional reloading costs is about 10% of total price, and when applied on the total amount of transferred TEUs during the year, it brings to enormous sum of unnecessary expenses. Besides, the existing infrastructure in above mentioned harbours requires further huge investments to improve its efficiency.

1.3.2 Building the ships of new design with particulars that will match the navigation conditions along the whole route

Due to the numerous restrictions regarding ships principal particulars in three different navigational areas, the compromise should be achieved to design and construct a ship that could be convenient and effective along the whole route. The idea to build a self-propelled vessel designed respecting at the same time the draught and height restrictions on the upper Danube and freeboard and strength requirements for the Black Sea, would result in economically non-effective unit with poor load to own weight ratio and overall load capacity. Such vessel would be too small for economical service on the huge section of the lower Danube, the Black Sea and Dnjepr up to Kiev. Therefore, an idea has been born to design special barges that shall be pushed along the river sections and towed over the sea. On each section, another suitable tug (Danube and Dnjepr pushboats and the Black Sea towing tugs respectively) shall be used, and the take-over manoeuvre shall be quick and easy. The barges shall be equipped for both pushing and towing. Their principal dimensions shall be determined to

match as good as possible the lock chamber lengths and widths on both rivers. Such considerations have brought the length overall of 95 m and the beam of 16.5 metres. Two longitudinally aligned barges, together with corresponding pushboat, can pass through all the river locks between Regensburg and Kiev. Between Komarno in Slovakia and the mouth of the Danube , even 4 barges can be arranged in single pushed formation.
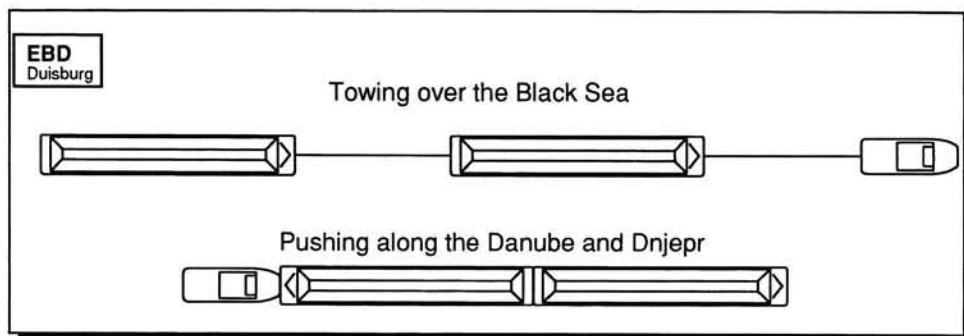
Figure 2: Danube-Dnjepr universal barges

Each barge would have about 3000 tdw with draught of only 2.5 metres, i.e. they could reach the harbours on upper Danube with significant probability. Even in the extreme low water periods, some 1500 tdw could be transported per barge with draught of 1.5 m only. The loading volume should allow the stowage of about 240 TEUs in just three layers.

There is no doubt that such a solution could decrease the specific transport price, at least because of two main reasons - the necessity of additional reloading in harbours on river mouths is avoided and because the bigger ship (standard Danube and Dnjepr vessel sizes have been already described) can offer the cheaper cargo capacity.

1.3.3 Building the special ships that could transfer the existing river barges over the Black Sea between Dnjepr and Danube estuaries

The third attractive possibility to bridge the Black Sea between Danube and Dnjepr mouth is to introduce barge carriers that could perform shuttle service transfer of river barges between anchorages somewhere in vicinity of river mouths. Plenty of existing barge carriers (LASH, BACO, BACAT I & II, SEABEE) [5, 18] all share the same disadvantage - they are designed for transportation on long distances over the sea, and the corresponding barge units are too small to be utilised economically on big rivers like Danube and Dnjepr. Besides, almost all these systems are designed for special barge type and size. On Danube and Dnjepr can be often seen so-called "USSR Seabee" or "Interlighter" barges, the

largest among the all aforementioned, but with the loading capacity of only 1070 tdw, i.e. about twice less as the standard "Danube-Europe II" barge. Furthermore, the existing barge fleets on Danube and Dnjepr, and probably river Don (yields in Sea of Azov that has direct connection to the Black Sea), are too great to be simply replaced with the new "standardised" units. Therefore, the basic request for the new design shall be the adaptability to take aboard almost any of existing barge types and to perform service even so loaded, economically. Due to the short distance, the barge carrier should be able to be loaded and unloaded in very short time, not more than a couple of hours.

		LASH	Seabee	Interlighter	BACAT I	BACO
Length over all	(m)	18.75	29.72	38.25	16.82	
Breadth max.	(m)	9.50	10.67	11.00	4.67	up to 9.50
Depth	(m)	3.96	3.81	3.90	3.30	
Draught	(m)	2.74	3.20	3.22	2.45	up to 4.06
Deadweight	(tdw)	376	847	1070	147	800
Weight unloaded	(t)	87	147	230	40	

Table II: Standard barge size for overseas transport

A very interesting and sophisticated concept has been recently offered by the German company NAVTEC CONSULT GmbH from Emden. Their so-called TSL (Trans Sea Lifter) is SWATH concept vessel [12] with a lot of originals. Amongst the undoubted advantage of low resistance and fast motion through the water, the TSL concept enables the least possible amount of ballast water for sinking platforms deep enough to accept a floating barge or even a smaller motorship. Of course, there is no need for any harbour reloading device, i.e. the only investment would be the barge carrier alone.

Considering the arisen political changes in the region and expected needs for cost effective and reliable transport of the goods along the route, it could be concluded that serious investigation regarding the three mentioned solutions for the Black Sea shipping between the Danube and the Dnjepr will have to be performed. Such an investigation should comprise analyses of investment costs, exploitation costs for a variety of different kinds of cargo, reliability of each, as well as the comparative analysis with alternative traffic modes - railway and road trucks.
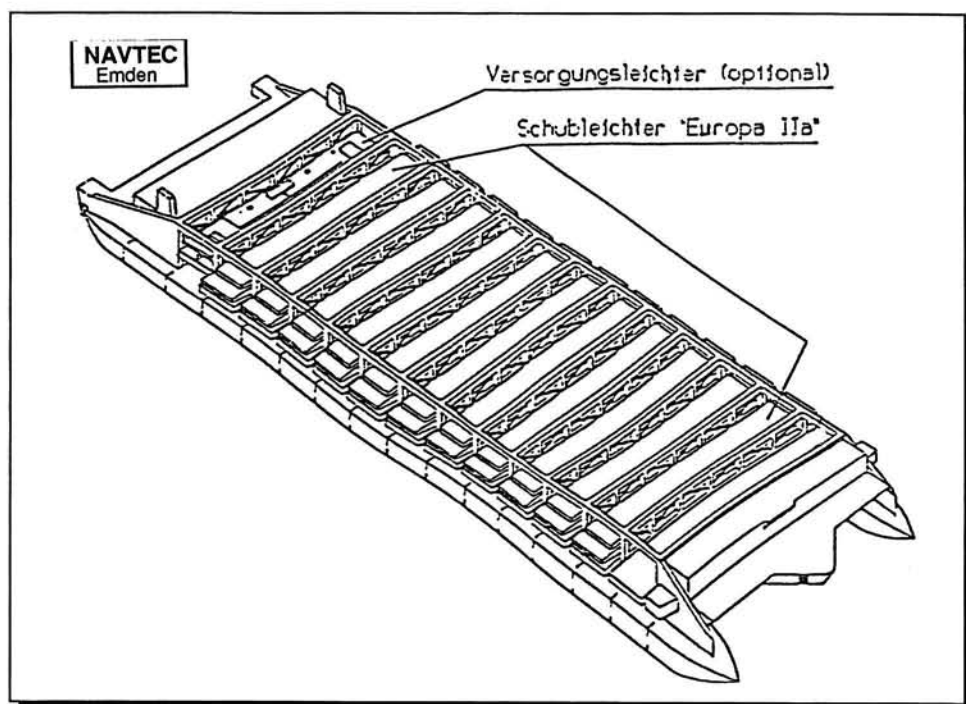
Figure 3: Trans Sea Lifter (TSL) concept of NAVTEC CONSULT GmbH [12]

2 MIDDLE EUROPE - GREECE LINK OVER THE IONIC AND ADRIATIC

2.1 INTRODUCTION

The total cargo being transported by road trucks between Germany and Greece is about 500 000 tons per year [14] in each direction. Simple calculation says that at least 25 000 trucks pass this route yearly from Germany to Greece and vice versa. The main Greek export commodities to the EU market, and particularly to Germany, are seasonal fruits and vegetables. Such goods have to be transported quickly and mostly in refrigerated containers. Besides the time losses, any reloading introduces increased risk of damage and increased percentage of refuse. Therefore, road trucks and refrigerated trailers have been optimal for such transport task.

2.2 TRAFFIC SITUATION NOWADAYS

Before the break-out of war in former Yugoslavia, the usual (probably the most cost attractive) truck traffic route between Athens and southern Germany, has been one over Yugoslavia and Austria. After political changes in Eastern block at the end of eighties, the new alternative route over north-east part of Yugoslavia and farther over Hungary and north-east Austria has been found to be interesting, too. With the declaration of independence of former Yugoslav Republic of Macedonia in the mid of 1992, a potential conflict situation arises between Greece and the newly-proclaimed state, and as a consequence, the Greek truck forwarders were forced to adopt a roundabout way over Bulgaria and farther to merge onto the "traditional" route by Nis in Serbia. That has introduced some additional costs (one check point more, a longer distance and worse road conditions), but was still not reason for alarm. Presumably, customers have paid the difference in transport prices, qualifying the situation as temporary.

Eventually, the cessation of transit of any goods through the rest of Yugoslavia came into force on April 1993. The "path of road cruisers" has had to be moved once more, this time on the route over Bulgaria and Romania. The existing road network, its service condition and duct capacity, prolonged distance, probably the duration of customs procedures aqnd so forth and now became reason enough for alarm. Each trip of road truck between Greece and Germany costs now about 2500 DM more and lasts at least 3 days longer as before.

Together with before existing problems of limited quota of truck crossings through Austria, Hungary and the Balkan states, the prohibition of truck traffic over night through Austria, highway net over long distances far behind the necessities - the newest circumstances represent a good challenge for EBD to consider existing and possible alternatives, especially different Ro-Ro solutions. As a representative example, the alternatives for the route between Athens and Munich has been considered regarding transport duration. Some of the results of this rough analysis have been found to be very interesting and even a little bit surprising.

2.3 CHANCES FOR RO-RO TRANSPORT MODES

Theoretically, combined traffic (Ro-Ro) exist both over the Adriatic (from Piraeus, Igumenitsa or Patras to Brindisi, Bari, Ancona, Ravenna or Venice) [14] or over Danube (from Vidin or Ruse in Bulgaria to Passau or Regensburg in Germany) [13]. But both had been not significantly in use due to the capacity shortage. The Danube connection was practically 100% occupied by SOMAT GmbH vehicles, while Adriatic route besides the lack of capacity, comprise additional expenses through extremely high highway fees and fuel costs in Italy when the southern Italian ports (Brindisi, Bari) are being used.
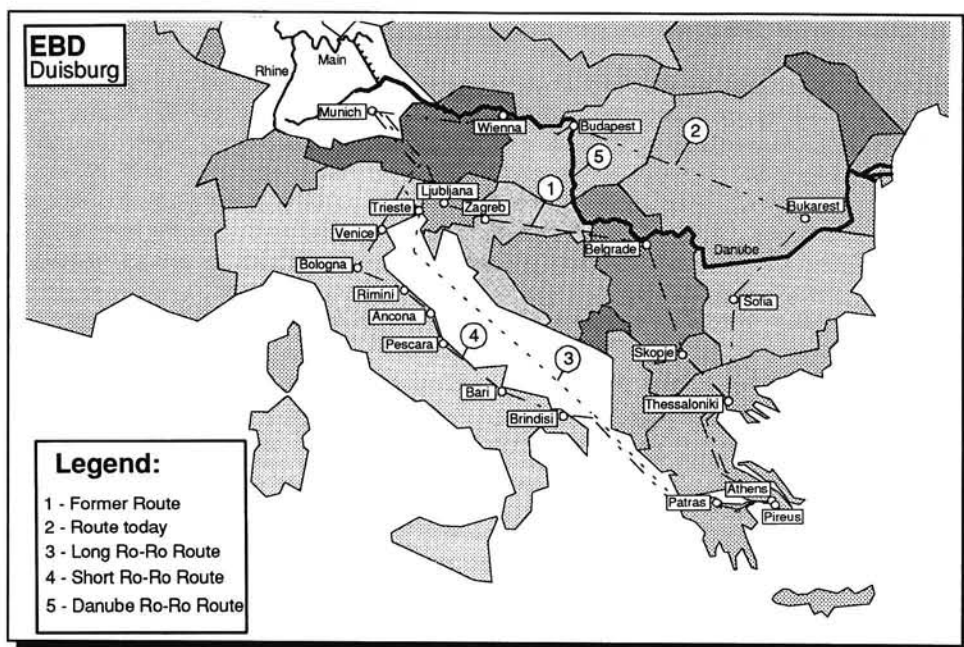
Figure 4: The truck route between Greece and Southern Germany

Theoretically, thanks to the all ferry line capacities available nowadays, some 2600 trucks and trailers could be transferred weekly between Greece and Italian Adriatic ports, but practically (due to the occupancy by passenger cars and busses), available truck capacity falls far behind demand[14]. Such status has brought forward an idea for a comparison of two extreme possibilities: to use ferries on the shortest section over Adriatic (between Patras or Igumenitsa and Brindisi or Bari), or over the longest (as the same time shortest for the rest of road distance to be overcome) up to the port of Trieste.

The first alternative provides the shortest Adriatic route but uses the long section of Italian highway network. The number of ferries to be used are minimal, trip duration on board is only about 16 hours when existing 14 knot ferries are in use, and this alternative enables the fastest overcome of the whole route at all. But on the other hand, a very long trip over Italy introduces enormous additional expenses because of highway fees, expensive fuel, and usual traffic jams. Even Italian freight forwarders themselves are trying to release their own highway net introducing new 20 knot Ro-Ro vessels between Palermo and Genoa/La Spezia.

Another ferry line runs over the Adriatic up to the port of Trieste. This alternative utilises the longest possible section over the Adriatic, and as a consequence brings the shortest road section. Therefore, the number of required ferries for
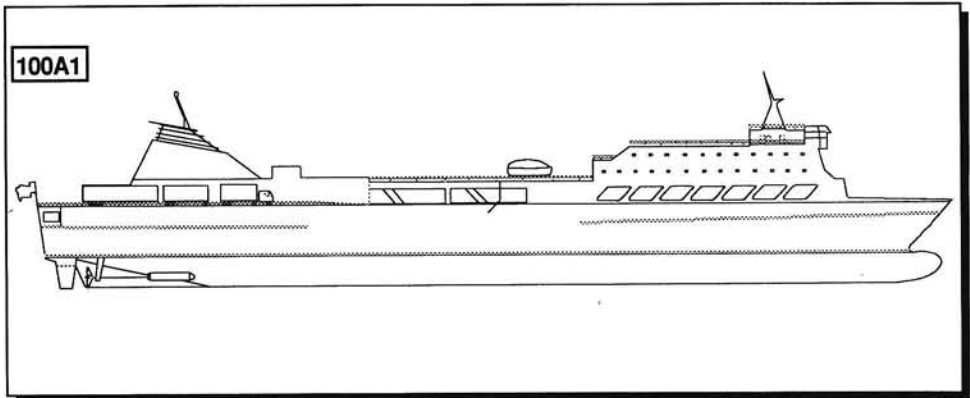
Figure 5: Ro-Ro vessel for Palermo-La Spezia line [11]

the same amount of trucks and trailers to be transported in the same time interval, is pretty higher than for the first solution. One thisng is sure, that only the extremely high investments in an all new sea-going Ro-Ro fleet could fulfil the necessities. Some feed-back information after experiences in the exploitation of 5 new Italian Ro-Ro ships (specially built recently for Palermo-La Spezia/Genoa line and Catania-Bari-Venice line, in order to free-up jams on Italian highways) could be very useful [11]. Such vessels have the capacity of 136 road trailers each, speed of 20 knots and the building investment was about 46 million US $ (80 million DM) per ship. The calculated costs for the Palermo-Milan route using Ro-Ro mode (Palermo-Genoa) is about 3 million Italian Lire (3100 DM) compared with approximately 4200 DM over the corresponding road section. Forwarding speed was reported the same - 24 hours - for both versions, but only when there are no jams or traffic accidents along the road route.

2.4 EVALUATION OF DIFFERENT POSSIBILITIES

An attempt was made to evaluate the main characteristics of above mentioned Ro-Ro alternatives and existing road routes (together with those which are today due to the political situation out of use). The total distance, road distance, total forwarding time and forwarding speed have been calculated and the results are presented in **Table III**. The following assumptions and estimates have been made:

Average truck speed: Highway: 70 km/h
                                      Motorway: 40 km/h
Service speed of Ro-Ro ship: Adriatic: 14 knots
                                        Danube: 16 km/h

Prerequisites for Improvements of the Shipping in South-East European Regions

Truck driving hours per day: 16 hours
Customs formalities on the road check point: 5 hours
Roll-on and Roll-off duration: 5 hours
Customs revisions on the Danube: 2 hours per revision

Route#	Overall distance (km)	Road distance (km)	Total forwarding time (hours)	Forwarding speed (km/h)	Relative speed mark*)
1 (road)	2272	2272	89.2	25.5	1.22
2 (road)	2588	2588	102.2	25.3	1.40
3 (RoRo)	1777	477	76.8	23.1	1.05
4 (RoRo)	2011	1431	73.0	27.6	1.00
5 (RoRo)	2296	1240	126.4	18.2	1.73

*) = Ratio between the corresponding total forwading time and the shortest forwarding time of all

1 - Former route, at the moment not applicable due to the situation in ex-Yugoslavia
2 - Route today over Bulgaria, Romania, Hungary and Austria
3 - Ro-Ro section between Patras and Trieste
4 - Ro-Ro section between Patras and Brindisi/Bari
5 - Ro-Ro section over the Danube (not applicable at the moment)

Table III: Distances and trip duration (ref. **Figure 4**)

According to the available information [14], the average duration over the route #2 is even three days longer as over routes #1, not only 13 hours as theoretically calculated and presented here. Probably the additional waiting time exists as a consequence of worse service and road conditions through Bulgaria, Romania and eastern Hungary. Therefore, at least 50 hours have to be added to the total forwarding time for route #2. Comparing the corrected total forwarding time for route #2 (now about 150 hours) with others, it is obvious that Ro-Ro alternatives could be very competitive.

Some attempts have been made recently to organise forwarding of Greek fresh agricultural products in refrigerated railway wagons over Bulgaria, Romania, Hungary and Austria [14]. The reported records are about 100 hours from Athens to Munich. A couple of hours should be added for storage-to-rail transfer and reloading at the final destinations.

Reflecting the given examples, in certain particular occasions shortsea shipping can even significantly increase the forwarding speed of otherwise much faster road carriers.

Adriatic route #3 (Patras-Trieste) appears to be ideal (by-passes the most of Italian road network) and could be even faster than here presented, if the new

Double deck RoRo barge for 32 trailers (in service between Passau and Budapest since 1992)
L_{oa} = 76.5 m, B = 11.4 m
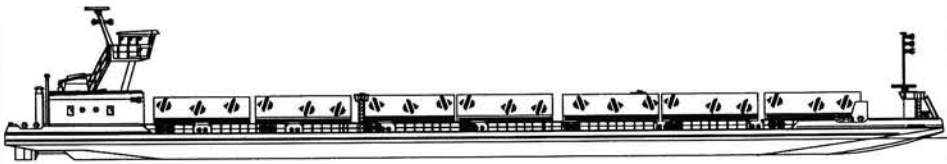
RoRo semicatamaran for 49 trailers (in service between Passau and Russe/Vidin since 1983)
L_{oa} = 114.0 m, B = 22.8 m

Figure 6: Danube Ro-Ro vessels [13]

20 knot ships [11] should be implemented. The Danube route #5 could be also very attractive in some better political circumstances, especially with the faster Danube ships than today. For example, 22 km/h (service speed of some big riverine passenger ships on Danube) instead of today's 16 km/h (existing Ro-Ro catamarans and pushed barge trains) could decrease the forwarding time over the route #5 for about one day.

The investment and exploitation costs have been roughly estimated (**Table IV**).

	Speed (kn)	Investment per ship (DM)	No. of 40' trailers	Investment cost (DM/trailer)	Investment cost (DM/trailer*knots)
Adratic ferry	20	80,000,000	136	588,235	29,412
Danuber Ro-Ro	12	22,000,000	49	448,980	27,415

Table IV: Investment costs for ro-ro ships for Adriatic and Danube

Assuming that the expected cost on Palermo - La Spezia line of about 3100 DM per trip and trailer is realistic, just a little bit higher than this has to be the cost per transhipped truck unit between Patras and Trieste - let's say 3400 DM. That

means that each kilometre costs about 2.6 DM per truck. Over the shorter Ro-Ro distance (Patras-Brindisi) slightly higher costs per kilometre could be expected. On Danube, the cost estimates on respective section have given approx. 1.8 DM per truck-km.

On the other side, on German highways and road network, the average costs per truck-km are nowadays about 2.5 DM, but on Italian highways due to the road fees and higher oil prices it is over 3.0 DM. Regarding the tax fees for transpassing Balkan states, Hungary and Austria, as well as the worse road condition, the similar specific costs have to be expected on the road routes over these non-EU countries.

The estimated values appeared to be pretty high, but compared with required investments for building highways (8 - 11 million DM/km and the need for some 1300 km through Bulgaria, Romania and Hungary or about 650 km of missing highways along the route through the ex-Yugoslav states), exploitation cost difference between truck-km and Ro-Ro/truck-km and at last (but not the least) environmental pollution difference, it is obvious that Ro-Ro alternatives to German-Greece truck routes have to be seriously investigated. With a certain amount of reorganisation in truck forwarding logistics, it could be possible to avoid, at least inside the European Union, the senseless transportation of drawing vehicles on board and as a consequence, to obtain more storage space on Ro-Ro ship. Assuming that the average length of truck with 40 feet trailer is 15.5 m and trailer alone only 12.2 m, the stowage savings of even 27% can be obtained. In the same time significant savings on salary costs of truck drivers could be achieved. Moreover, such logistic changes should not require the new investments for container terminals and costs for their handling.

3   CONCLUSIONS

It can be seen that in some occasions, new arisen circumstances can induce search for new transport solutions, or improvements of existing ones. In the both given examples the inquires are to find the missing or to replace the loosing link in existing transport chain. Sometimes, the obtained results can brought to the solutions that have been often neglected during the past.

Shipping policy makers, freight forwarders, shipowners and shipbuilders must cast off traditional, rigid ways of thinking. The random eventuality makes for changing situations, and such a situation must be utilised in the best possible manner. We should never forget the old Latin sentence "navigare necesse est", and must always be ready to adopt ourselves for current market conditions.

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METRO COASTAL SHIPPING

By J. Truau

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METRO COASTAL SHIPPING

1   THE CONTEXT

The port of Marseille-Fos is the biggest in France and in the Mediterranean. It benefits from a central location in the Mediterranean Arc, at the outlet of the Rhône Valley, a major land transport axis in Western Europe for North-South traffic flows (**Figure 1**).
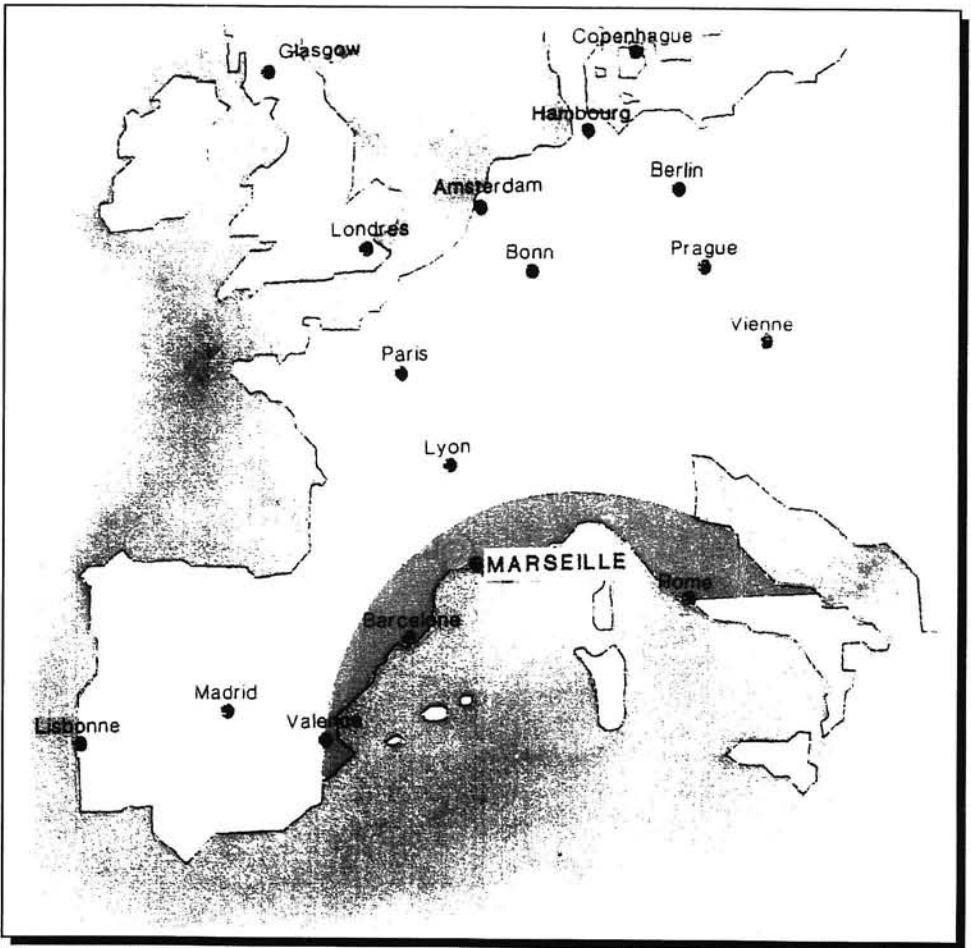
Figure 1: Mediterranean arc

Just two years ago, the French government began a reform of port facilities, the first stage of which was devoted to modernisation of stevedoring.

Our Chamber of Commerce decided to take this opportunity to initiate a *5 year Development Programme for the port of Marseille-Fos* in collaboration with all the port professions, to coincide with this reform. The programme's objective is to define the strategic positioning of our Mediterranean port faced with the changes in the European and world-wide competitive environments.

Within this framework, the geographic location of our port briefly described in the introduction, and its well-established vocation as a port handling land-based traffic led us to examine the potential for developing new land-sea transport systems along the Mediterranean Arc.

Indeed, this was a theme that had been mentioned more and more frequently during discussions about infrastructure policy on both a national and European level. From our point of view to a great extent it has become a reality as far as it concerns the Mediterranean Arc, on the basis of the following observations:

1. The progressive saturation of the coastal motorway routes running along the Mediterranean Arc between Spain and Italy via the Languedoc-Rousillon and Provence regions.

   The doubling of North-South motorways linking Europe to the Mediterranean and the coastal motorways between Spain and Italy comprises projects for tunnels in the Alps and Pyrenees. These projects are increasingly difficult to implement, because public opinion has become more sensitive to environmental deterioration.

2. The inevitable strengthening of administrative measures and cost constraints linked to road transport.
   Apart from the cost of new infrastructure made necessary because of congestion, calculations are made to evaluate the additional cost of the consequences of road use (noise, pollution, safety, etc.).

   As a result we can expect the cost of road use to increase further, although an exact figure cannot yet be determined.

3. The modernisation of stevedoring in the major Mediterranean ports.
   This makes it possible to increase substantially the level of reliability of transit via ports, which previously was a major weakness when set against overall reliability of road transport. Today, modernisation makes it possible to develop projects for specialised terminals.

4. The development of exchanges within the European Community.

In the last decade, the increase in demand for transport led to dispropor-
tionate development of road transport, due in part to this mode of
transport's flexible adaptation and continued low costs.
Road traffic from Northern Europe to the South of France, from Italy and
more recently from Spain is intensifying. Most of it is carried by the
Rhône Valley, and is amplified by East-West flows near to the mountain
transit points in the Alps and Pyrenees. Intensifying these flows will in-
evitably accelerate saturation of motorway routes.

Indeed, the very magnitude of the road transport phenomenon could ul-
timately lead to more moderate and more intelligent use of roads in the next
few years.

It is on the basis of these four observations that we have decided to propose a
maritime solution that we bellieve to be complementary to land-based solutions
and suited to the geography of the peninsulas in Mediterranean Europe.

Given the twin requirements of regularity of turnarounds and speed which this
new coastal shipping concept would have to satisfy to integrate into a two-
mode land-sea system, we have baptised it metro-coastal shipping .

2   HYPOTHESES AND METHODS

Although the solution we have envisaged aims to replace road kilometres with
 nautical miles , the programme also aims to ensure that both modes of trans-
port contin ue to be complimentary.

Such a complementary relationship is essential for sea transport, since the quay-
side is rarely the final destination for goods.

The same approach is also essential for road carriers.

Naturally, such complementary features are only worthwhile if it means there
are benefits from the advantages stemming from these two modes of transport,
and a reduction in disadvantages. The logistics envisaged must therefore ensure
that we preserve the flexibility and speed of road transport while maintaining, at
least to some extent, the cost advantages of sea transport.

From this persepctive, the use of roll on/roll off vessels is the most effective
solution since it minimises the costs generated by transhipment, in terms of
both time and money.

In addition, the unit cost advantage of sea transport stems partly from the large
volumes carried. Although it is developing quickly, with the complex logistics it

requires combined transport still represents only a small proportion of all goods transport operations.

In this context, and in the light of the above hypotheses, we felt it was vital to proceed using the following method:

1. Verification that a market does exist, i.e. that the flow of goods to transport is sufficient to correspond to a target volume;

2. Examine the economic profitability of a maritime structure to transport these goods.

2.1 EVALUATION OF A TARGET VOLUME

We selected exchanges between France, Spain and Italy, according to their type (excluding heavy cargo), and their present route identified by the present border crossing point.

From an initial market of 51 million metric tons, this method of selection resulted in the identification of a target volume of 9.1 million metric tons of goods (**Figure 2**):

* 3 million between France and Spain;
* 3.5 million between Spain and Italy;
* 2.6 million between France and Italy.

It should be noted that this potential traffic is minimal. We have seen that the development of combined traffic could lead to concentration of flows from Northern France and Europe via rail, and the avoidance of mountainous sectors by loading (unloading) at Marseilles. This assumes general use of mobile containers.

2.2 ECONOMIC PROFITABILITY

The aim of this stage was to estimate as accurately as possible the costs of transporting trailers or trucks on a roll on/roll off vessel, and to compare them with the cost of road transport.

Clearly the cost of a semi-trailer journey carrying 15 metric tons of goods depends on the distance covered. The cost of transporting such a truck or its trailer loaded on a vessel is different, and varies.
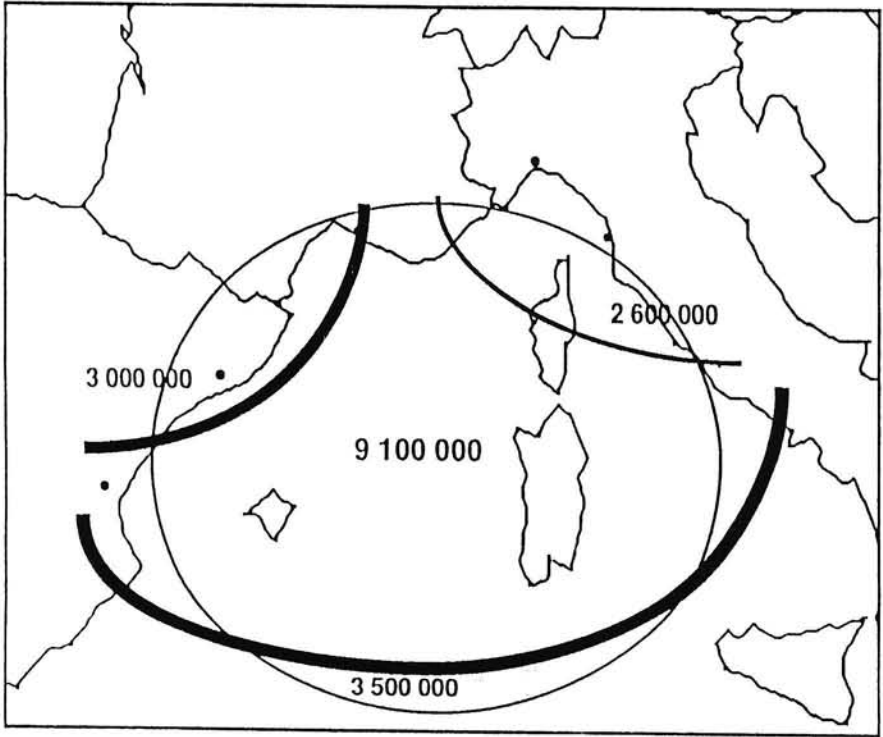
MAIN FLOWS AFTER
SELECTION OF GOODS
AND OF
ORIGINS/DESTINATIONS

THE SELECTION LEADS
TO REBALANCING THE FLOWS
TO THE BENEFIT OF
THE SPAIN-ITALY LINK
THIS IS CONSISTENT
WITH THE POTENTIAL
OF THE LINE ENVISAGED

Figure 2: Demand analysis

It doesn't just depend on the distance to cover, because economies of scale also play a part. The proportion of fixed cost is clearly greater in sea transport (because of the size of the investment represented by the vessel), and so this cost must be divided up by transporting a large number of trailers.

The calculations and hypotheses presented below aim to evaluate this large number .

However, the operating cost of a shipping route is difficult to define because of the numerous parameters that are involved (**Figure 3**).
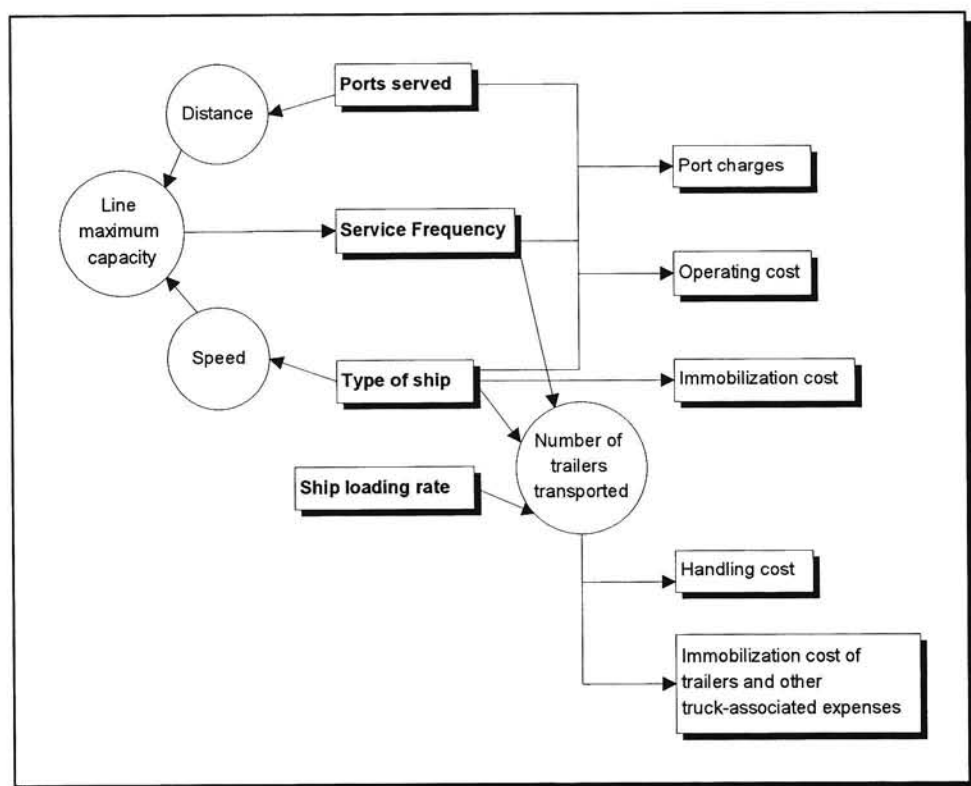
Figure 3: The offer

Figure 3 is a diagram which comprises the main parameters that must be taken into account in the calculation, and shows how they interact. It shows the choice variables in dark characters, and the calculations of costs in which they are involved are shown in normal characters. The variables resulting from intermediate calculations are ringed.

The type of vessel (size and speed) modifies not only the cost of investment, the running costs and the port costs, but also the transport capacity and the number of turnarounds per year.

The route and in particular the selected ports of call affect the distances covered, the number of turnarounds and the port costs.

On the basis of this diagram, operating hypotheses were then established by interviewing specialists in shipping and ports.

The guiding principle in selecting the hypotheses was to choose those which are the most realistic at the present time. This means the vessels of the year 2015 are not included in our calculations. In this specific example, it would have been pointless to evaluate the purchase price of equipment which does not exist. However, certain parameters such as the handling costs were added to the model as variables, so that they can be changed.

As **Figure 3** shows, the choice variables are:

The vessels;
The ports of call;
The turnaround frequencies;
The occupancy rates.

The vessels

We have shown that it is vital to conserve the speed and flexibility of the road transport mode. This means we must give priority to high turnaround frequencies and rapid vessels.

However the faster the vessel the greater its size. The challenge is therefore to find, if it exists, a vessel whose speed and capacity enable it to compete with road transport costs for realistic quantities of transported goods, bearing in mind the overall volumes evaluated in the first stage of the study.

Three vessels were tested:

* A small RoRo vessel: 450 lm;
* A medium-sized RoRo vessel: 700 lm;
* A larger RoRo vessel: 2,000 lm.

The ports

As far as possible, the choice of ports must take account of two divergant parameters. On the one hand the selected ports must make it possible to reach a hinterland of activities and consumption that is as large as possible. On the

other hand, the greater the distances covered on land, the more competitive sea transport becomes.

In the case of the Mediterranean Arc, the further you move towards the South of the peninsulas, the smaller the hinterlands of activity become. However, the further South you go the more the coastal geography favours the maritime solution.

The ports tested were Voltri, Genoa and Leghorn for Italy, Barcelona and Valencia for Spain and Marseilles for the French coast. Each combination involves the use of one port per country.

The occupancy rates and frequency

It has been established that the maritime unit cost is linked to its occupancy rate.

The occupancy rate hypothesis was added to our calculation model in the form of a variable. So the results following are based on occupancy rates of 50, 70 and 100%.

Similarly, the frequency of turnarounds depends on the vessel's speed, the loading/unloading times, the opening times of the ports, etc...

For example, a vessel sailing at 17 knots cannot carry out more than 120 turnarounds in one year.

The costs

Each constituent element of the costs was carefully integrated into our calculation model, and validated by a steering committee made up of professionals. The following parameters were taken into account for the sea route:

* The vessel's standstill costs, based on the chartering price, thus making it possible to include the maintenance and crew costs;
* The vessel's running costs;
* The standstill costs for the transported trailers or trucks, which although they economise on fuel and tyres continue to generate a standstill cost and possibly salary costs if the drivers are on board;
* Port costs (port duties + handling costs).

Concerning the road route, the following parameters were taken into account:

* The standstill costs of the trailers and tractors;
* Their running costs, linked to the kilometres covered;
* The annual running costs: tax, insurance, salaries.

When put together, the road transport costs form a cost per kilometre which is constant for each trailer.

3   SIMULATIONS AND RESULTS

The figures following give the transport cost for a trailer according to the annual frequency of the number of calls in each port and according to the average occupancy rate of the vessels.

The minimum frequency was set at 50, i.e. one call per week.

The maximum frequency is calculated according to the vessel's speed and the duration of the call (itself dependent on the number of trailers being handled).

Three curves are shown corresponding to three possible occupancy rates: 50, 70 and 100%.

The horizontal line corresponds to the cost of road transport by trailer, which is constant and constituted by adding the road transport costs to each link on the envisaged route.

Given the extent of the differences between the road transport time and the sea transport time, especially for small vessels which are therefore slow, we felt it was necessary to represent the lost time as an additional cost of sea transport.

Example 1: Marseilles-Voltri-Barcelona route

(**Figure 4 and 5**)   450 lm RoRo vessel
(**Figure 6 and 7**)   700 lm RoRo vessel
(**Figure 8 and 9**)   2,000 lm RoRo vessel

Example 2: Marseilles-Leghorn-Valencia route

(**Figure 10 and 11**)   450 lm RoRo vessel
(**Figure 12 and 13**)   700 lm RoRo vessel
(**Figure 14 and 15**)   2,000 lm RoRo vessel

These graphics demonstrate the technical and economic
feasibility of a metro-coastal shipping line in the Mediterranean, with a certain number of constraints.
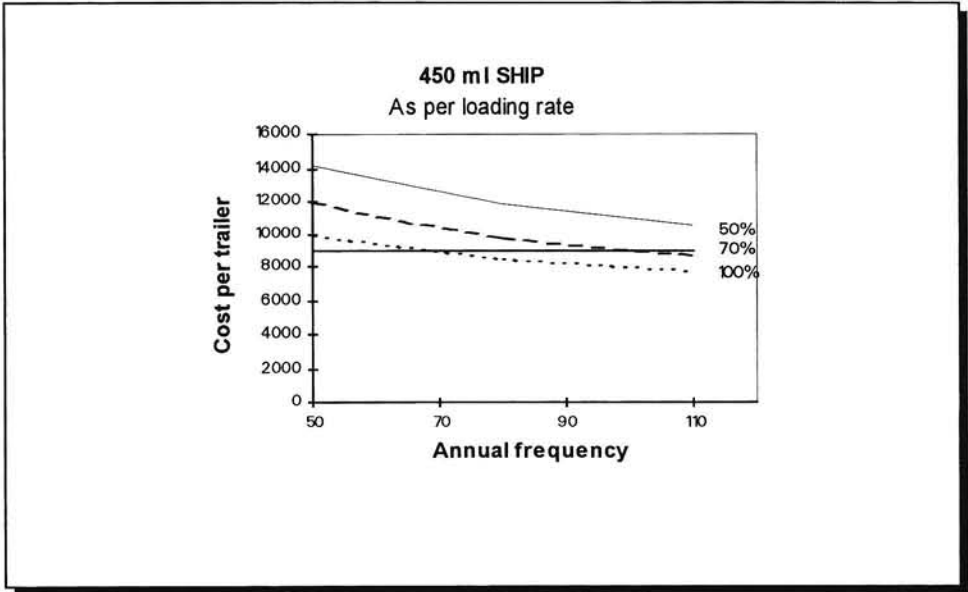
Figure 4:   Marseilles - Voltri - Barcelona, 450 ml ship
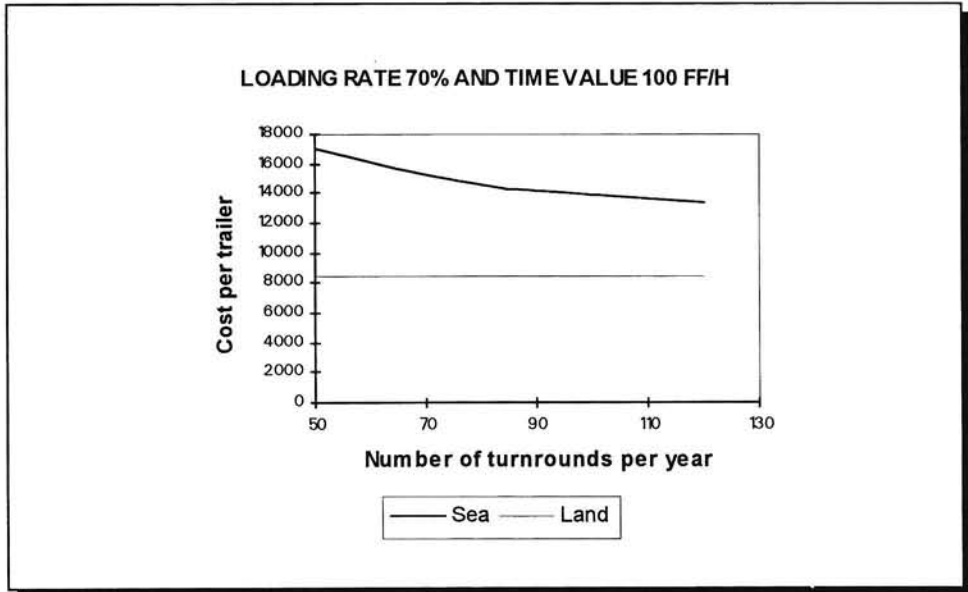
Figure 5:   Marseilles - Voltri - Barcelona, 450 ml schip

700 ml SHIP
As per loading rate
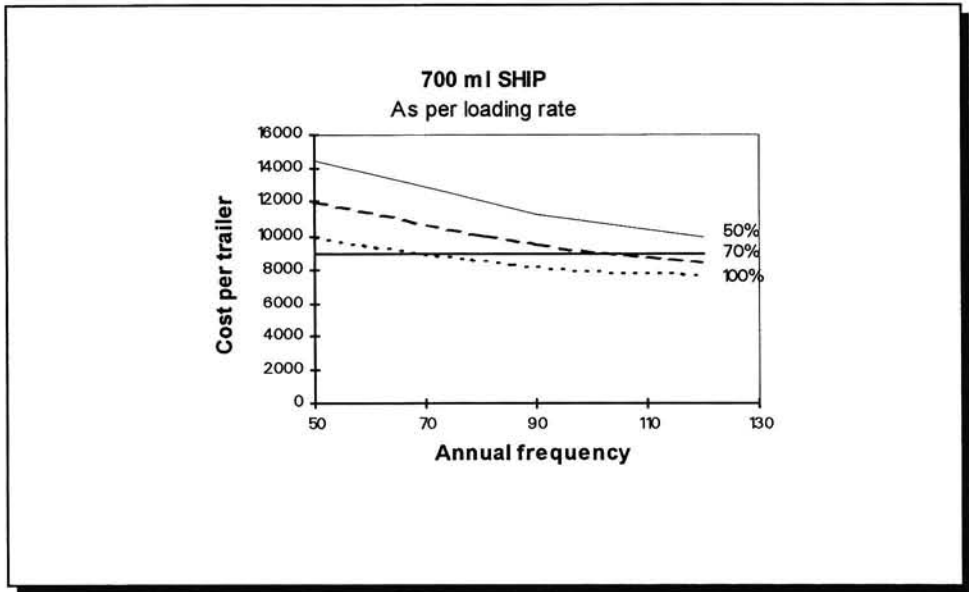
Figure 6: Marseilles - Voltri - Barcelona, 700 ml ship

LOADING RATE 70% AND TIME VALUE 100 FF/H
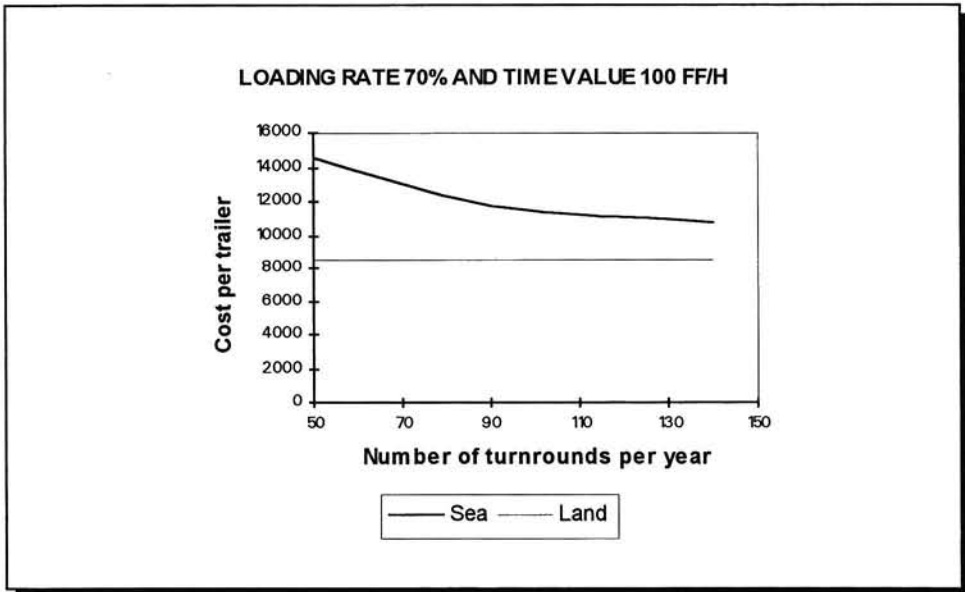
Figure 7: Marseilles - Voltri - Barcelona, 700 ml ship
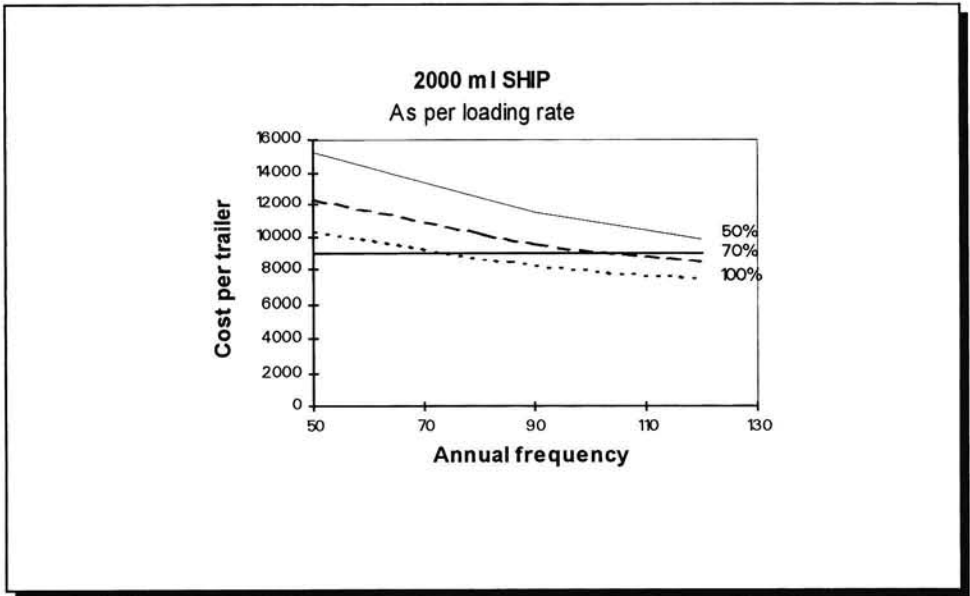
Figure 8: Marsilles - Voltri - Barcelona, 2000 ml ship
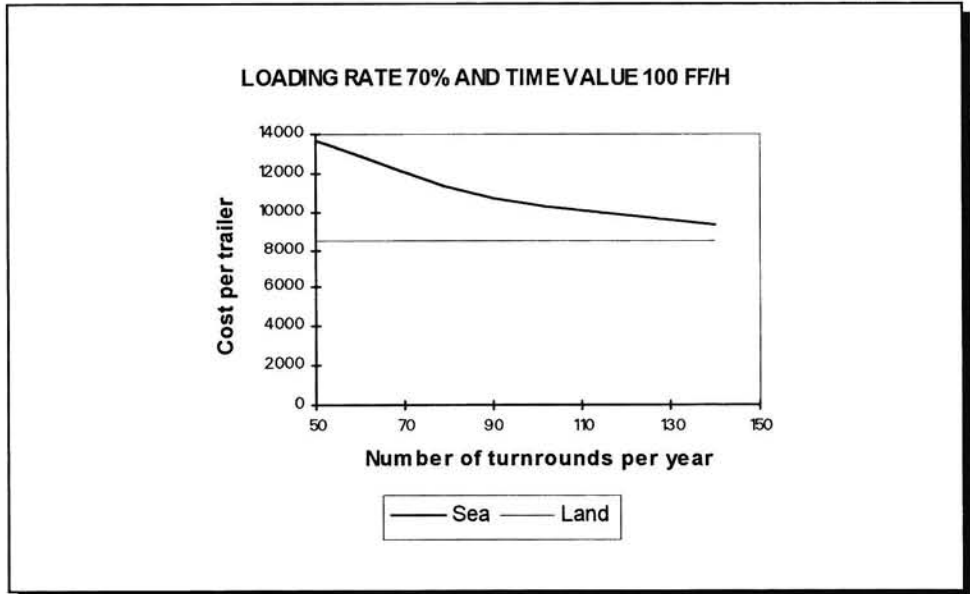
Figure 9: Marseilles - Voltri - Barcelona, 2000 ml

450 ml SHIP
As per loading rate

Cost per trailer

16000
14000
12000
10000
8000
6000
4000
2000
0

50%
70%
100%

50   55   60   65   70   75   80
Annual frequency
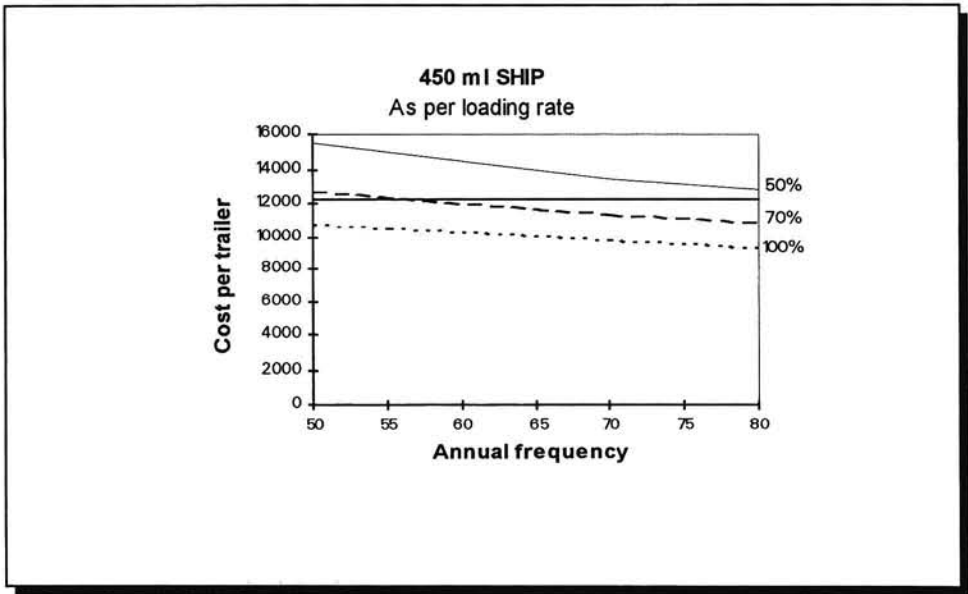
Figure 10: Marseille - Livorno - Valencia, 450 ml ship

LOADING RATE 70% AND TIME VALUE 100 FF/H

Cost per trailer

20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0

50   60   70   80   90
Number of turnrounds per year

Sea ——— Land
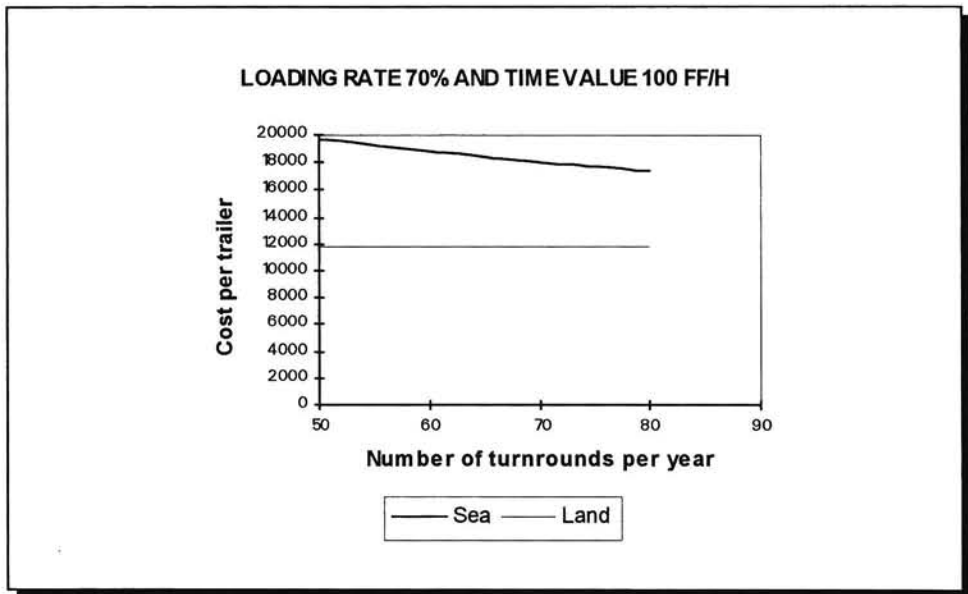
Figure 11: Marseilles - Livorno - Valencia, 450 ml ship
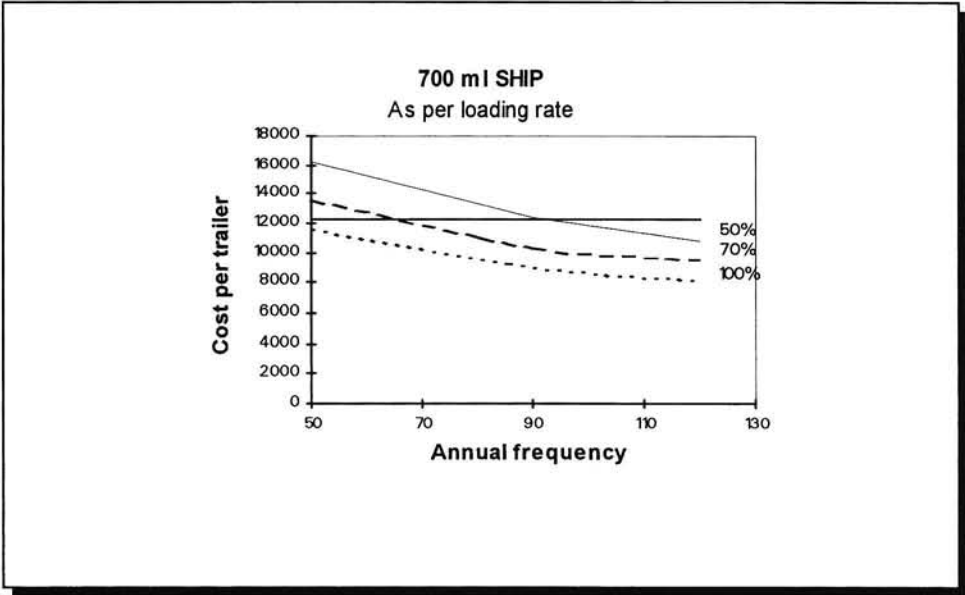
Figure 12: Marseilles - Livorno - Valencia, 700 ml ship
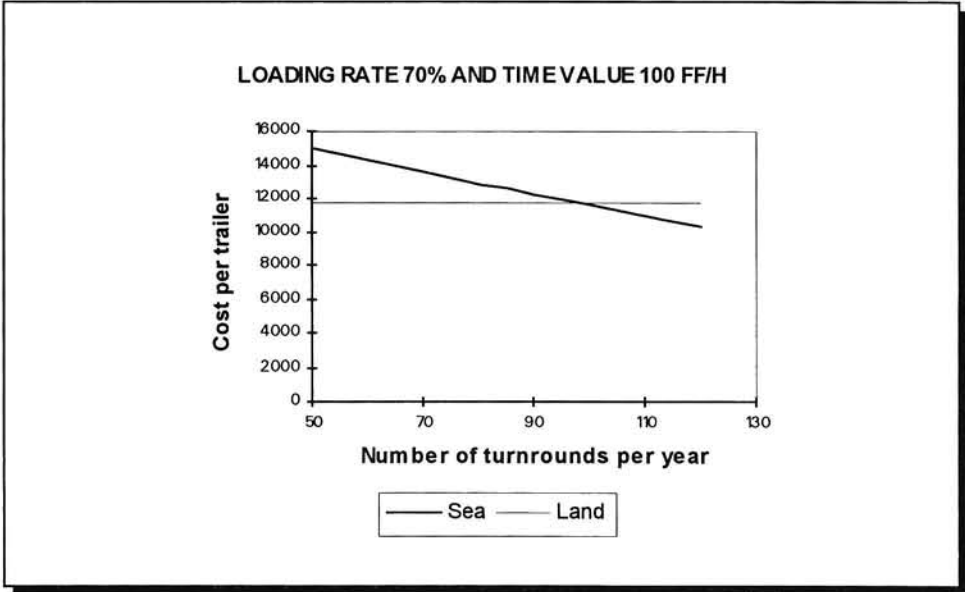
Figure 13: Marseilles -Livorno - Valencia 700 ml ship

2000 ml SHIP
As per loading rate
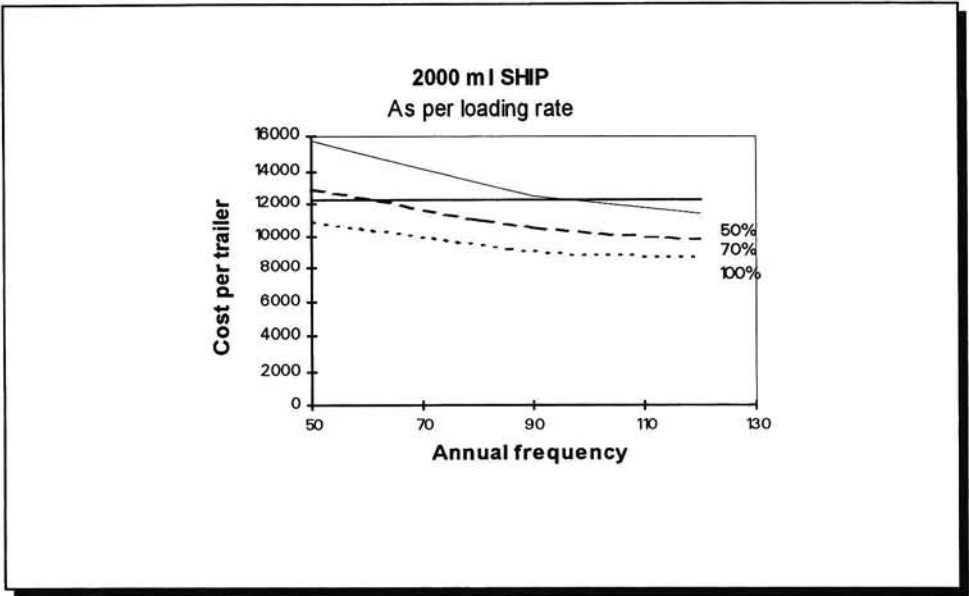
Figure 14: Marseilles - Livorno - Valencia, 2000 ml ship

LOADING RATE 70% AND TIME VALUE 100 FF/H
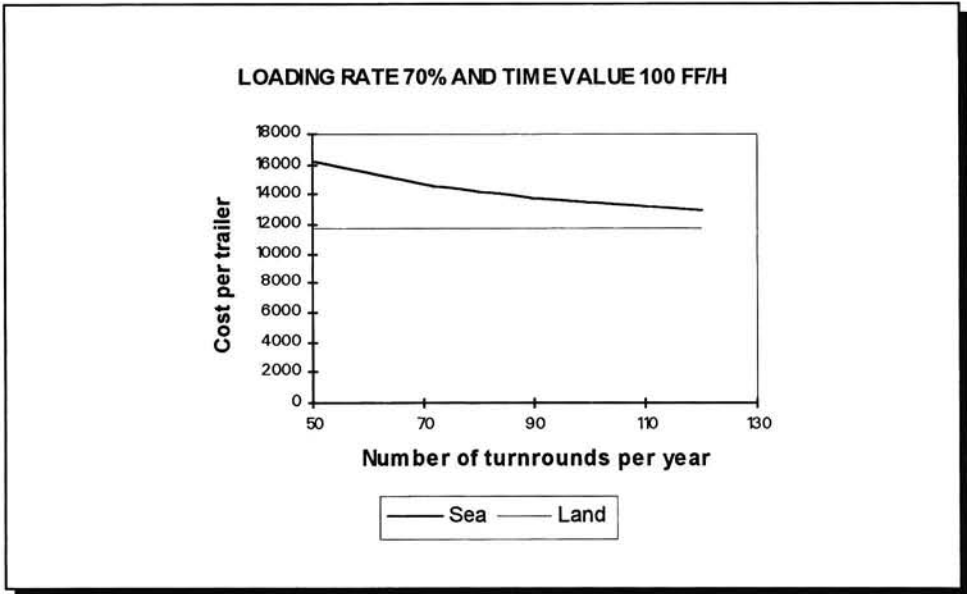
Figure 15: Marseilles - Livorno, Valencia, 2000 ml ship

These constraints are mainly linked to the technical characteristics of the vessels. Speed is essential, but if the size is too great it implies very considerable capacities, and the occupancy rate is a major factor contributing to profitability.

In the near future, high speed goods transport vessels should become available on the Mediterranean market. If they were used, the new metro-coastal shipping line in the Mediterranean would be an experimental operation.

In our present calculations, it is obvious that the highest profitability is obtained using the 2,000 lm vessel, on the route where the ports are at the greatest distance. However, the required occupancy rate (70%) means that it is essential to have a minimum load on call. A determined commercial effort will be required to obtain it.

Finally, the crucial factor remains fluidity, to be achieved through total reliability, competence and efficient organisation in the ports.

4   UNDERLYING ORGANISATION OF LOGISTICS

The results - obtained from a calculation of profitability - correspond to the use of a vessel that carries trailers without tractors.

However, at the end of this stage in which we had studied the pure economic profitability, we felt it necessary to examine the type of general organisational structure best suited to ensure the commercial success of a new metro-coastal shipping line.

Basically, two types of general organisation can be identified:

* The vessels load the trailers and tractors with their own driver;
  This solution has the advantage of minimising loading and unloading times. However, it also requires the vessels to be equipped to accommodate the drivers and is thus more costly. It should be noted that these vessels could be used to develop passenger transport (tourism) as an additional seasonal activity.

  This type of organisation corresponds more to a heterogeneous and totally independent set of customers. It would be especially suitable for the present road transport structure in Italy, but to a lesser extent in the other countries involved.

* The vessels load the trailers only;
  This solution requires warehouses in each port and centralised international organisation. The tractors and drivers are not carried, but rather take over from each other.

  This structure also requires close collaboration with one (or more) international carriers or forwarding agents to take charge of the goods' transport, as well as concentration of the flows and a minimum load on call.

  This option is undoubtedly the most likely to overcome the reservations among haulage firms, who are still reticent about integrating multi-modal structures for transport of goods.

Clearly, the definitive organisational structure used could be mixed, and combine a minimum load on call comprising trailers plus additional cargo constituted by trailers and their tractor and driver.

◆

In conclusion, the study of metro-coastal shipping has given birth to a new sea transport concept in the Mediterranean region.

Encouraged in our efforts by the results of the profitability study that presented here, we are now looking to define a commercial structure for this service that will live up to the requirements of road transport carriers, and will be sufficiently powerful to overcome existing habits.

At the European level the Brussels Commission will soon present a programme for action aiming to open up new short-distance sea routes and land-sea routes, following the work carried out by the Forum of Maritime Professions.

This means our project fits perfectly into the framework of European concerns.

We now intend to continue our work by mobilising all our European partners to open a metro-coastal shipping line, along the Mediterranean Arc as a first step.

This mobilisation will take place within the framework of the ASCAME (The Assembly of Chambers of Commerce and Industry of the Mediterranean, chaired by Marseilles), and may well lead to a widening of this transport concept to the whole of the Mediterranean Basin.

BALTIC BULK SHIPPING IN THE 1990S: HOW TO MATCH AN AGEING SHORTSEA FLEET WITH INCREASING DEMAND

By L. Ojala, S. Lall and M. Svendsen

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BALTIC BULK SHIPPING IN THE 1990S: HOW TO MATCH AN AGEING SHORTSEA FLEET WITH IN-CREASING DEMAND

1   INTRODUCTION

The purpose of this paper is to describe the market of shortsea bulk shipping in the Baltic region, and to analyse the possible outcomes of the current structure of supply and demand in this market towards the end of 1990s. The emphasis in the study is on the supply side, i.e. on the tonnage employed in the trade.

The type of tonnage under study consists of the dry bulk, general cargo and specialized dry bulk ships, together with dry bulk barges in the 1000 to 12000 DWT range, the typical size range of vessels employed on the Baltic trades. Countries of register include Germany, Denmark, Sweden, Finland, Russia, The Baltic States, Poland, Norway and the Netherlands. Tonnage from these countries form the core of the supply side in the Baltic (and the North Sea) market in the size range under study. By end-1993, the tonnage totalled 7 mDWT and over 1500 vessels (excl. Russian tonnage outside the Baltic area).

Data on tonnage, freight markets, insurance premiums and vessel markets is gathered for two indicative years, 1990 and 1993. The focal point in the market analysis is to compare the data within this very dramatic time interval in the Baltic region.

The Baltic bulk market has a strong potential in cargo demand for the 1990s. Data on cargo movements are gathered mainly within the Baltic basin only, while it is reckognized, that the market for the tonnage included in the study stretches also to the North Sea and beyond. For this reason, it is difficult to define the actual volume of the total trade. However, an attempt to assess the structure and the volume of the trade is made.

Despite of its importance for the Baltic countries, this 'small tonnage' market has largely been neglected by researchers (cf. Carlquist 1991). A number of papers have appeared on the restructuring of the former CIS and Baltic states' maritime activities (see e.g. Peters 1993, Hayter 1993, Jenssen 1993, Holt 1993, Vanags 1993, Levikov 1993, Krzyzanowski 1993). However, studies treating this shipping market from both the supply and the demand side are non-existent. Furthermore, the Baltic bulk shipping market seems to have improved substantially as from September 1993. Studies published in 1993 have, of

course, been unable to take such a trend shift on these highly turbulent markets into account.

This market could be described by a looming tripodization of the market (tripod = three legs). Firstly, there seems to be a growing interest in renewing tonnage in the 5000 to 10000 DWT range spurred by strong freight rates. Secondly, the smaller segment of the tonnage operated by Western shipowners, i.e. ships under 4000 DWT, is growing older, while there is little hope for newbuildings on current construction prices. Thirdly, the recent appearance of a large number of privatized/privatizing low-cost operators from the former Soviet fleet, including the Baltic states, are adding new dimension to this market in an unprecedented scale.

Our aim is, then, to analyze this market, and present conclusions as to which way the market is going, and whether there is a possibility to introduce technological innovations that would enhance the productivity of the fleet, thus reducing the need for major newbuildings which would otherwise seem inevitable. Finally, some policy recommendations are presented for shippers, shipowners, shipyards and countries involved.

2 MARKET SIGNALS

In this small chapter, a few recent news flashes and other market signals are presented. They are gathered from various maritime sources having one thing in common: they all are beams of light in the broad spectrum of issues in the Northern European shortsea bulk shipping markets in 1993/1994.

The purpose of this passage is in other words to "tune in" the interested reader, who already has "turned on"; and hopefully, to keep him or her "tuned in" till the end rather than let him or her "drop out" during the early chapters of the paper.

"Open for business - The Russian enclave of Kaliningrad, for years a fortress, has opened its doors to Western Europe and two shipping companies in particular are taking advantage of their freedom and geographical position." (Seatrade Review, August 1993, Ivan Berenyi)

"The shipping business has catched the wind in Finland - thanks to an rapid export growth by 15% in 1993." (Forum 2/1994, Christian Schönberg)

"A part of St. Petersburg's river port - Vasileostrovskij - turned into handling timber exports instead of incoming sand and macadam. 70 000 cubic meters exported to Sweden and Finland in 1993." (Ålands Sjöfart & Handel, 1/1994)

"Aged Swedish Coaster fleet. The Coaster M/S "Sydfart", built 1879 is 114 years old and still going strong with Swedish flag. The Swedish coaster fleet has an average age of 36 years." (The Scandinavian Shipping Gazette 31-32, 1993)

"Rise in P&I claims forecast - Forecasts of substantial increases in claims on P&I clubs, because of reinsurance changes, and tougher legislation in some parts of the world are made by the Britannia P&I Club in its outlook on prospects for the policy year running into next February." (Lloyd's Ship Manager, August 1993).

"The observation made in many previous reports - that inadequate maintenance could be seen as the main cause of most deficiencies - is still valid." (Lloyd's Ship Manager, September 1993)

"Financing costs are in the rise - raising funds for shipping is increasingly difficult as the banks become more risk averse." (Lloyd's Shipping Economist, July 1993)

"It is not true to say that the older the ship, the more prone to structural failure. In ships, as in humans, middle-age is the problem! It is the 14-22 year-old ships that have most frequent major claims of this category." (The Anatomy of Major Claims - A Mariners Guide; UK P&I Club, 1994)

"DNV [Det Norske Veritas] Classes Latvian reefers with a previously Russian class" (Fairplay, February 1994)

"States face fleet renewal - a lot of restructuring and fleet replacement work still lies ahead for shipowners and managers in the Baltic republics." (Lloyd's Ship Manager, September 1993)

3   MAJOR TRENDS IN THE SEABORNE BULK TRADE WITHIN THE BALTIC SEA

The democratic revolutions in the East European countries since mid 1989 have essentially changed the international context of Europe. The members of the European Community have to face up to their new role as the leader in the construction of a greater Europe - New Europe. Time stood still in Eastern Europe for 40 years. Before the World War II several of these countries were major European exporters of manu-factured commodities. What could be better for all these countries in the Eastern Europe than to have a large single European market as neighbour, and to provide it with goods on the basis of labour which is still cheap and raw material from huge natural resources. Available cargo statistics collected by individual Baltic ports during early 1990s does not fully

support the idea that exports from these countries would have picked up substantially yet.

Faltering economic growth in the West has caused major economic problems in Sweden and Finland. Especially for Finland, the almost simultanious breaking-up of the key trading partner Soviet Union greatly affected the country's economy. Now in 1994 the Swedish and Finnish export industries appear to be back on track again. The Finnish cargo statistics for 1993 showed both an all time high of exports and of total cargo turnover in Finnish ports. Finland has also improved its position as major "gateway" for Russian cargoes. Although the turnover in Swedish ports has also been improving slightly, some ports of other Western Baltic, notably in Germany and Denmark still present a negative trend.

The market for seaborne transport in the Baltic is of such complexity that it is impossible to assess all aspects of the market in the short space of the report. Also the difficulty to get comparable commodity trade statistics is inconvenient for this type of study. Therefore, this part of the study concerning cargo movements in the Baltic, is especially focused on a few fundamental factors that exert strong influences on the Baltic shortsea shipping market. We are beginning with a brief look at the complex mix of cargoes transported within the Baltic region. Then we are studying major port traffic developement in the Baltic focusing on the Eastern Baltic region including Finland.

3.1 THE COMPLEX CARGO MIX IN THE BALTIC SHORTSEA SHIPPING

To explain how the Baltic shortsea shipping industry approaches the task of transporting the complex mix of cargoes, we have to inroduce an indicative list of commodities in the Baltic trade (**Table I, Table II**). The purpose is to describe which types of cargoes are included in the Baltic shortsea trade in terms of parcel size, handling and value category.

The typical size of the consignment describes the range of parcel size in which respective cargo is actually shipped (1000-4000 tons and > 4000 tons, respectively). The list is not complete, but it helps to understand the parcel size distribution for each commodity. Because several products are shipped both in bulk, general cargo and special vessels, the commodity list cannot be divided in to bulk and general cargo. This is also the fundamental reason to the complexity of the Baltic shortsea shipping . The commodities are also devided into three CIF-value categories: low, medium and high value products. The transport requirements of these products and the demand they make on the Baltis shortsea shipping industry are very diverse. (For detailed discussion on parcel sizes, see e.g. Stopford 1992).

1. ORES	A	B	C	D	E	F	Handling	Value range
1.1. Iron concentrate		X			X	X	Bulk	Medium
1.2. Bauxit		X					Bulk	Low
1.3. Alumina		X		X			Bulk	High
1.4. Copper concentrate		X					Bulk	High
1.5. Zink concentrate		X					Bulk	High
1.6. Ilmenit		X		X			Bulk	Medium
1.7. Phosphate		X					Bulk	Low
1.8. Other ferroproducts(silica etc.)			X				Bags	Medium

2. COAL AND COKE	A	B	C	D	E	F		
2.1. Energy coal		X	X			X	Bulk	Low
2.2. Coking coal		X				X	Bulk	Low
2.3. Coke			X	X		X	Bulk	Medium
2.4. Petcoke				X		X	Bulk	Low

3. MINERALS	A	B	C	D	E	F		
3.1. Limestone/meal		X			X	X	Bulk	Low
3.2. Clay	X				X		Bulk	Medium
3.3. Soda			X				Bulk	Medium
3.4. Gypsumstone/REA-gypsum			X				Bulk	Low
3.5. Salt (Industrial, food,road)			X				Bulk and bags	Low
3.6. Sand products			X				Bulk	Low/Medium
3.7. Gravel			X	X	X	X	Bulk	Low
3.8. Sulphur			X				Bulk	Low

4. AGRICULTURE	A	B	C	D	E	F		
4.1. Grain	X				X		Bulk	Medium
4.2. Animal feedstuffs/meal			X				Bulk and bags	High
4.3. Sugar (raw and refined)				X			Bulk and bags	Medium/High
4.4. Soya beans			X				Bulk and bags	High
4.5. Sugar beet			X			X	Bulk	Medium

5. FORESTRY	A	B	C	D	E	F		
5.1. Timber (Logs and lumber)	X					X	LogsLow	
5.2. Sawn timber			X				Pre-slung	Medium/High
5.3. Wood chips			X			X	Bulk	Low
5.4. Peat			X				Bulk	Low

6. SEMI-MANUFACTURES	A	B	C	D	E	F		
6.1. Wood pulp	X				X		Bales	High
6.2. Steel products	X						Ingots, coil, etc.	High
6.3. Fertilizer				X			Bulk and bags	High
6.4. Quick lime			X		X		Bulk	Low/Medium
6.5. Cement				X	X		Bulk and bags	Medium
6.6. LECA pellets			X				Bulk	Medium

Table I: The mix of cargoes in the Baltic shortsea trade (1)

7. MANUFACTURES	A	B	C	D	E	F		
7.1. Paper	X				X		Rolls and bales	High
7.2. Construction material (bricks etc.)					X		Pallets	Medium/High
7.3. Other construction material (wallboard etc.)						X		PackagedHigh
8. VARIOUS RECYCLED PRODUCTS								
8.1. Slag				X	X		Bulk	Low
8.2. Metal scrap				X	X		Bulk	Medium
8.3. Waste paper			X				Bales	Low

Legend:
A:	Major commodities in Baltic trade parcelsize 1000-4000 t	**Value range**	
B:	Major commodities in Baltic trade parcelsize > 4000 t	Low	0-49 USD/ton
C:	Minor commodities in Baltic trade parcelsize 1000-4000 t	Medium	50-200 USD/ton
D:	Minor commodities in Baltic trade parcelsize > 4000 t	High	> 200 USD/ton
E:	Suitable for special vessels (selfdischarging, Ro-Ro, etc.)		
F:	Suitable for push or conventional open deck-barge		

Table II: The mix of cargoes in the Baltic shortsea trade (2)

3.2 CARGO MOVEMENTS IN INDIVIDUAL EASTERN BALTIC PORTS TO END-1993.

There are ten major ports along the coast starting from Szczecin-Swinoujscie in Poland up to North to St. Petersburg in the Gulf of Finland. The cargo statistics from this region is based on individual port data collected by the Baltic Port Organization (BPO). BPO was founded in early 1990s and its members counted 36 port authorities in 9 countries by the end of 1993.

St. Petersburg is located on the Eastern shore of Gulf of Finland and is an entry/exit point to the extensive canal system to the hinterland. However, the major Russian port in the region, St. Petersburg, has lost traffic in terms of the total cargo handled. The handling of dry bulk cargoes dropped by 31% from 1992 to 1993. On the other hand, the port of St. Petersburg managed to increase turnover of general cargo by 35% 1992-93. Port statistics in 1988-90 (Canfield 1993) support the positive results of the Russian policy to re-route transit cargo away from ports in Estonia, Latvia and Lithuania to ports located in Russia. However, the port of St. Petersburg did not succeed in increasing the handling of coal as planned after 1990.

The current trend, however, is that the Baltic State ports slightly outweighed St. Petersburg - the only major Russian port in the region during the period 1992-93 (Table III). The harbour has been badly operable due to lacking capacity to handle all necessary shipments and due to ice blockage from early November 1993 and shortage of icebreaker capacity.

Port	BPO data as per		1988	1990	1991	1992	1993	%change 92/93
St. Petersburg	December	import				9870	6864	-30.0
		export				2365	3566	51.0
		total import/export	**10900**	**10800**	**9800**	**12263**	**10479**	**-14.0**
		dry bulk of total	7600	7100		9245	6392	-31.0
		gen.cargo of total	3300	3700		3018	4087	35.0
Muuga **(Tallinn now port)**	December	import				4473	4992	11.6
		export				1183	2085	76.2
		total import/export	**5400**	**5000**	**6900*)**	**5657**	**7077**	**25.1**
		dry bulk of total	5200	4700		5105	5785	13.3
		gen.cargo of total	200	300		502	746	48.6
Tallinn city port	December	import						
		export						
		total import/export	**3600**	**3300**	**6900*)**	**4380**		
		dry bulk of total	2200	2400				
		gen.cargo of total	1400	900				
Riga	December	import				2810	840	-70.0
		export				1196	1482	23.9
		total import/export	**7000**	**6000**	**4400**	**4006**	**2323**	**-42.0**
		dry bulk of total	4700	4600		3400	1024	-69.9
		gen.cargo of total	2300	1400		606	1299	114.3
								* Klaipeda% change 91/92
Klaipeda	December	import			3781	3907		3.3
		export			10822	8227		-24.0
		total import/export	**20700**	**15300**	**14603**	**12134**		**-16.9**
		dry bulk of total	2500	2000	3398	4861		43.0
		gen.cargo of total	7900	6200	2973	2579		-13.2
Swinoujscie	December	import				1539	1586	3.0
		export				3209	4631	44.0
		total import/export			**19400**	**4749**	**6217**	**30.0**
		dry bulk of total				4591	5217	13.6
		gen.cargo of total				158	1001	535.2
Gdynia	September	import				2272	84624.9	
		export				4000	4914	22.9
		total import/export			**7500**	**6279**	**7760**	**23.6**
		dry bulk of total				3122	4382	40.4
		gen.cargo of total				2644	3256	23.2

1) The original figures by Canfield was given in million of tons.   *) Muuga and city port combined

The table is generated from: for the years 1988 and 1990: Canfield, 1993.
for the years 1991/1992 avg. (except for Klaipeda): Hayter, 1993
for the years 1991 for Klaipeda, all others for 1992 and 1993:
BPO Cargo Statistics, 1994

Table III: Breakdown of port statistics in he Eastern Baltic region 1988-1993 (1000 tons)

The major dry bulk ports in BPO statistics, Muuga (Tallinn), Gdynia and Swin-oujscie accounted for a major increase in cargo turnover - mostly in coal. A major part of the transit cargoes passing Tallinn is coal from as far away as Kazakhstan and the Urals.

Tallin has actually three ports: Muuga, City port and Kopli. Muuga is newly constructed and it is the new main port of the Estonian capital. City port still plays an important role with a turnover of 4.4 Mtons in 1992, while Muuga and the City port accounted together for 10.1 Mtons in 1992 (and 9.0 Mtons in 1988). In 1993, Muuga reached a cargo turnover of 7.1 Mtons, an increase of 25.1 per cent from 1992. The port of Kopli is a fishing harbour.

The Baltic Republic ports are still playing a leading role as links in Russia's and other C.I.S. countries' transit (usually westward) traffic. The current transit traffic through Estonian, Latvian and Lithuanian ports is roughly 27 Mtons (**Table V**). The biggest loosers in the competition on this traffic have been the ports of Riga and Klaipeda. Crude oil and petroleum commodities represent the main cargo categories affected in Klaipeda - a decrease of 2.8 Mtons from 1991 to 1992 (BPO statistics 1994). The liquid cargo turnover in the port of Klaipeda was 10.3 Mtons in the peak-year 1988, but only some 5.5 Mtons in 1993 according to BPO data (cf. Canfield 1993, Kryzanowski 1993).

The ports of Gdansk and Swinoujscie are the main ports in Polish coal exports, counting for about 70 per cent of all Polish maritime trade. The ports of Swinoujscie and Gdynia for which data is available in **Table III**, show high increases in cargo turnover. This is due to an increasing market in 1993 for Polish coal within the Baltic Sea and also an increasing trend for general cargoes for export. The Polish coal export increased by some 13 per cent from 1992 to 1993 (STINNES 1993).

In 1993, Poland exported about 22.1 Mtons of coal of which 19.6 Mtons was sold by the state-owned Weglokoks company. Notable increases in imports of this coal by Weglokoks were recorded in Finland: from 2.1 Mtons in 1992 to 3.7 Mtons in 1993, and in Denmark; 0.7 Mtons in 1992 compared with 2.1 Mtons in 1993 (International Coal Report, Jan. 24th, 1994).

3.3 GATEWAY FINLAND - C.I.S. TRANSIT TRAFFIC IS RISING

While cargo traffic in St. Petersburg has been declining, the traffic over Finnish-Russian border has been increasing. The decrease in transit traffic through Finland was very severe in 1990-1991. The decrease stopped in 1992 and the transit traffic rose significantly in 1993 (20%). The transit traffic through Finland, with its modern and highly operable ports, has a great potential of growth (**Table V**). The actual growth has above all been caused by the increasing market share of Finland in Russian transit.

FINLAND

EXPORT	1990	1991	1992	1993	% change 92/93
Dry Bulk	4932	6251	5330	6606	23.9
Liquid Bulk	3300	4035	4818	4376	-9.2
Gen. Cargo	15576	16151	17438	20715	18.8
Other	239	181	172	179	3.9
Total	24047	26618	27758	31876	14.8

IMPORT	1990	1991	1992	1993	% change 92/93
Dry Bulk	17659	15540	15736	16685	6.0
Liquid Bulk	11506	12167	11363	10469	-7.9
Gen. Cargo	4987	4192	4576	4982	8.9
Other	673	378	424	424	-0.1
Total	34825	32277	32099	32560	1.4

TOTAL	58872	58895	59857	64436	7.7

TRANSITO	1990	1991	1992	1993	% change 92/93
Import	1154	611	735	625	-15
Export	4119	3900	3354	4288	27.8

ORIGIN/DESTINATION OF FINNISH SEABORNE TRADE IN 1993 IN 1000 TONS

	IMPORT	% of imports	EXPORT	% of exports	TOTAL	% of total trade
Baltic Sea	16108	49.5	10322	32.4	26430	41.0
Europe total	30600	94.0	27034	84.8	57635	89.4
All other regions	1960	6.0	4842	15.2	6801	10.6
TOTAL	32560		31876		64436	

Table IV: Finnish seaborne trade in 1990-1993. *(Source: the Finnish Board of Navigation, 1994)*

The growth in transit traffic is mainly explained by that the Russia has lost nearly all its Baltic and Black Sea ports to the Baltic Republics and Ukraine where they are entailing new border-crossing formalities and extra costs for through traffic. The ports are, of course, still there, but there is also a considerable unwillingness by the Russians to use these ports. Consequently, the port of St. Petersburg, which has been Russias only operable Baltic port in 1993, has been seriously congested.

After a few bad years in the early 1990s due to the break-up of the former Soviet Union, the Finnish industry appears to be back on track mainly thanks to the downward adjustment of the markka by about 30% since 1991. Now the Finnish business has catched the wind, which can be seen in the traffic figures for 1993 (**Table IV**).

	Traffic Mt/y	Billion tonnekm/y
Export		
Through Baltic ports	22.6	53.3
Through Finland	4.4	12.1
Import		
Through Baltic ports	4.1	2.4
Through Finland	0.8	3.3
TOTAL	31.9	71.1

(Source: Mr. P. Aaltonen, The Finnish Ministry of Transport & Communications, Feb. 1994)

Table V: Current transit trades through Finnish and Baltic Republic ports.

3.4 OTHER BALTIC TRAFFIC

The Nordic countries Sweden and Finland are both substantially dependent on seaborne traffic within the Baltic. Shortsea shipping between Scandinavia and the continent is the dominant transport mode. Looking at the latest seaborne traffic reports from Sweden it shows a modest increase **(Table VI.)**. On the other hand the figures are collected from a short period January - September. The period of growth within the export traffic is normally the late autumn September - December. Thereby these figures are not representative in general.

Other ports accounted for in the BPO statistics were ports in Denmark and Germany presenting a decline in cargo turnover (encl. 1. BPO cargo statistics 1992/1993). The current recession in the West has still an negative effect on the cargo turnover in other Western Baltic ports.

3.5 CONCLUSIONS - TRENDS IN THE CARGO MOVEMENTS IN THE EASTERN BALTIC

The brief look at the cargo statistics in **Section 3.2.** was not expected to give absolute answers concerning the prospects for cargo movement, but the results identify some major trends. Russian, Baltic and Polish ports will be competing in a market which will continue to be characterized by uncertainty and disruption of traditional trading patterns in a time with increasing foreign trade demands and reorganization of the transport patterns.

The Russian concept of developing and constructing new capacity ports and the gradual shifting of cargo flows to them, seems not to affect the traffic patterns in the near future. A study about the todays situation regarding transportation projects including ports in the St. Petersburg region, tells us that their impact on the trade routing is a vision of the future. Taking into account todays emerging

situation in the Russian Baltic cargo handling capacity, the competition for the traditional volumes of Russian and C.I.S. transit cargo between other Baltic ports will increase.

The transit cargo from and to Russia and C.I.S. is seeking for "gateways" and require reliable and secure transport channels based on well functioning ports in the Baltic sea. The Baltic ports and shipping services are important satellites of the C.I.S. countries, when they are building up their exports to and imports from Europe. Several signals present increasing movements of general cargo in the ports reported. Also the major dry bulk ports within the Eastern Baltic region are presenting an upward trend. Russia and Poland are still heavily dependent on energy exports to get hard currency.

	9/1992	9/1993	% change
Export			
Dry bulk	6872	5666	-17.5
Liquid bulk	8205	8186	-0.2
General cargo	11547	11827	+2.4
Other	9142	9604	+5.1
Total	35766	35283	-1.4
Import			
Dry bulk	6887	8031	+16.6
Liquid bulk	20520	21446	+4.5
General Cargo	6193	5886	-5.0
Other	7396	7037	-4.9
Total	40996	42400	+3.4
TOTAL	76762	77683	+1.2

(Source: Sweden overseas shipping during July-September 1993, Statistics Sweden, T 47 SM 9304)

Table VI: Swedish seaborn trade 9/1992-9/1993 (September), 1000 tons

After having suffered in the early 1990s from the break-up of the important trading partner the former Soviet Union, Finnsih exporters began seeking out new markets. Now the Finnish industry appears to be back on track and the exports in terms of tons has increased by 15% from 1992 to 1993. Sawn timber, pulp, paper, metals, chemicals are main export growth areas. Therefore, also the demand for raw materials has increased substantially. The bulk import has increased by 6% during the same period. At the same time the transit traffic of Russian cargoes has increaed substantially. There is also a slightly increasing trend in the seaborne trade of Sweden. Seaborne traffic in other Western Baltic regions presents still a negative development.

4 STRUCTURE OF THE SHORTSEA BULK TONNAGE IN THE BALTIC REGION

4.1 TONNAGE DEFINITIONS

The term 'shortsea shipping' is here understood as execution of shipping activities using relatively small ships in a limited geographical area. This is in contrast to deepsea shipping, where usually larger vessels are employed in worldwide trades across the deep oceans.

Vessels engaged in shortsea shipping are usually built, equipped and manned to satisfy the requirements in the (limited) trading area where they are meant to operate. For the Baltic and North Sea dry bulk trades this means in practice bulk or general cargo ships in the range of 1000 to 8000 DWT. The average size of spot trading bulk ships in the Baltic and the North Sea trades is roughly 3000 DWT. Formal standards in this respect do not exist, however. In the relatively short coastal and intra-Baltic trades, barges are also common in transports of low value goods.

A variety of specialized ships are also common in the Baltic trade. When gathering data for relevant vessel types for this study, the various tonnage data sources used partially different names oir definitions for the vessels. The vessel types targeted for this study included bulk and general cargo ships (incl. single and multi deck ships; and the so-called multipurpose vessels), specialized bulk ships, and ships for specialized cargo, and barges.

4.2 DETAILS OF THE TONNAGE DATA SEARCH

The main source of tonnage data was Lloyd's Maritime Information Services (LMIS), which produced a detailed vessel list according to our specifications. Data was gathered for both end-year 1990 and 1993. This data is very detailed, but a major drawback was that the Russian (1993) and the Soviet (1990) data was not specified by regions. In this way, the whole of Russian (or Soviet) fleet of the actual type and size were included. (see **Table VII**)

Russian tonnage operating in the Baltic is almost entirely controlled by three major shipping companies. They are the Baltic Shipping company, North western River Shipping Co. and White Sea & Onega Shipping Co (see e.g. Peters 1993a). Complementary data for these three companies was gathered from from the

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LMIS = Lloyd's Maritime Information Services, London

	Register codes used		Ship groups in the study
	1990	**1993**	
Finland	FIN	FIN	*Group 1* 19200 Bulk
Sweden	SWD	SWD	19010 General Cargo
Denmark, national	DEN	DEN	*Group 2* 19060 Specialized Cargo
Denmark, international	DIS	DIS	19800 Specialized Bulk
Norway, national	NOR	NOR	*Group 3* 19008 Barge
Norway, international	NIS	NIS	
The Netherlands	NTH	NTH	**Size distribution**
Germany	GFR	GEU	1000-3999 DWT
Poland	POL	POL	4000-7999 DWT
Latvia		LAV	8000-12000 DWT,
Lithuania		LTH	
Estonia		ETN	**Type of data gathered**
Russia		RUS	No. of vessels
Soviet Union	USR	USR (!)	Total GT
			Total DWT
Tonnage data as per	Dec. 31.1990	Dec. 31.1993	

Other principal ship type codes used by LMIS not included in the study

12000	Roro Cargo	19030	Tanker	19006	Specialized service
13000	Gas Tanker	19040	Factory	19007	Laker
15000	Sail	19070	Naval Combat	19009	ORSV Supply
18000	Sand Carrier	19080	Dredger	19807	Bulker, Great Lakes
19100	Passenger	19001	Container	19232	OBO
19300	Gas Carrier	19002	Ore Carrier	19032	ORO
19400	Tug	19003	Specialized Tanker	19011	Container
19600	Research	19004	Ferry	12004	Ro/Ro Cargo Ferry
19700	Hopper	19005	Fishing	19409	Tug/Supply Ship

No sub codes on ship types were employed in the data search

Table VII: Details on the tonnage data search from LMIS employed in the study

July 1993 edition of Lloyd's World Shipowning Groups (LWSG). This data refers to early 1993 only. Data on current newbuildings was gathered from Fairplay's newbuildings supplement (27th January 1994). Bulk, general cargo and multi-purpose ships were included from this data. The newbuildings included are due for delivery in 1993-1996. Despite of the fact that they do not represent identical ship type definitions than LMIS or LWSG data, they give a fair indication on the volume of tonnage now on order in this type and size range.

The newbuilding data is given by country of ownership (with data on the flag used). In this way, some other flags than the actual Baltic flags are included in this data. There are only two major groups of vessel orders being registerd under 'non-Baltic' flags. These include ten 2750 DWT dry cargo ships orderd by Russian interests from the Volgograd shipyard under the Maltese flag, and nine 4250 DWT dry cargo ships ordered by the German Chr. F. Ahrenkiel shipping company from the Sava and Begej shipyards under the Liberian flag (Fairplay 27th Jan. 1994). A few other German orders in this category are registered under other flags (Cyprus, Singapore and Antigua), too.

In Lloyd's Ship Manager (August 1993) the Russian interests behind the Maltese-flagged NB's were said to be the North-Western River Shipping Company. According to the Swedish Shipping Gazette (SSG) in early 1994, the current name of the company is North Western Shipping Company, thus indicating the growing emphasis on sea-going tonnage operated by this company. According to SSG, such changes in names seem to interest other Russian river shipping companies, too.

4.3 STRUCTURE OF THE TONNAGE IN THE CHOSEN REGISTERS

The structure of the overall tonnage data in the 1000-12000 DWT ships size category for the bulk tonnage (see **Table VII** for tonnage details) in end-1990 and end-1993. It shows clearly that the bulk and general cargo vessels (the two bottom blocks in the diagram) form the core of this type of tonnage. Equally clear is the high proportion of elder tonnage in these categories; about half of the tonnage is at least 15 years old. The data does not allow a reliable calculation of the avergae age of the tonnage, however.

The total fleet of these bulk, general cargo, specialized bulk ships and barges was 10.7 mDWT as per Dec. 31, 1990, and 9.4 mDWT as per Dec. 31, 1993. There was a decrease of some 1.3 mDWT between the two dates.

The data includes, however, the total Soviet and Russian fleet in this category, respectively. In 1990, the total Soviet fleet was 6.3 mDWT, and in end-1993 the Russian fleet with a small remainder of Soviet-registered tonnage totalled 4.4 mDWT. Thus the Soviet-Russian fleet has underwent a reduction equal to 1.9 mDWT from end-1990 to end-1993.

This simple calculation indicates that the fleets of all other registers increased by 1.9 mDWT - 1.3 mDWT = 0.6 mDWT. But at the same time, the fleet of the newly independent Baltic states totalled 0.9 mDWT by end-1993. Most part of this tonnage was included in the Soviet data for end-1990. This leads us to the conclusion that the overall tonnage for all other countries than Russia (and the Baltic states) remained at a constant level, or even diminished slightly. Without doubt, the fleet grew older from 1990 to 1993. (see **Figure 1**)
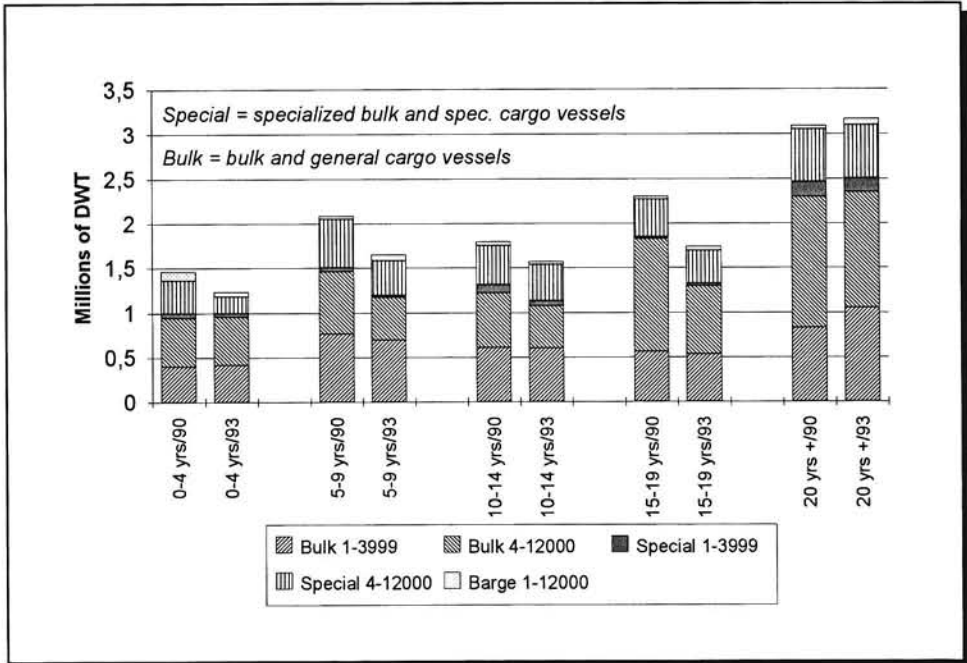
Figure 1: Aggregated tonnage data by age for the surveyed vessel types; end-year 1990 & 1993, *(Source: LMIS)*

4.4 TONNAGE DATA BY COUNTRY OF REGISTRY

In this chapter, the tonnage data is given by country of registry as prepared by LMIS (see **Table VII**). It is reckognized, however, that there is tonnage operated by shipowners domiciled in the countries included in the study that fly other, often FOC flags. Such data is very difficult to gather, and that effort has not been made here.

FOC tonnage in the vessel range under study is owned e.g. by German, Dutch and Norwegian shipowners[1], as well as lately by Russian owners/interests, too. One reason for the Russian flagging-out has been the inability to arrange ship mortages within the weak commercial banking system in Russia, though legal arrangements for this have been established (Holt 1993). On the other hand, e.g. the Baltic Republics' registers have been used by owners from mainly Germany and the Netherlands. For these reasons, even the most detailed data by country of registry is able to give only a partial picture of the reality.

The tonnage data is divided by the major tonnage sizes used in the Baltic (and the North Sea) trades. This division goes in practice roughly at 4000 DWT, so the tonnage range from 1000-3999 forms one group and the range from 4000 to 12000 DWT the other (cf. the parcel size table in **Chapter 3**). The countries with the largest fleet in these categories are Russia, Germany and the Netherlands.

The data for these countries includes also a number of river going vessels, which cannot be exctracted from the data; for example the LMIS does not provide any sub-code to do this type of data search. On the other hand, such a division may not be realistic since part of these river-going vessels may be employed in coastal and other shortsea trades as well.

Because of the overwhelming size of the total Russian tonnage, separate data for the Baltic Russian tonnage was necessary for this paper. Such data is derived from LWSG data. It should also be stressed, that despite of strong evidence of falling traffic and excess capacity of the (total) Russian fleet proponed e.g. by The World Bank's recent report (Holt 1993, 149-150), the subject matter in this paper is excplicitely the Baltic trades, where rapid changes have occured since late-1993 and early-1994.

To separate the Baltic Russian fleet from the total Russian tonnage is very important here; e.g. in the larger size group (4000-12000 DWT), the Baltic tonnage (approx. 0.2 mDWT) was only about 11 per cent of the Russian total fleet, which exceeded 1,6 mDWT as at December 31, 1993. In the smaller segment (1000-3999 DWT), the Baltic fleet amounts to almost 0,7 mDWT, or some 45 per cent of the total Russian fleet of some 1.5 mDWT at end-year 1993.

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[1]Examples of the Norwegian owners are the *Jebsen Thun Shipping Group* with some 15 bulk and general cargo ships in the 3000 to 7000 DWT range with a total tonnage of some *75 000 DWT*, and the *Paal Wilson & Co. A/S* with some 7 general cargo vessels in the 2500 to 4700 DWT range under the Maltese flag, together with two cement carriers of 2000 and 3000 DWT, with a total tonnage of some *30 000 DWT*.

In the following sub-chapters, only bulk and general cargo vessels are included in the data, since these vessel types form the core of the trading tonnage in this region. Specialized bulkers and barges are not included in **Sections 4.4.1.** and **4.4.2.** These two ship classes count for less than 20 per cent of the total tonnage (see e.g. **Figure 1**), are mainly employed in industrial shipping, i.e. the tonnage is owned or controlled by the shippers (see e.g. Ojala 1993a).

4.4.1 Bulk and general cargo tonnage in the 1000 to 3999 dwt range

The age structure of the individual registers can also be clearly seen in the following **Figure 2** and **Figure 3**. The larger fleets of Russia, Germany and the Netherlands are portrayed separately from the 11 other registers. Interestingly, these include the old Soviet register with 15 vessels (at 50000 DWT). The data is gathered as at December 31, 1993.

In this deadweight range, the German tonnage is remarkably new compared to other countries' tonnage, the only exception being the DIS-registered fleet, which is also relatively large.
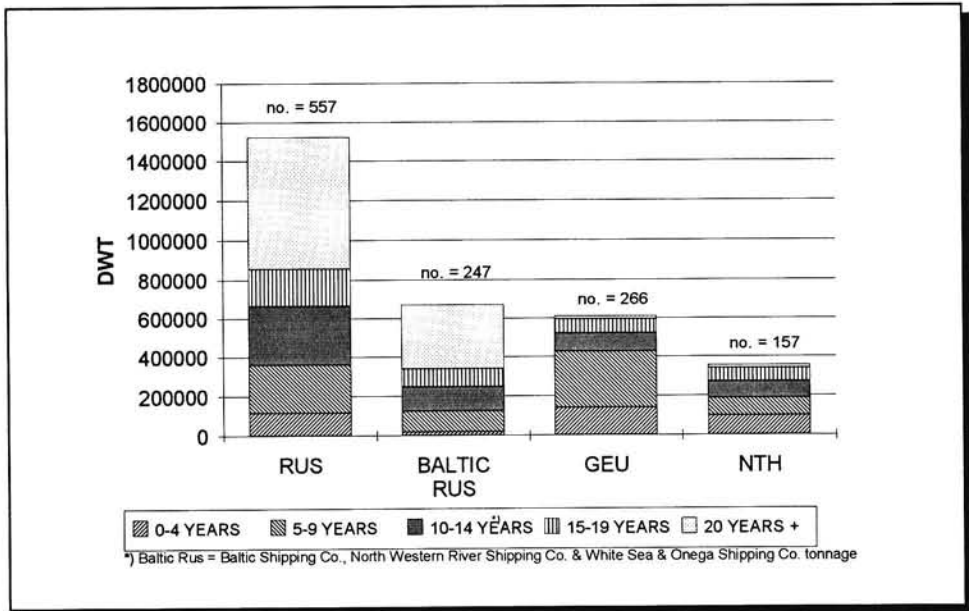
Figure 2: Bulk & general cargo tonnage in the 1000-3999 DWT range end-year 1993 *(Source: For Baltic Rus - Lloyd's World Shipowning Groups, july 1993; For RUS, GEU, NTH = LMIS)*
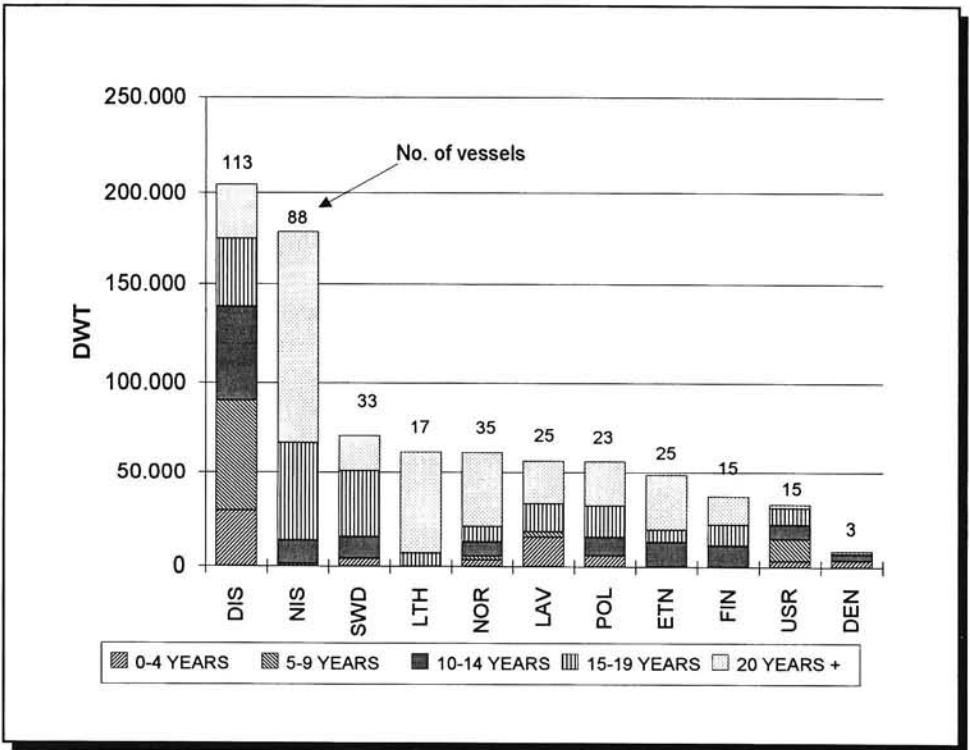
Figure 3: Bulk and general cargo vessels in the 1000-3999 DWT range, end-year 1993, *(Source: LMIS)*

In absolute terms, almost 0,9 mDWT of tonnage were under 10 years of age. Old tonnage in this size range is found in Norway, Russia, Finland and the Baltic states as well as in Sweden and Poland. Alltogether, there were 1062 vessels in these registers in this size range (for Russia, only Baltic Russian ships were included).

4.4.2 Bulk and general cargo tonnage in the 4000 to 12000 dwt range

In this larger size group the newest fleet is that of the Netherlands, followed by Germany and Russia. Finland, Norway (NIS) and Denmark (DIS) have also fairly young fleet in this group. (**Figure 4** and **Figure 5**).

In absolute terms, a tonnage of some 0.7 mDWT in these registers were under 10 years of age. In these registers, there were alltogether 353 vessels in the size range (for Russia, including only Baltic Russian ships).
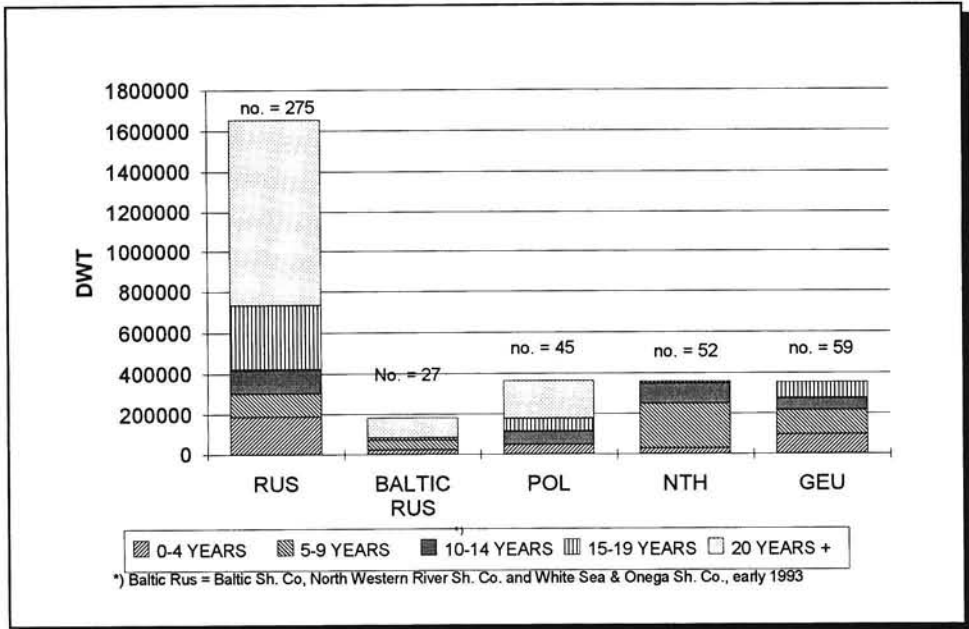
Figure 4: Bulk & general cargo tonnage in the 40000-12000 DWT range end-year 1993 *(Source: For Baltic Rus - Lloyd's World Shipowning Groups, July 1993; For RUS, GEU, NTH = LMIS)*

4.5 DATA ON NEWBUILDINGS

The latest available data on the newbuilding (NB) orders were gathered from Fairplay's list from January 27th, 1994. This data refers to NBs from yards to be delivered in 1993-1996. Some of the vessels in this data have been delivered by end-1993, but the majority of tonnage is due for delivery in 1944 and beyond. The data includes dry cargo, multipurpose and bulk vessels in the size gropu 1000 to 12000 DWT, as defined by Fairplay.

In the Baltic range, the most NBs are ordered by German interests, followed by Norwegian, Danish and Dutch interests. Despite of the sizeable Russian orderbook, only six vessels were order by the three Baltic Russian shipping companies. **(Figure 6)**

Very few small ships are being ordered, strengthening the evidence that small bulk ships under 4000 DWT cannot find a feasible market under current con-struction prices and freight markets. Larger vessels (usually at 6000-7000 DWT) clearly dominate the orderbooks.
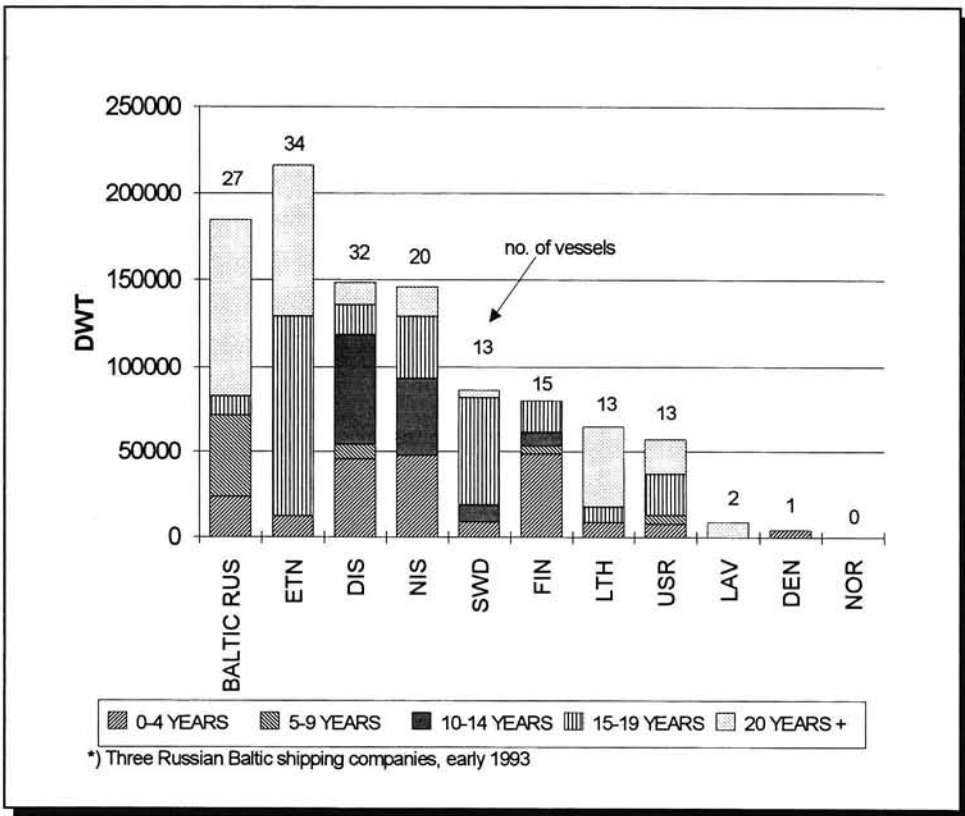
Figure 5: Bulk and general cargo tonnage in the 4000-12000 DWT range, end 1993, *(Source: LMIS, except for Baltic Rus; Baltic Rus = LWSG, July 1993)*

Germans are also registering some of their NBs to other flags than the German one. There is also one order by the Dutch Soertermeer on a 3200 DWT vessel to be registered under the Cyprus flag, along with the 11 vessels' order by Russian interests to the Maltese flag mentioned earlier.

4.6 PRICE DEVELOPMENTS FOR THE MINOR BULK VESSELS IN 1990 TO 1993

The price development of regular dry cargo/bulk ships could be characterized as a steep increase in both NB and second-hand (SH) prices. This is indicated in the **Table VIII**, which is gathered from reliable Norwegian shipbroking sources (Bredrup, Bergen Shipping A.S., February 1994). These indicative prices in the
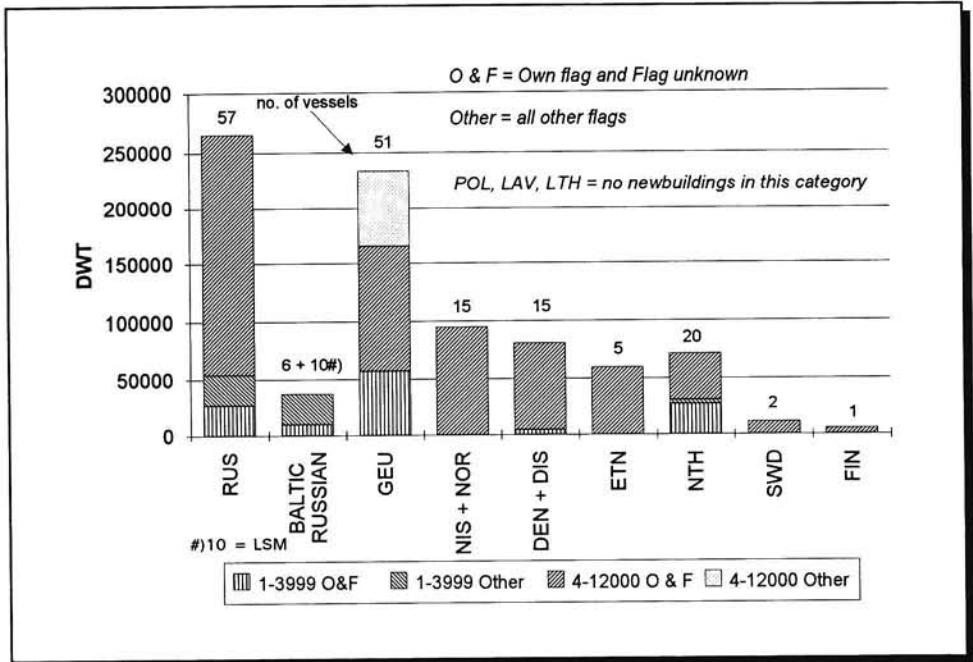
Figure 6: Newbuildings on dry cargo, multipurpose and bulk vessels in the 1000-12000 DWT range, 1993-1996, *(Source: Fairplay, newbuildings suplement, 27 jan, 1994; LSM, Aug. 1993)*

Northern European range are given for approximative vessel sizes of 1000, 3000 and 8000 DWT, respectively.

	Year	NB min	NB max	SH 8 years	SH 16 years
1000 DWT	1990	3,0	5,1	0,9	0,4
3000 DWT	1990	7,6	11,8	2,2	5,1
8000 DWT	1990	13,5	18,6	1,1	2,7
1000 DWT	1993	3,6	5,7	1,0	0,3
3000 DWT	1993	7,2	11,5	3,9	1,3
8000 DWT	1993	11,5	17,2	5,3	2,3
		NB = Newbuilding		SH = Second hand	

Table VIII: Indicative prices for newbuildings and second-hand ships, 1990 and 1993, in USD million

5 FREIGHT RATES AND TRENDS IN SOME BULK SHIPPING COSTS

The freight rates for simple bulk vessels in the size group under study are given in **Table IX**. The data is collected from a number of Norwegian shipbrokers dealing in this particular market, and they reflect the spot market rates calculated in T/C equivalents for the Baltic/North Sea market for vessels approximately 1000, 3000 and 8000 DWT by cargo carrying capacity.

Approx. size	1990 Average	1990 December	1993 Average	1993 December	% change Dec.90/Dec.93
1000 DWT	1270	1500	1500	1600	6,7
3000 DWT	2550	2550	2750	3600	41,2
8000 DWT	4230	4740	4600	6200	30,8
NOK in USD	5,9	5,9	7	7	

Table IX: Freight rate developments for three aproximative vessel sizes in USD/day; sport rates calculated in T/C-equivalents

There are also seasonal fluctuations in the rates during the year. **Figure 7.** is indicating this type of fluctuations, where the average rate refers to 1993 freight level. In the long run (since 1990) the freight rates have been improving slightly, but especially during end-1993 andf early 1994, the freights seem to have been climbing 'permanently' to higher levels than during the previous years. Shipbroking sources seem to confident that this improvement in early 1994 is going to stay on in the market, raising the freights for the whole of 1994 clearly above the 1993 level (see **Figure 7**).

The authors have got confirmation by a number of shipbroking and shipping sources in the Baltic trade that a steady upward trend of the freight rates started in September 1993. This trend seems to be continuing for the rest of the year 1994, as far as the market expectations are concerned, keeping the rates some 20 to 30 per cent above the 1990-1993 average freights. One indication of this that the ongoing affreightment negotiations in February/March for coal for the rest of 1994 seem to settle for such levels, thus creating a firm reference point for all other cargoes in the Baltic, too.

Compared to the relatively stable levels of spot-rates throughout 1990 to 1993, the December 1993 indications are some 40 per cent up for the 3000 DWT
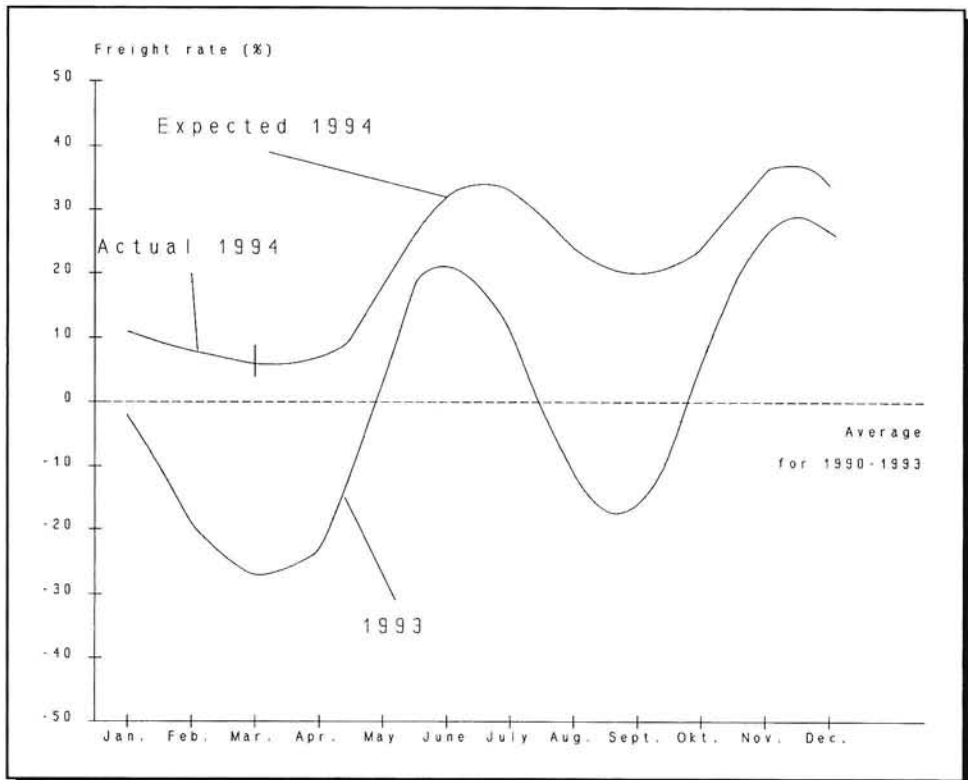
Figure 7: Freight market cycles in north European short sea shipping, *(Source: Data collection from leading norwegian brokers, shipowners and operators in shortsea shipping)*

range, and some 30 per cent up for the 8000 DWT range. Reflecting the supply of smaller vessels (e.g. elder vessels from the Baltic Russian and NIS fleets) in the 1000 DWT range, this segment has not experienced any increases to speak of.

5.1 INSURANCE PREMIUMS

5.1.1 Cargo insurance

The effects of using aging tonnage for the shipper are exemplified by the following construction. Let us assume that, for the sake of simplicity, we have a 10,000 ton consignment. The value of the cargo could be charachterized as low (like e.g. 15 USD/ton for minerals), medium (say e.g. 170 USD/ton for clay) and

high (e.g. 510 USD/ton for pulp; all values indicating the CIF value of the cargo). Further, we have two types of owners, the A type representing a standard owner and the B type standing for an owner with good records. These are standard terms used in Institute Cargo Clause (ICC) cargo insurances.

The subject under study is the age of the vessel and its effect on these combinations of cargo and owners. By regular ICC practices, an additional premium is placed on shippers using vessels over 10 years of age. This additional premium is increased after every five years, as shown in the figure.

Putting all this data together, we can conclude that in the worst case, a pulp shipper with the 10,000 ton consignment would be liable for an extra premium exceeding USD 40,000 when relying on a A type shipowner running a 26 to 30 year old vessel. This would mean more than 4 USD/ton in freight terms, which means in practice that this option is completely unfeasible.
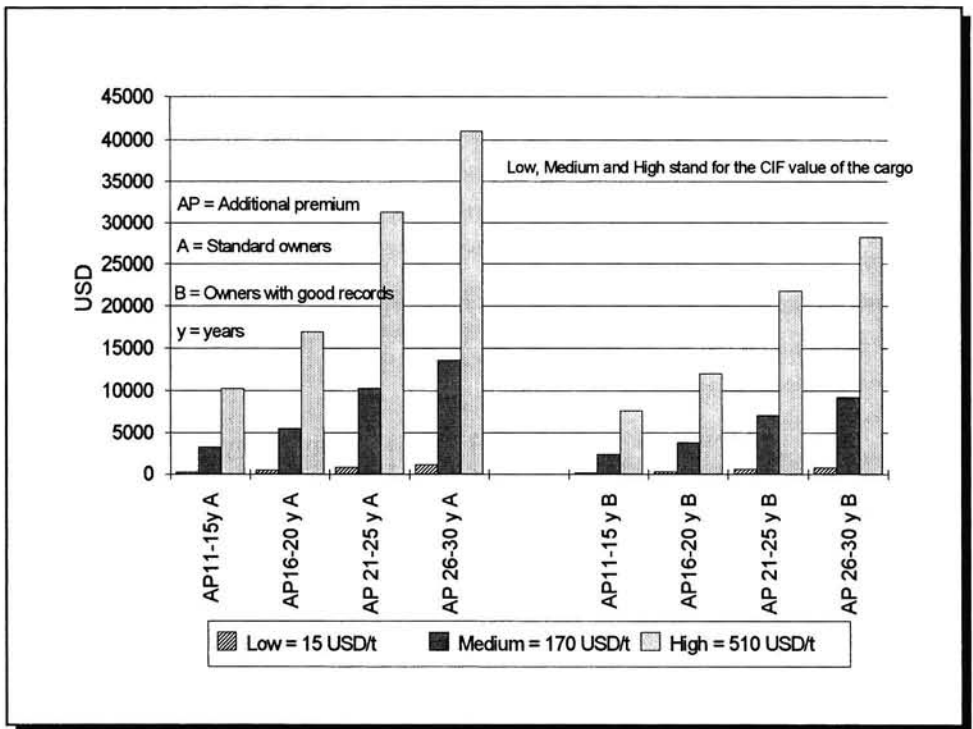
Figure 8: The difference of cargo insurance premiums on elder vessels and A and B type owners vs. normal insurance premiums in USD for a 10000 ton shipment

Alternatively, for low value shippers of mineral, additional premiums do not constitute any major problems in absolute terms. The type of cargo is also such that it is not easily affected by poor cargo space or hatch cover standards. But even for medium valued cargoes, old vessels are not very attractive, with additional premiums ranging at USD 10,000 for both A and B type shipowner options.

5.1.2 Hull and P&I insurances

Shipowners' insurances on the vessel and cargo claims have soared dramatically for the operators of small bulk vessels between 1990 and 1993. Descripitve market indications on hull insurance for a gearless bulk vessel, singledecker with 2000 DWT and 999 GT, Scandinavian flag, Germanischer Lloyd class, built 1970, average good condition and with average insurance statistics runs at following premiums (separately for 1990 and 1993, respectively (Kystskipsassuransen, February 1994):

	1990	1993
Premium (USD p.a.)	31,000	40,000
Franchise (USD p.a.)	6,800	21,500
NOK in USD (currency conversion rate used)	5,9	7,0

During the same interval (1990 to 1993), the average increase in the P&I premium for a similar type of vessel has been in the range of 85 to 100 per cent (Assuransforeningen Gard, February 1994). On top of this, both off-hire and cargo insurance premiums have been showing a similar trend.

5.2 SOME INDICATIONS ON RUNNING COST DIFFERENCES BETWEEN DIFFERENT REGISTERS

Differences between various registers are clear when the daily running costs (DRC) are compared. The major cost component of DRC is the crew cost, the other components being repairs and maintenance, insurance and administration.

The crew cost includes costs for repatriation and some other crew related costs, but the major cost is, of course, the wages incl. social insurance and pensions costs. In this study DRC, or crew costs, for that matter, are not compared with other major costs, such as the capital costs. Generally speaking, capital costs account for a larger share of shipowners' costs with small vessel than with large vessels. Similarly, capital costs for NB's tend to be higher than for SH vessels.
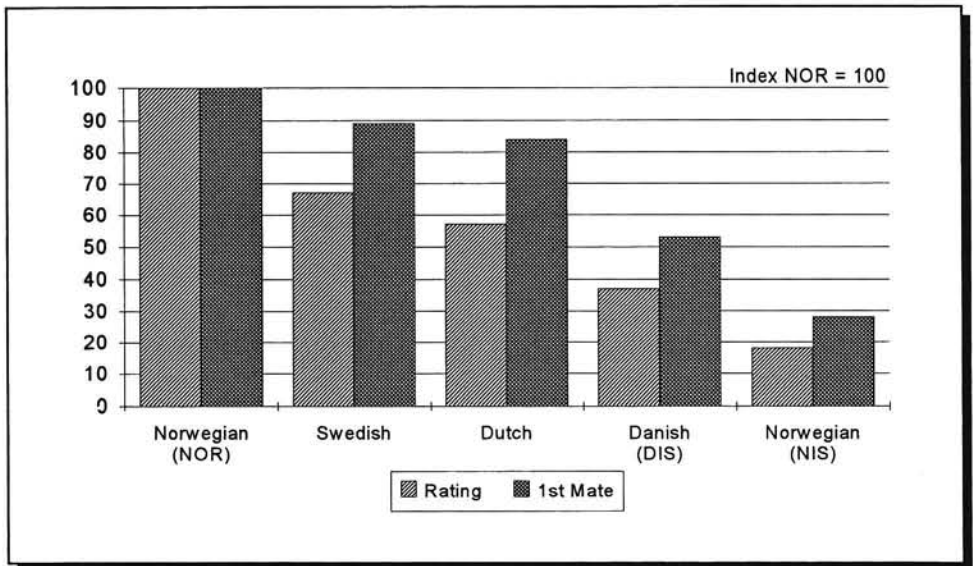
Figure 9: Crew cost indexes in end-1992 for small ships in five registers (NIS with Filipino crew), *(Source: Frakteman, 1/1993, Norway (Original: Norwegian Shipowners' Association)*

Differences in crew costs (wages) in end - 1992 between Norwegian, Swedish, Dutch and Danish (DIS) registers are portrayed in **Figure 7**. The original source of the data is the Norwegian Shipowners' Association.

Small tonnage ship is not excplicitely defined in the source, but it is assumed to reflect a standard dry bulk vessel in the 5000-8000 DWT range. The differences between the ordinary Norwegian (NOR), Swedish and the Dutch registers is very large vis-a-vis the DIS and NIS (with Filipino crew) operating ships. However, it is not clear, whether the Swedish data includes any direct subsidies available in Sweden (cf. MARAD 1993).

5.3 CONCLUSIONS ON CHAPTER 5

As a conclusion for the freight rate development, there is a strong indication that the current supply and demand situation is pushing up the freights especially for the larger tonnage in the size range under study. Newbuilding indications **(Figure 6)** are strongly in line with this observation based upon the freight rate development.

The freight rate development of small tonnage in the 1000 DWT range indicates, that these vessels are in much ampler supply than the larger tonnage. The data also reflects the age structure of the 1000 DWT tonnage; it is usually very old

tonnage, and growing ever older, since the rates do not allow the current NB prices. The practical consequences of this aging tonnage segments
are more frequent cargo damages due to e.g. old and leaky cargo hatches, which, in turn show up steeply rising (cargo) insurance costs for the shippers as well as high (hull and P&I) insurance costs for the shipowner. The outranging and scarpping frequency is very low in this segment of ships under 3000 DWT. This tendency has went on for the past 15 years (Svendsen 1993 a) and b)). In this segment of the industry, the shipowners usual means of staying in the business could be characterized by three measures: reconditioning, upgrading and rebuilding.

6   CONCLUSIONS: ON A VERGE OF A NEW ERA IN BALTIC BULK SHIPPING

In this chapter, a collection of conclusions are presented under separate headings for the focal issues of the paper.

Cargo movement developments

The prospects for the future of Baltic bulk shipping will depend on trade developments in the Eastern Baltic and the Nordic Countries around the Baltic Sea. Several signals by end 1993 and early 1994 indicate increasing movements of bulk cargoes within the Baltic. The major dry bulk ports in the Eastern Baltic region covered in the study are showing an upward trend in the cargo turnover. However, the ports in the Eastern Baltic, data for which was shown in **Chapter 3**, are still far away from their peak cargo turnover years in the late 1980s.

At the same time the industry in Finland and also Sweden appears to be back on track. The exports of mainly general cargo consisting of paper,pulp, steel and sawn timber has increased substantially in terms of tons during the period from 1992 to 1993. Consequently, also the import of raw materials to Sweden and Finland increased substantially in the same period. The cargo demand in the dry bulk segment has remained rather constant in Germany and Denmark as a whole. For the unified Germany, there has been a shift to North Sea ports and some Baltic trades of the former GDR ports have evaporated altogether.

Even a limited growth of bulk cargoes in the Baltic shortsea trade, has very rapidly caused a shortage of of small bulk tonnage, mainly in the market for bulkers in the range of 3000 to 8000 dwt. A real and rapid increase of the freight level vessels in this range, started in September 1993. In average, the freight rate level has increased by 30-40% through the last 5-6 months from the "normal" level which has been virtually stable during the past 10 years. This trend is still keeping up in February 1994 despite of the anticipated cyclical slump in the beginning of the year (see **Figure 6**).

Tonnage developments

The bulk vessel category 1000-12000 dwt size in the Baltic region has remained at a constant level during the last years. There has been a long period with a very low newbuilding activity and a very low outranging and scrapping frequency. The average age of these vessels operating in the Baltic and North Sea range has been increasing. However, this aging fleet must meet ever stricter quality and safety requirement.

Over the next few years, scrapping or outranging is likely to increase as a larger proportion of the fleet is no longer able to meet the more rigorous requirements set by insurance companies and classification societies, thus making them less interesting for many Baltic shippers. Despite of mounting interest among some Western shipowners, no real upsurge in newbuildings to replace the aging fleet can be seen yet. Therefore, the supply of ships is expected to go down in the short term.

Freight rate developments, newbuilding prices and ship finance

Despite of the optimistic freight rate trends in the 3000-8000 DWT range, it remains very difficult for shipowner operating in the Baltic market to make both ends meet with a newbuilding. This is mainly because of unrealistically high newbuilding prices, backed up by increases in shipowners' insurance premiums (see **Chapter 5**). With small tonnage like this, even the minimum of low cost crew members will not make any difference, since the number of crew is already small. And, similar low cost crew options are equally available to operators of second hand tonnage.

Under such circumstances, it is extremely difficult to get any commercially sound financing for renewals that would go to the competitive spot market. In Russia, Poland and the Baltic republics, capital is scarce. In Finland and Sweden, financing institutions have traditionally had limited interest in shipping finance. This interest is further diminished by a severe banking crisis in 1991-1993, from which the countries are slowly recovering. Banking crisis occurred in Norway, too, but there ship finance has a completely different standing than in Sweden and Finland.

Ship finance is possibly heading for very difficult times even globally and with the deepsea tonnage, too, making it increasingly difficult to allocate capital even within the shipping industry (cf. Peters 1993b). According to Peter's estimates, the total cost of ocean tonnage repair and conversion will be around USD 52 billion during the period between 1993 and 2000.

No such estimate was calculated for the Baltic bulk tonnage, since the adoption of feasible technological innovations (see scenario 2 below) enabling efficient refittings and the of this tonnage group as well as adoption of modern barge

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technology are focal parameters in such calculations. However, a rough estimate of the need for new bulk and general cargo ships in this category could easily go up to 100 to 200 ships (some 7 to 15 per cent of the fleet) by the year 2000. At current NB prices, this would mean a total cost of some USD 1,5 to 3 billion, which is a crude estimate.

Apparently, a basic requirement for (Western) shipowners to arrange finance for ships in the range under study are sizable subsidies. Sizeable construction sub-sidies are available especially in Germany, but they are also found in Denmark and the Netherlands. These countries also currently support operational sub-sidies that surpass those endowed in Sweden, and in Finland, too. (MARAD 1993 a) and b) for the Danish system : see 'Det blå Danmark,' 1991).

Generic competitive strategies and national advantages

From such a starting point it is also extremely difficult to get any commercially sound financing for renewals that would go to the competitive spot-based market. Mainly two types of investment in this bulk ship range can be identified. Firstly, they include (often) specialized ships employed in industrial shipping. These ships are seldom exposed to spot market competition. Secondly, there have been emerging interest among German, Dutch and Danish shipowners in this range.

Shipowners in these countries have also been able to combine the market in the Baltic with that of the North Sea, and while operating from an EU country, they have also been able to benefit from EU cabotage.

As a part of the EEA talks (and later, of the EU membership negotiations con-cluded on March 2, 1994, Scandinavian time) the EU cabotage is likely to be enlarged to Finnish and Swedish waters by July 1994. Especially the Swedish small bulk tonnage seems to be poorly equipped to compete against competitors from EU member countries. The same applies for Finnish small tonnage not engaged in industrial shipping, too. This, in turn, may call for further actions in the maritime policies for these countries (cf. Ojala 1994).

The cost leadership strategy may, on the other hand, be pursued by operators from Russia and the Baltic Republics. They are operating vessels with very low daily running costs, and often with minimal capital costs, at least for the elder part of their fleet (cf. Vanags 1993, and Sletmo & Holste 1993). These low cost elements may also be effectively combined with the shipping know-how and available capital from Western countries. This option is likely to be more widespread as the level of transaction costs (e.g. costs for uncertainty, the working of the banking system) are getting lower in these low cost countries.

Shippers' options and shipowners' responses

The industries around the Baltic Sea rely heavily on shortsea maritime transports and they have a pronounced need for serious and reliable bulk as well as general cargo tranports to and from the continent (cf. Ojala 1993b). Due to this development in the Baltic bulk shipping combined with the shippers increased awareness to total cargo-handling economy and environmental requirements, it is expected that contract market shipping will increase. These shippers will develop a long term partnership with experienced and high quality shipping companies.

The increase of the freight level, if enduring, will pretty soon cause dramatical shifts in the traditional market segmentation. Flexible bulk vessels will enter more profitable segments with high-value commodities. This will have a tremendous effect especially on the freight level within the segment for "rock bottom" cargoes as minerals and coal.

One group of shipping companies consists (and will consist) of serious shipowners, who operate a competitive fleet of flexible rebuilt second hand bulkers. They will be active mostly in the spot market, but the next step can also be also longer contracts of affreightment.

Yet another segment of shipping companies in the Baltic bulk shipping will be there to stay. This segment consists of shipowners with only a few low-standard, old vessels mainly in the 1000 - 3000 dwt range. Such companies exist in all of the countries studied here, but the segment will be dominated by Russian, Estonian, Latvian, Lithuanian and Polish operators.

Operators from these former socialist countries, if succesful in pursuing their cost leadership option, will probably enter the first-mentioned segment pretty soon.

Two possible scenarios of tonnage development

Two scenarios of tonnage development and usage emerge as likely alternative outcomes in this market. The following figure illustrates the case.

Scenario 1 exemplifies a case with a steady increase in transport demand for bulk cargoes in Baltic shortsea bulk trades with limited newbuilding and refitting activities.

In scenario 2 we assume a steady increase in the transport demand followed by active and numerous newbuilding and refitting programs.

In *scenario 1*, the usage of tonnage will, by and large, remain as it is now, but there will be substantial increases in freight rates for high-quality tonnage, especially for tonnage in the 4000+ DWT range. Newbuilding activity may be directed to specialized tonnage instead of competitive (multipurpose) tonnage.

In *scenario 2*, new innovations in refitting technology dealing with more efficient self-discharging methods and novel hatch construction designs could play a pivotal role in supplying (i.e. refitting) tonnage to the higher-valued cargo segments. One such solution, the so-called LIFTUP vessel system could prove very efficient in this respect. (see e.g. Svendsen 1993 a) and b))

In scenario 2, however, new capacity suitable for lower-valued goods could be generated fairly economically by increasing the use of open sea going and ice classed pusher-barge technology. This technology has been succesfully used in Finnish industrial shipping since mid-1980s. These pusher-barges with shallow draft also combine efficient and cheap roll on - roll off cargo-handling, a feature that is definitely an asset in poorly equipped ports as it is in well equipped ports, too.

7   POLICY RECOMMENDATIONS

A number of policy recommendations emerge from the analysis above. Only some major issues are presented under this last heading.

Firstly, the immense importance of the Baltic bulk shipping should be recognized as it counts for a major part of the Baltic/North Sea commodity trade volume. Also the tonnage employed in this traffic is impressive: some 1500 ships and a total of some 7 mDWT and more than 1500 ships.

Secondly, the fleet is aging, while at the same time the newbuilding (NB) prices are unrealistically high compared to current freight rates and operating costs. To compensate for the rising average age, roughly 100 to 200 ships would have to be built by the year 2000. At current NB prices this would mean a total cost in the range of USD 1,5-3 billion, as a crude estimate. To lower the average age of the fleet would need another 100 to 200 ships to be built in the 1990s.

Thirdly, as a consequence of the above-said, freight rates may continue to rise in this market, provided the improvements since September 1993 in the Baltic traffic are enduring, for which there is strong confidence in the market.

Fourthly, three different types of succesful operating modes of shipowners seem to stabilize in the market: i) the high-quality competitive operators at present from the Western countries, notably from Germany, the Netherlands and Denmark, but possibly later on from the Baltic republics, Poland and Russia, too; ii) low-cost, low-quality operators mainly from Russia, the Baltic republics and Poland, and, finally iii) specialized operators engaged in industrial shipping either on long term contracts with multipurpose tonnage, or in specialized trades with special tonnage, which is often (part-)owned by shippers.
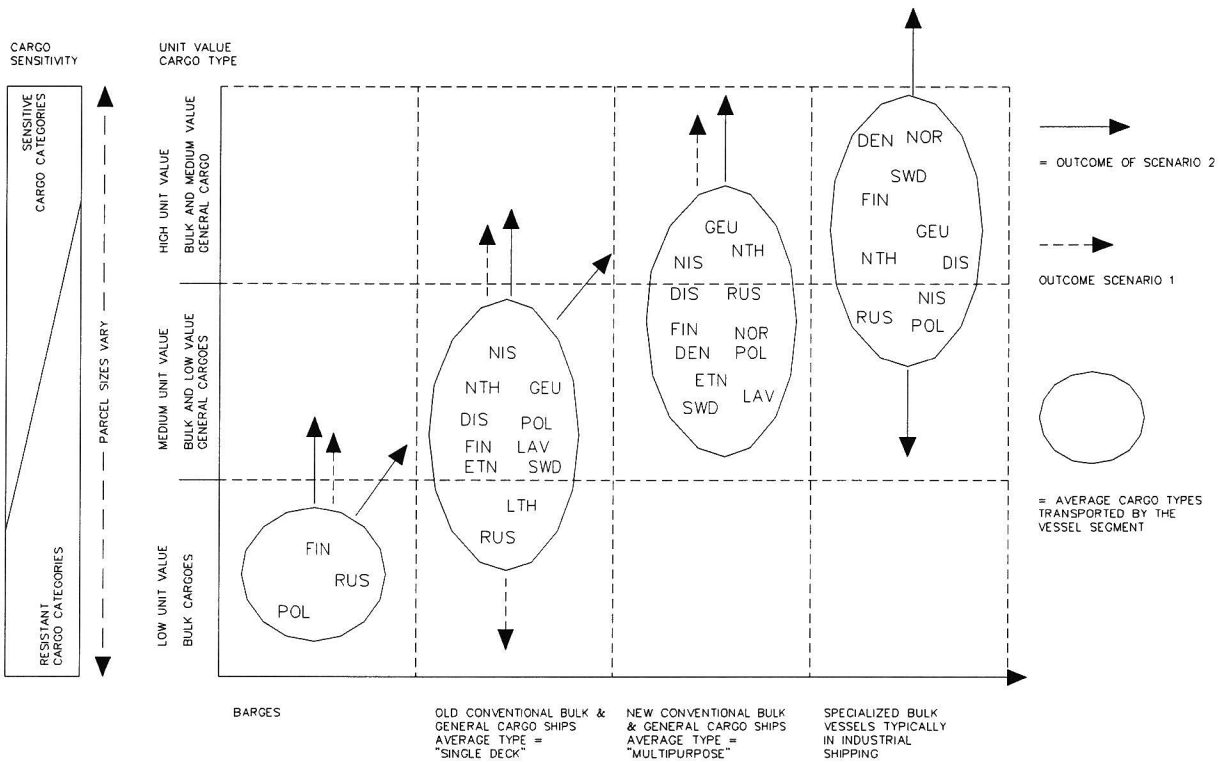
Figure 10: Generic cargo markets and corresponding vessel types in the baltic bulk shiping with scenario outcomes

The German, Dutch and Danish as well as Norwegian shipowners seem relatively well equipped for the competition in operation modes i) and ii), whereas the Swedish competitiveness in these modes seems poor. The Finnish competitiveness is fairly good in mode iii), but it could probably reach competitiveness in mode i), too, if Finnish small tonnage operators could effecitively operate with mixed crews under the Finnish flag.

The low cost option is likely to remain the option for the rest of the 1990s for operators from Russia, Poland and the Baltic states, unless they form join ventures or other management contracts with Western counterparts. The major problem for low-cost operators is the lack of capital at the present combined with the difficulty to accumulate capital in the long run to enable the purchase of modern ships.

The need for new innovations in developing more efficient cargo-handling techniques (e.g. self-discharging methods) and solutions to upgrade elder tonnage to high-cost cargo segments with limited capital (e.g. new hatch constructions) seems obvious. Also the potential of modern sea-going and ice-classed pusher-barge technology seems very promising. These approaches could provide a cost-efficient solution for the Baltic trades in the 1990s substantially reducing the need for capital in ship finance.

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SHORTSEA SHIPPING FROM HINTERLAND PORTS BY SEA-RIVER GOING VESSELS: STUDY OF THE INFLUENCE OF A FREE CABOTAGE POLICY

By J.L.J. Marchal

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SHORTSEA SHIPPING FROM HINTERLAND PORTS BY SEA-RIVER GOING VESSELS: STUDY OF THE INFLUENCE OF A FREE CABOTAGE POLICY

ABSTRACT

This paper deals with the appraisal of intermodal transport projects, taking into account the shortsea shipping and the inland navigation. The main objective of this economic appraisal is to evaluate the economic costs and benefits at the level of a region, a country or a continent.

At a financial level, an example of container transport will illustrate the cost computation of an intermodal transport system. The container transport on waterways can be made by adapted material; several river terminals are under development. Well adapted inland boats can connect these terminals with sea harbours located on the same inland waterway network. Sea-river going vessels can also be used to connect river ports with sea harbours which need a travel on sea. Through an example of containers' transport between the Liège hinterland port and England or Scandinavian harbours, a comparison study is presented between the sea-river going vessel mode and several intermodal transport alternatives as:

*   By truck with transfer to a ferry-boat;

*   By truck up to the inland port, then by an inland boat up to a sea harbour, and by a sea vessel with redistribution by truck;

*   By truck up to the inland port, then by sea-river going vessel and redistribution by truck.

This comparative study will answer by an economical computation at the two following important questions:

*   Is the waterway competitive in comparison with the road transport if only continental transport is considered?

*   In a transfer which needs a travel on sea, what are the conditions to use efficiently sea-river going vessels?

The influence of the free cabotage is considered in the different prospected alternatives by considering different loading rates for each mode.

Through the example of containers transfer between Liège Port and London, the optimum port hinterland has been located.

In the transport field, the program choice and preparation is an important perequisite of economic growth.

The government authorities have to use a good evaluation methodology to realize careful economic choices of important investments required in the transport sector which has a strategic role in any country's economic development. This paper aims to present a methodology based on financial and external costs and benefits to evaluate intermodal transport projects including the shortsea shipping mode.

1   INTRODUCTION

This paper deals with the appraisal of intermodal transport systems including the inland navigation to compare with sea-river going vessel solutions.

The main objective of this economic appraisal is to evaluate the economic costs and benefits at the level of a region, a country or a continent. The government authorities have to use a good evaluation methodology to promote careful economic choices of important investments required in the transport sector which has a strategic role in any country's economic development.

The first step of such an evaluation is to realize comparisons at the financial transfer costs level. The present paper will present first transport costs computation technics mode per mode, except for the railway for which direct door to door official prices will be taken into account.

Comparisons will be considered to define, through an example of containers' transport, the size of the hinterland of a river port necessary to promote the short-sea shipping with sea-river going vessels.

Taking into account the financial results, comments will then be presented at the economic level to take care of all the external economic benefits and costs which are important to consider in order to promote a strategy of goods transfers in a region, a country or a continent.

2   TRANSPORT COST COMPUTATION

2.1 INLAND NAVIGATION

The general case is to consider a unit with a capacity of Z containers which is moving during a certain time on the following successive distances: d_1, d_2, d_3, ... km in different waterway sections.
We suppose that the following parts n_1d_1, n_2d_2, n_3d_3, ... km are done in loaded conditions at the relative speeds of v_1, v_2, v_3, ... km/h.

The boat is than unloaded. The rest of each distance, it means: $(1-n_1)d_1$, $(1-n_2)d_2$, $(1-n_3)d_3$, ...km is covered in light condition with the relative speeds w_1, w_2, w_3, ... km/h.

The renumerated distance for the considered time is thus: $D=\Sigma nd$ km

The number of navigation days in loaded conditions is: $N=\Sigma\dfrac{nd}{hv}$

where: h = the number of navigation hours per day and v is the relative speed in loaded conditions.

The number of navigation days in light conditions is: $I=\Sigma\{\dfrac{(1-n)d}{hw}\}$

The number of days spent in the ports is computed by the following formula:

$$H=\Sigma(\frac{Z}{T_d})+\Sigma(\frac{Z}{T_c})$$

where: T_d = the rate of unloading in the successive parts (containers/day)
         T_c = the rate of loading (containers/days).

The number of waiting days is equal to: $J=\Sigma j$

where: j   = the number of waiting days in each port of the travel.

The transport of Z.D (Ton.km) needs fixed expenses during a number of days equal to:

$$X = N + I + M + J + \Sigma\left(\frac{nd}{hv}\right) + \Sigma\left\{(1-n)\frac{d}{hw}\right\} + \Sigma\left(\frac{Z}{T_d}\right) + \Sigma\left(\frac{Z}{T_c}\right) + \Sigma j$$

The amount of fixed expenses per Ton.km is: $\Phi_f = \dfrac{F + F'}{ZD} X$

where: F = fixed expenses per day for the unit without the propulsion installation

F' = fixed expenses per day for the propulsion installation (the redemption time of the propulsion installation is less than for the unit structure).

In fact: $F = \dfrac{Au + S}{365}$

where: A = unit construction cost without the engine

u = rate of fixed expenses corresponding to this cost (%)

S = annual total salary of the crew.

The fuel expenses are defined by the following expression:

$$\Phi_c = \frac{Q \cdot c \cdot p \cdot N \cdot h + Q' \cdot c' \cdot p \cdot I \cdot h}{Z \cdot D}$$

where: Q = shaft power in loaded condition (HP)

c = specific consumption in loaded condition (kg/HP/hour)

p = fuel cost per kg.

The index ' is concerning with the navigation in light conditions.

Finally, the total value of exploitation expenses per container.km is:

$$\Phi = \Phi_f + \Phi_c + d + d' \frac{\Sigma(1-n)d}{\Sigma nd} + \frac{\Sigma f}{\Sigma nd}$$

where d = navigation dues in loaded condition per container.km

d' = navigation dues in light condition per containers.km

f = port dues per ton

The number of container.km realized per year is given by: $Z_a = Z\left(\dfrac{365}{X}\right)\Sigma(nd)$

In order to normalize the calculations, **Table I** can be used for each river transport unit.

2.2 ROAD TRANSPORT

The cost price of road transport includes the following terms:

1. The annual fixed costs including:
   - The redemption and financial fees depending on the mean purchase cost, the pneumatic value, on the value without pneumatic (V) and on the residual value (R);
   - The annual redemption is computed by the formula (V-R)/n (n = number of life years of the truck). The financial fees are given by the expression (V + R/2).i (i = rate in %);
   - The insurances including burning of the vehicle and goods;
   - The drivers' salaries and their fees;
   - Taxes.

2. The kilometric expenses (fuel, oil, pneumatic, repairing...);

3. General fees.

2.3 MARITIME TRANSPORT

2.3.1 Exploitation cost

The annual exploitation cost of a chip is composed by three fundamental terms:

* A term proportional to the investment with:
   - the financial expenses a_1;
   - the insurances, $a_2 I$;
   - the maintenance experises, $a_3 I$;

* A term function of the exploitation degree, including: $C = n j_m c \cdot P$

   where: n = number of annual trips,
   j_m = number of days on sea per trip,
   c = consumption in tons per day,
   P = the cost of one ton of fuel corrected to take the oil into account.

   For a type of machinary, the factor c is proportional to the continuous service speed

No:	A: Items	B: Formulas
1.	type of unit	data
2.	origin - destination	data
3.	possible navigation duration (hours/day)	data
4.	number transported per unit	data
5.	of containers transported per year	data
6.	barge number per unit	data
7.	propulsion power (HP)	data or evaluation
8.	distance (km)	data
9.	investment value of the pusher	data or evaluation
10.	investment value of the barge(s)	data or evaluation
11.	life duration of the pusher	evaluation
12.	life duration of the barge(s)	evaluation
13.	redemption cost of the pusher per year	evaluation
14.	redemption cost of the barge(s) per year	evaluation
15.	navigation crew salaries per year	data
16.	pusher insurance per year	data or evaluation
17.	barge insurance per year	data or evaluation
18.	fixed cost per year	B13 + B14 + B15 + B16 + B17
19.	navigation speed against the current (km/h)	data or evaluation
20.	navigation speed with the current (km/h)	data or evaluation
21.	navigation time against the current (days)	B8 / (B19 x B3)
22.	navigation time with the current (days)	B8 / (B20 x B3)
23.	waiting-round time (days)	evaluation
24.	turn-round time (days)	B 21 + B 22 + B23
25.	possible navigation time (months/year)	data
26.	number of turn-rounds per year	30.5 x B25 / B24
27.	fixed cost per turn-round	B18 / B26
28.	fixed cost per container	B27 / B4
29.	annual transport capacity per unit (containers)	B4 x B26
30.	number of necessary pushers	B5 / B29
31.	number of necessary barges	B30 x B6
32.	fuel cost per liter	data
33.	fuel and oil cost per year	a x B3 x B7 x B26 x B32(B21 + B22)
34.	maintenance cost of the pusher per year	b x B9
35.	maintenance cost of a barge per year	c x B10
36.	cargo insurance cost per container.km	data
37.	cargo insurance cost per year	B36 x B4 x B26 x B8
38.	variable cost per year	B33 + B 34 + B35 + B37
39.	general cost per year	(B18 + B38) x d
40.	total cost per year and per unit	B18 + B38 + B39
41.	total cost per turn-round	B40 / B26
42.	total cost per container	B41 / B4
43.	total cost per container.km	B42 / B8

a.	fuel and oil consumption in liter per HP and per hour
b.	percentage of the pusher cost
c.	percentage of the barge cost
d.	percentage of the transport cost.

Table I

- The harbour expenses (p') per ship means the harbour fees, the towing and pilotage fees etc... excluding the stowage and handling expenses:

$$p'=p_0+bj \text{ per trip} \quad \underline{Or} \quad p'=n(p_0+bj) \text{ per year}$$

where: j = tonnage and p_0 = fixed cost
- A fixed term per ship (F) for the crew expenses.

* A fixed term per service (G) representing the management fees supported by a given service (for a fleet)

The total annual exploitation cost for a given service is thus:

$$N(aI+nj_{mcp}+n(p_0+bj)+F)+G$$

where: N = number of ships in operation.

2.3.2 Transport capacity

The annual transport of containers Z will be assured by N units for n trips per year with a capacity of V containers, thus:

$$Z=N \cdot n \cdot V$$

2.3.3 Specific investment

The first term of the general equation of the exploitation cost is: $NaI=\dfrac{Z}{nV}aI$

If I suppose that each ship is effectively in operation during 360 days per year, the number of trips per year is:

$$n=\dfrac{360}{\dfrac{D}{24}v+J_p}$$

where D = the total distance per trip
v = the mean speed per hour
j_p = the number of days in the harbour per trip.

This last term can be considered as proportional to the ship capacity at least when it is a bulk ship with regular handling operations:

$$NaI=Z\cdot\frac{D+24\,v\cdot(fV)}{8640}\cdot\frac{aI}{vV}$$

This relation shows a ratio which is the specific investment or the unit cost of "dynamic capacity" of transport.

An experimental formula for I is the following:

$$I=k_cV^{0.8}+k_m(V^{0.66}\,v)^{40.6}$$

Where: k_c and k_m are cost coefficients. The first one is concerned with the hull and its general equipment, the second with the machinary wich depends on the speed and the capacity. The specific investment can thus be:

$$\frac{I}{vV}=K_cV^{-0.2}v-1+k_mV^{-0.6}v^{1.4}$$

The speed corresponding at the minimum specific investment is:

$$v=\sqrt[2.4]{\frac{k_c}{1.4k_m}}\cdot V^{1.6}$$

where: V = the capacity.

2.3.4 Fuel and oil consumption, specific power

The second term of the annual exploitation cost is: $cpNnj_m=\frac{Z}{V}\cdot\frac{D}{24v}pc$

2.3.5 Ship fixed expenses

The last term in brackets in the annual exploitation cost formula is:

$$NF\frac{Z}{nV}F=\frac{ZD}{8640}(1+\frac{24\ fv\ V}{D})\frac{F}{vV}$$

This term contributes to increase the optimum speed. This increasing is as lower as the ship is bigger.

2.3.6 Harbour fees

This term is: $Nn(P_0+bj)=\frac{Z}{V}(P_0+bj)$

As the tonnage is, in first approximation, proportional to the capacity of the ship, we can write:

$$Z(\frac{P_0}{V}+b_1)$$

This term has no influence on the optimum speed; an increasing of the ship size does not generate a substantial economy

3   COMPARISON OF CONTAINERS TRANSFER COSTS (door to door) BETWEEN SEVERAL TRANSPORT ALTERNATIVES USING SHORTSEA SHIPPING

3.1 ALTERNATIVES DEFINITION

The transport of a container from an inland port to a destination located in another continent or along a sea coast can be done by several transport modes:

*   By truck with transfer to a ferry-boat;
*   By truck up to the inland port, then by an inland boat up to a sea harbour, and by a sea vessel with redistribution by truck;
*   By truck up to the inland port, then by sea-river going vessel and redistribution by truck.

3.2 COMPUTATION EXAMPLE

3.2.1 Continental transportation

The preceding theory will be applied at the case of the Port of Liège, the third inland port in Europe.
This port is located at 120 km from the sea harbour of Antwerp.
The transfer costs of containers from Liège to Great-Britain, Ireland and Scandinavian countries, will be compared.
The handling costs of a container are represented in **Table II**.

	HANDLING COST (BEF - 1984)	
TRANSPORT MODE	INLAND PORT	SEA HARBOUR
Truck	500	2,500
Inland Boat	1,000	5,000
Sea-River going vessel	1,000	

Table II: Container handling costs

The rapprochement by road in a maximum radius of 30 km costs 3,000 BEF.
The first question to solve is to know in which conditions the waterway can be competitive in comparison with the road if only continental transport is considered.
Table III gives a first comparison between different transport modes: it defines the container.km costs taking into account the mean annual distance normally realized by each mode and the different loading rates.

The mean cost per container.km for the waterway transportation takes into account that 75% of containers have 20' length and 25% of them have 40'. The number of crew for an inland boat is around 4 men and 8 men for a sea-river going vessel.

The results show that in general the waterway transport is more interesting than the road for displacements higher than 600 T, if nonstop travels are considered. It will be assumed that the loading rate for the waterway is 60%. The following **Table IV** defines the distance over which the waterway is competitive in comparison with the road for two loading rates (50 and 100%) and if the road transport up to the inland port is taken into account or not.

If the loading rate for the road transport is 100%, the inland boat with a loading rate of 60% will never be competitive for a line between Liège Port and

MODES OF TRANSPORT	LOADING RATES				
	50%	60%	80%	90%	100%
Road	70.9				35.45
Self-propelled boat 300 T 600 T 1200 T		86.8 35.4 25.6			52.1 19.7 14.4
Pushed convoy 2250 T 4500 T 5000 T		26.5 16.23 14.41			14.0 7.5 7.1
Sea-River going vessel			31.2	27.7	

Table III: Container.km costs (BEF 1984)

TYPE OF BOAT	Distance of which the waterway is competitive (km)			
	Loading rate of the road mode			
	50%		100%	
	Road rapprochement			
	With	Without	With	Without
300 T	never	never	never	never
600 T	85	169	never	never
2250 T	68	135	336	673
3500 T	55	110	156	312
9000 T	53	106	143	285

Table IV: Minimum competitive distances for the inland waterway transport mode

Antwerpen harbour. To be competitive with the road transport, the breaking of load at Antwerpen harbour must be avoided.

It is thus necessary to study now in which conditions the use of sea-river going vessels will be interesting.

3.3 TRANSPORTATION FROM AN INLAND PORT TO A SEA HARBOUR WITH A TRAVEL ON SEA

As examples (see **Table V**), several lines between the Port of Liège and Great-Britain (London, Liverpool), Ireland (Dublin) and Scandinavian countries (Oslo, Stockholm, Helsinki), will be considered.

The rapprochement cost to Liège Port by road and the distributio n by road from the arrival harbour is taken into account in the following computations of the sea-river going vessel cost of a container transport.

The loading rate of the trucks is assumed to be 100%.

For the sea-river going vessel two rates are considered: 80 and 90%.

Lines	Transfer cost - (BEF - 1984)				
	Truck + con-tainership + truck	Truck + ferry boat + truck	Sea-River going vessel		Railway
	50%	100%	80%	90%	
Liège-London	35,900	30,200	24,500	22,900	
Liège-Liverpool	43,000	53,800	54,500	49,500	
Liège-Dublin	52,750	62,700	50,000	45,500	
Liège-Oslo	52,000	60,000	56,600	46,000	84,200
Liège-Stockholm	56,550	61,500	60,400	55,000	80,000
Liège-Helsinki	55,000	102,350	73,000	66,000	90,000

Table V: Transfer costs per container

Following these results, it clearly appears that the sea-river going vessel transportation from Liège Port is almost the best one for all the destinations even when the best conditions for this transportation mode are not choosen.

However, an important parameter is the loading rate which is greatly influenced by the cabotage policy: it could be observed that a free cabotage policy will increase the waterway transport competitiveness.

3.4 OPTIMUM LOCATION OF THE LIÈGE PORT HINTERLAND FOR THE TRANSPORT OF CONTAINERS TO LONDON

3.4.1 General data

In Liège region, the customer has two alternatives to transfer containers to London:

* The traditional solution by road and ferry-boat on container ship;
* By sea river going vessel.

The two solutions will be compared in order to define the minimum sizes of the influence zones around Liège port for the sea-river going vessel mode to collect containers.

From the data and hypothesis on annual fees of each transport alternative, the unit costs have been evaluated to compute the travel costs. Mean cost values have been collected near Transport Companies, builders, shippers, ...

The main computation data for the two alternatives are represented in **Table VI**.

ITEM	SEA-RIVER GOING VESSEL	TRUCK
Investment cost (BEF)*	140,000,000	5,800,000
Loading capacity (containers number)	80 (20')	1.125 (75% of 20' and 25% 40' containers)
Redemtion time (year)	15	7
Offered mean annual production (TEU.km)	3,500,000	112,500
Crew number (man)	7	1
Fuel consumption (BEF/km)	130	5

*)1987 value

Table VI: Cost computation data of the two alternatives

Other general data have been considered as administration, maintenance, port, navigation and financial fees.

The global unit costs of realized production in function of the exploitation efficiencies are represented in **Table VII**.

3.4.2 Definition of the alternatives assumptions

As the exchanges with England are not in equilibrium, it is supposed that the loading rates are 90% from Liège and 70% from London. The rapprochement costs per truck in a radius of 30 km are respectively 500 BEF and 6,000 BEF around Liège and London; the computed unit cost is 38,214 BEF/TEU.

| EXPLOITATION | UNIT COST (BEF/TEU.km) | |
EFFICIENCY (%)	SEA-RIVER GOING VESSEL	TRUCK + FERRY
100	0.17	0.36
90	0.19	0.40
80	0.21	0.45
70	0.24	0.51
60	0.27	0.60
50	0.32	0.72
45	0.36	0.80

Table VII: Global unit costs of realized production

As the transport alternative "truck + ferry" is concerned, 4 cases are considered:

a. A normal production (100 000 km/year; unit cost = 44,249 BEF/TEU);
b. A higher production (140 000 km/year; unit cost = 38,619 BEF/TEU);
c. In case b, the ferries company allocates a 10% discount due to the regularity and the number of crossing travels (unit cost = 36 629 BEF/TEU);
d. Same than case b. except that the discounting rate is 20% (unit cost = 34,640 BEF/TEU).

The considered loading rate is for each case equal to 50%.

The unit costs are related to the travel from Liège area to London area and the back travel. Taking into account the difficulty for the sea-river going vessel mode to collect enough containers around Liège and the possibility for the road mode to have the advantage of discounting rates (case c. end d.), the competitiveness of the full waterway transport mode is low.

In a policy of intermodal transfer, it is thus important to define the Liège hinterlands in the different preceeding studied-cases of competition. In this purpose, equivalence curves have been computed between the two proposed options; the following formula has been used (**Figure 1**):

$$A + K_1 C_1 = B + K_2 C_2$$

Where: A, B   = constant transport costs;
K_1, K_2 = distances from the customer company;
C_1, C_2 = unit costs for the road rapprochement to the ports.

The **Figure 2** shows the equivalence curves for each cases.
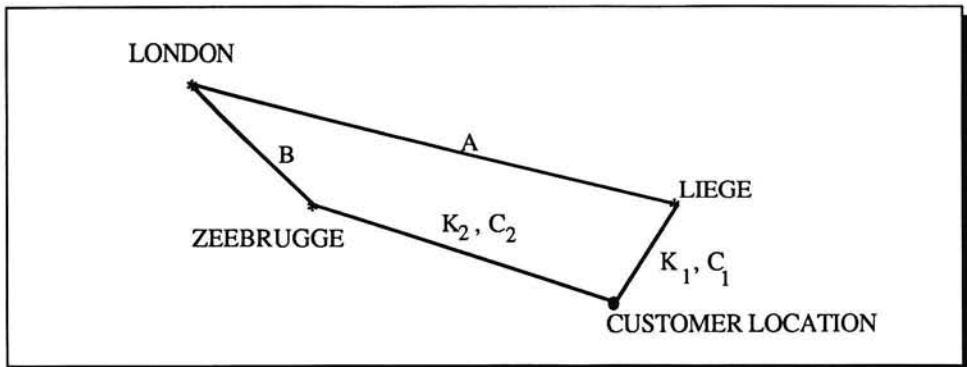
Figure 1
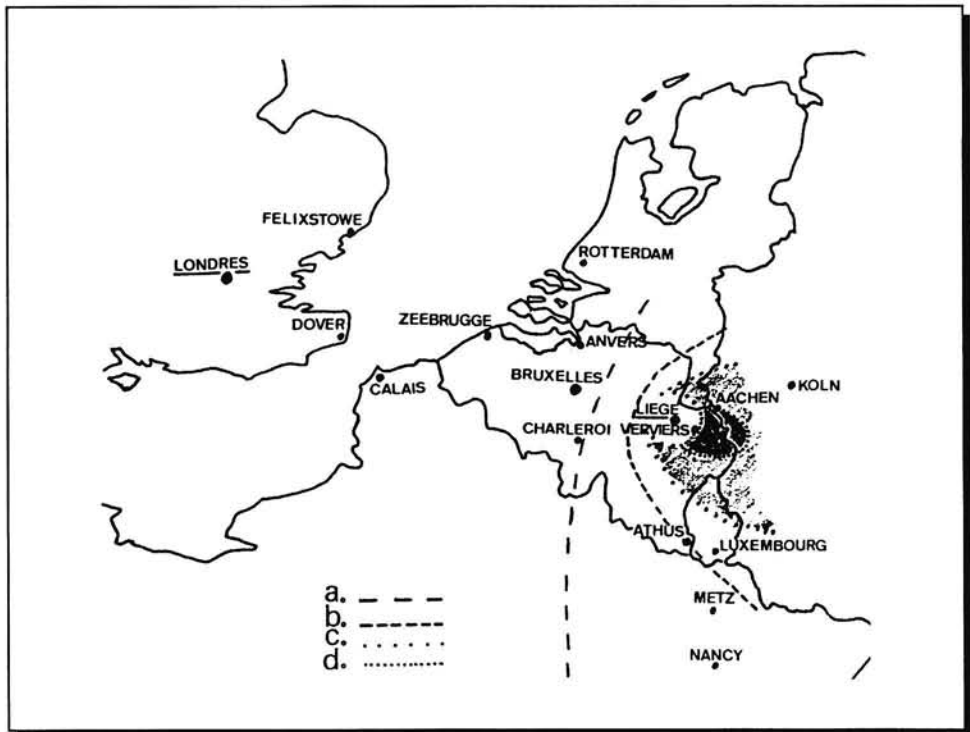
Figure 2: Liège port hinterlands

A regular line of transport by sea-river going vessels from Liège port is mainly concerned (case c, and d) with the extreme east part of Belgium, the Germany border and Luxembourg areas: the commercial policy objective is to find important potential customers in this hinterland to assure a regular containers feeding.

This policy needs to promote the intermodal transport supported by a rigorous logistic approach.

4 ECONOMIC EVALUATION

4.1 GENERAL COMMENTS

The preceeding considerations point out the competitiveness conditions of the waterway transport at a financial level. A transport policy has to be founded at this level but it must be completed by economic evaluations.

4.2 SUMMARY OF THE WELL KNOW METHODOLOGY FOR AN ECONOMIC RATIONAL CHOICE BETWEEN SEVERAL TRANSPORT SCENARIOS

In order to establish priorities in intermodal transport chain including the waterway transport mode, leading to ranking of projects in terms of their value and to optimize a particular project amongst various possible alternatives, it is very important to follow a well adapted method of study.

One of the more appropriate assessment criterion is the economic benefit/cost ratio for ranking the projects. The numerator of this radio is composed by the sum of all the effects of project implementation and its denominator the sum of all the costs involved in project implementation.
As the benefits and costs are evaluated at different steps of the projects, they need to be discounted from a common reference date by application of an appropriate discounting rate: it corresponds generally to the date when the decision could be taken to go ahead with the project.

The different proposed alternatives must be compared with a fixed competitive situation of reference.

The transport flows must be forecast by considering directly the cargo categories and the transport flows and by defining origine-destination tra
ffics. The situation prevailing at the time of preparation the project design must be considered and must be complemented by a higher precision analysis of forecast changes in traffic in the years to come.

A part from investments, the costs must also naturally include future operating, maintenance and general costs.

In order to appreciate the real effects resulting from the eventual investment decision, it is necessary to substract, from the total cost, the costs involved in the situation of reference which give rise to a variety of inevitable costs.

By determining the benefit/cost ratio following this methodology and after an overall comparison, a final decision can be taken.

If the results of the two cheapest alternatives are very close one from the other, the study of each of them must be pursued in more details.

4.3 INFLUENCE OF A REAL TRANSPORT POLICY AT A LEVEL OF A CONTINENT LIKE EUROPE

4.3.1 Economic advantages of the waterway transport mode

To evaluate the economic benefits of investments in waterway infrastructures and navigation materials, it is important to point out the following well known considerations:

* The waterway has several functions: transport, irrigation, energy production, water supply, flood control, leisure, industrial development (only 50% of the infrastructure investments along Seine river in France were concerned with the transport function);

* The waterway transport mode has several advantages in comparison with other modes: less energy consumption, better environment protection, higher transport security (traffic accidents, dangerous goods...) and reliability, possibility to transfer important indivisible loads, offer of additional storage capacities;

* The use of the waterway mode reduces the road traffic.

It is thus important to take into account both direct and indirect preceeding advantages to assure an economic rational choice: many studies allow now to evaluate these effects with a higher accuracy.

4.3.2 European Community policy

The commission has drafted outline plans and proposed decisions, either adopted already by the Council or under discussion, which will influence very strongly the transport infrastructure and networks in Europe. These concern high-speed trains, the road networks, inland waterways and ports and combined transport.

With regard to the promotion of intermodal transport, two areas have priority:

* Combined transport of goods;
* Collective transport in urban areas.

Special attention shall be given to improving freight transport for the efficient distribution of goods to bring economic benefits to business and consumers, as well as to residents affected by environmental nuisance. In multimodal operation, freight terminal operation is the crucial issue.

The maritime industries forum has considered that the maritime transport on short distances has to be developped in a free internal cabotage market and that it has to be classify among the priority actions. A more intensive use of inland navigation and shortsea shipping must be encouraged. These transport modes must be more integrated in the combined or multimodal transport chains.

For European seafarers' unions, it is important that simulation of short sea transport in Europe occurs under European conditions. In view of the fact that European coastal shipping is constantly switching to flags of convenience, there is a danger that conditions similar to those in international tanker shipping will soon be predominant. In the interest of maritime safety, environmental protection and maintenance of maritime know-how in Europe, the European seafarers' unions attach great value to short sea transport existing within an EC-cabotage - similar to that of the other two great industrial centres of the world: the USA and Japan.

It was further observed that both road and rail transport enjoy substantial benefits from the government-funded infrastructures, costs of which are only partially charged, resulting in unfaircompetition for short sea transport.

Traffic management and control systems should be developed which are able to react in real time to incidents and causes of delay, and are able to optimise transfers between the different transport modes. The mission of the Transport Telematics Requirement Board is to address at a strategic level future requirements and options in Transport Telematics and resulting services for all modes of transport and the interfaces between them.

5   CONCLUSION

The presented advantages of the inland navigation and the EC policy will encourage the development of shortsea shipping and increase the sea-river going vessels traffic.

Even on a strict financial level, this mode is already competitive in certain conditions, as demonstrated in this paper. The EC promotion policy to promote multimodal transport systems has to be put in concrete form. The external and indirect costs of each mode have to be integrated in the total costs.

A free cabotage policy has to be really implemented to increase the production efficiency which is a more sensitive factor for the waterway transport mode.

The policy of modernization of the West European waterways network will increase the navigation production of bigger sea-river going vessels which will penetrate more deeply in the continent.

This direct transport mode, which avoids transhipments at the sea harbour and goods damages, will increase its market if a policy is really implemented, increasing the role of the inland ports in the international foreign trade.

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AN ALTERNATIVE SYSTEM FOR SHORTSEA SHIPMENT OF ROAD VEHICLES

By J. Igielska

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AN ALTERNATIVE SYSTEM FOR SHORTSEA SHIPMENT OF ROAD VEHICLES

ABSTRACT

The present transport system of vehicles in short sea trade is not satisfactory in various respects:

* Safety in securing of road vehicles for sea voyages;
* Extent of necessary manual work on board;
* Broad variety of vehicle types and general absence of standard lashing points for securing on board;
* Pegree of ship capacity utilisation.

The new concept based on a special cassette for intermodal transport of a wide variety of road trailers is proposed. The idea mainly aims at elimination of stevedoring work on board, higher safety at sea and cargo handling cost and time reductions in the long term.

The trailer cassette concept might be explained as an idea for cuting off the particular area of the roll-on/roll-off deck needed for stowage of a single trailer and separating it from the ship hull structure.

It is assumed that securing of the trailer to the cassette would be carried out in portterminal before ship arrival and stevedoring work on board should be eliminated completely.

The cassettes will be stowed on board in the cell guide system and on special supports built into the ship's structure. The design principles of the guide system are similar to those proven on container carriers with some modifications regarding slot dimensions and support arrangement for cassettes. The guide system would be adjustable in order to stow other unitised cargo as containers of various lengths and widths if such flexibility is required.

The ship would be of the "hatchless" type which could additionally decrease both capital and operating costs.

The trailer cassettes may fill up the whole depth of the ship and consequently the stowage factor is much higher in comparison with roll-on/roll-off vessel, as well as cargo handling production rates of lift-on / lift-off mode are generally higher, especially if two container gantry cranes with good performance are engaged. It would additionally improve the efficiency of the ship by reduction of required port time.

1   GENERAL

A road vehicle moves on its own wheels and fits well into a whole transportation chain, i.e. from door to door. There is access to roads everywhere, and road vehicles carry all sorts of goods, from valuable industrial products unitized in small parcels to high cube containers, and bulk cargoes.

With the introduction of combi-trains for trailers in the mid-80s, linking remote industrial areas with port terminals, road vehicles became important elements of intermodal transport systems.

Wheeled cargo units are carried often in shortsea shipment but there are important reasons why sea transport is unfavourable in comparison with other transportation modes.

The competitivness of sea transport should be improved, as there are circumstances in its favour, including growing road congestion, public expenditure cuts, and increasing public awareness of the environmental cost of road haulage. There are also needs for improvement of the whole transportation chain of cargo from manufacturers to consumers in order to decrease costs and shorten transit times. This requires general analysis of all linkages in transportation process which should lead to formulation of requirements for unification of road, railway and sea transport systems.

2   TYPES OF ROAD VEHICLES

There are many types of road vehicles. In accordance with the ISO Standard (No 3833) these include:

1) *Commercial vehicle*, a motor vehicle which, on account of its design and appointment, is used mainly for conveying goods. Its may also tow a traile;.

2) *Special vehicle*, a motor vehicle which on account of its design and appointment, is intendend:
   - only for conveying persons and/or goods for which special arrangements are necessary;
   - only for performing a specific work function.

3) *Trailer towing vehicle*,a motor vehicle which is designed exclusively or principally for towing trailers;

4) *Semi-trailer-towing vehicle*, a motor vehicle which is designed for towing a semi-trailer;

5) *Trailer*, a vehicle of which, on account on its design, no substantial part of its total weight is supported by the towing vehicle;

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6) *Semi-trailer*, a trailer which is designed to be coupled to semi-trailer towing vehicle and to impose a substantial part of its total weight on the towing vehicle;

7) *Combination of vehicles* with one or more independent trailers connected by a draw-bar or semi-trailer-towing vehicle with a semi-trailer.

3   PRESENT SEA TRANSPORT SYSTEM OF ROAD VEHICLES

Road vehicles are often transported over sea by ferries for relatively short distances, and by roll-on/roll-off ships within European trade.
Motor vehicles do not need any cargo handling equipment for stowage on board,such as terminal tractors. The drivers follow their vehicles and are treated as passengers during the sea voyage.
Semi-trailers released from towing vehicles, as well as such roll-on/roll-off equipment (not allowed in road traffic) which are only used in port-to-port operation i.e. mafi, terminal trailers, and special cassettes are often transported on sea routes.
The present transport system of wheeled vehicles in shortsea trade is not satisfactory in various repects:

*   Safety in securing of road vehicles for sea voyages;
*   Extent of necessary manual work on board;
*   The broad variety of vehicle types and general absence of standard lashing points on the chassis for securing on board;
*   The degree of ship capacity utilisation.

3.1 SAFETY

Road vehicles are transported by roll-on/roll-off ships on strong, fixed decks. The ISO Resolution A.714(17) states requirements regarding stowage, lashing and securing of trailers for sea voyage . Application is made to roll-on/roll-off ships which regularly carry road vehicles on either long or short international voyages in unsheltered waters. The ship should be provided with a Cargo Securing Manual in accordance with ISO resolution. The decks of a ship intended for road vehicles should be fitted with securing points. The minimum required securing points are recommended in ISO resolution but their exact spacing is left to the discretion of the shipowner/shipbuilder.
Generally the securing system should be such that road vehicles are safety secured for sea voyage. ISO Guidelines for Securing Arrangements for the Transport of Road Vehicles on Ro-Ro Ships specify general requirements only. The guidlines do not totally prevent casualties. The accident record of

roll-on/roll-off vessels exceeds any other type of ships. There are many reasons for the high frequency of serious accidents, including the following:

1) The road vehicle lashed on board a ship constitutes a complicated system which, when described in a mathematical model, is assumed to consist of girders and springs with varying stiffness, spring constants and damping coefficients. The excitation variables in the calculation model are the ship's motions in six degree of freedom. Furthermore, due to spring suspensions, friction between the trailer wheels and the steel deck may vary substantially.
Therefore, the mathematical model for calculation of lashing forces is based on simplified assumptions.

2) The roll-on/roll-off ship in a damaged condition has generally lower survival probability that any other type of vessels, owing to her nature i.e. spacious holds subdivided by horizontal decks. Stern, bow and side access through watertight doors seriously affect integrity of the hull. Technical features and operational procedures of such equipment often cause dangerous near-accident situations.

3) There are often human errors in securing the road vehicles or complete negligence of lashing for sea voyages as well as poor observance of instructions regarding closing access doors.

4) The relatively small vessels engaged in shortsea trade with rather limited seaworthiness in adverse weather conditions at the North Sea, the Aegean Sea, the Bay of Biscay etc., are exposed to higher risks caused by poorly lashed cargo.

3.2 MANUAL LASHING ON BOARD AND CARGO HANDLING LOGISTICS IN PORT TERMINALS

Generally, there is no need to carry out any work regarding preparation of road trailers in port terminals for stowage on conventional roll-on/roll-off ships. The only thing that must be done is to make sure that the trailers are parked on the quay in the right order to stow them on the respective decks. All the work of securing and lashing the trailers is done on board. The time required for unlashing of units to be discharged as well as for securing loaded trailers for sea trips must be included in the vessel's round trip schedule. Consequently, there is a huge amount of work on board during the time when ship is in terminal and high costs for cargo securing are involved.

Each operator, especially in liner traffic, is interested in shortening port time of his fleet as much as possible by introduction of improvements in cargo handling and utilisation of the ship's operational time in the most effective way. In this manner the vessel could have increased cargo carrying ability, shortened transit

time, higher voyage frequency and increased competitiveness in relation to other operators.

Furthermore, all operators are constantly aiming at cost reduction and all activities in terminals are regularly scrutinised. Here a comparison can be made with a container carrier fitted with a cell guide system, which secures containers for sea voyage without any need of lashing. Time in port depends on crane performance and organisation of stevedoring work in terminal. Stowage patterns of containers in cargo holds for loading and discharging in consecutive ports govern a number of cranes which could be engaged simultaneously and generally on the whole logistics interface from ship to quay. Thus are important part of stevedoring activity is to prepare optimal container stowage plans as far as possible and to organise the stream of the boxes to and from shipside for crane operation in the best possible way in order to decrease crane waiting time to a minimum.

3.3 LASHING STANDARDS

Many different road vehicles are used in transport systems generally classified by the ISO, but not all have been designed for sea transport conditions i.e. ship motions, excitations and accelerations. The trailers do not have enough lashing points of sufficient strength fitted in proper places for securing them on board for sea voyages. Therefore, many road vehicles are secured to ships' decks in improvised ways and often the lashing used is not sufficient in case of severe weather conditions at sea. It has been also observed that in extreme cases, where a valuable heavy vehicle is transported on board roll-on/roll-off ship special precautions are taken and many lashing chains are used, although not in a proper way, and some of them play a more psychological role for the crew than securing the trailer against shifting.

A study regarding standardisation of seagoing trailers was undertaken more than ten years ago in Sweden but today hardly any improvement has been in this field has been observed. In present intermodal transport systems all vehicles should fulfil requirements for safety for securing them to roll-on/roll-off decks.

The trailer lashing system for transport on roll-on/roll-off decks used today is shown in **Figure 1** and consists of trestles, jacks and lashing chains the numbers varying depending on lashing points fitted on trailers and the ship as well as on individual lasher skills. The system has many deficiencies and is time consuming and expensive. Generally lashing points on trailers are more or less casually positioned by vehicle manufacturers. Trailer lashing point locations should be designed more systematically for each vehicle type depending on its dimensions (especially length and height), having in mind the worst possible combination of ship motions.
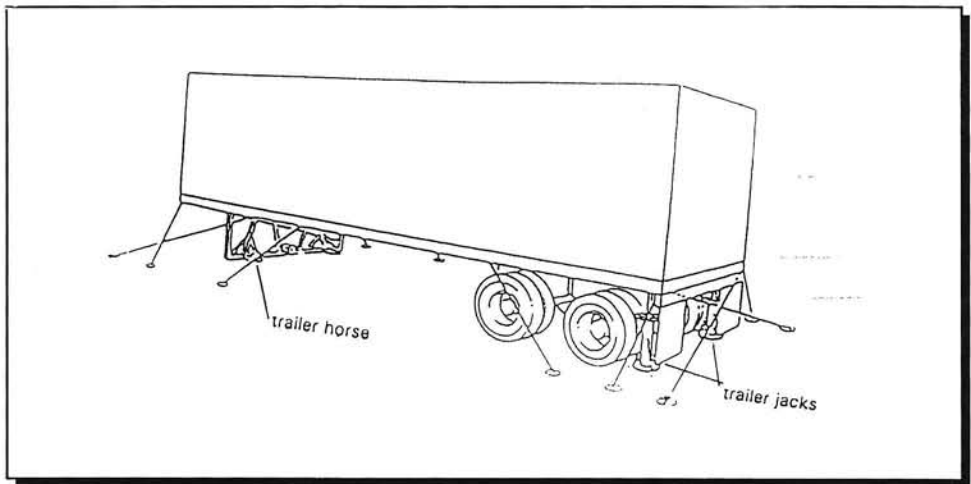
Figure 1: Conventional trailer securing system on ro-ro deck

3.4 SHIP CAPACITY UTILISATION

The roll-on/roll-off vessel has a high flexibility for stowage of various types of cargo. However, this flexibility is at the expence of utilisation of cargo hold capacity. Holds of the roll-on/roll-off ship are subdivided by fixed horizontal decks and have constant headroom for stowage of road trailers and other cargo. The most often free heights of fixed decks on the existing ships are 6.3 m, 5.8 m and 4.5 m. The highest free height makes it possible to stow on deck even containers in two layers or to transport "project cargoes" of extreme dimensions. For most voyages road trailers are transported on these decks. The vehicle heights also vary but generally do not exceed 4.3 m. For free and unobstructed access and stowage such trailers require 4.5 - 4.6 m headroom. Non-utilised space above a vehicle may be as much as 1.8 cu.m per each sq.m of fixed deck. Utilisation of deck area is also low. The deck is subdivided into trailer lanes of widths 2.8 - 3.2 m, i.e. wider than vehicles, because there must be sufficient space for securing points and lashing equipment. Wasted deck areas also include internal fixed ramps, with headrooms varying with slopes of the ramps.

4 NEW CONCEPT OF THE VEHICLE TRANSPORT SYSTEM

4.1 THE PRESENT SITUATION AND GENERAL TRENDS IN SEA TRANSPORT SYSTEMS

During the last decade liner operators in world wide trade faced substantial increases of stevedoring costs and, at the same time, heavy market pressure for widening of intermodal services. In order to cope with such developments under fierce competition and of low freight rate levels, shippers have expanded containerisation of traditionally non-unitised cargo commodities. In consequence, pure container carriers are dominant in transoceanliner shipping nowadays and also even in shortsea trade new ship designs which aim at further cargo unification and lift-on/lift-off handling systems have been observed. Cargo handling of cellular container vessels is much simpler, take generally less time and does not require lashing of cargo when containers are secured by fixed cell guide system. Trends towards unification of cargo and steady growth of the number of containers in sea transport systems are observed. In accordance with the latest statistic, there are more than 7 M TEUs in operation. This cargo carrying equipment dominates the market. Not only general cargo but all kind of break bulk cargoes are transported in containers and even road vehicles are loaded on container platforms fitted with gables. It is also possible to transport off-size cargo, which was traditionally shipped in roll-on/roll-off mode, in the top layer of container stacks.

The general tendency to expand lift-on/lift-off operation modes in port terminals, the latest container ship design of hatchless type as well as a newly developed "CASH" vessel for transport of forest products on cassettes are compelling shippers to consider an alternative system for shortsea shipments of road vehicles.

4.2 TRAILER CASSETTE CONCEPT

The concept for intermodal transport of a wide variety of road trailers is based on a special cassette system.

The idea mainly aims at elimination of stevedoring work on board, higher safety at sea and cargo handling cost and time reductions in the long term.

The trailer cassette concept might be explained as an idea for cuting off the particular area of the roll-on/roll-off deck needed for stowage of a single trailer and separating it from the ship structure.

It is assumed that securing of the trailer to the cassette would be carried out in the port terminal before ship arrival, and stevedoring work on board would be eliminated. The proposed cassette is shown in **Figure 2**. The frame is about 14.0 m long and 2.6 m wide. The cassette would incorporate such features as driving

channels and built-in trailer supporting and securing arrangement, which is hardly possible on a conventional roll-on/roll-off deck.
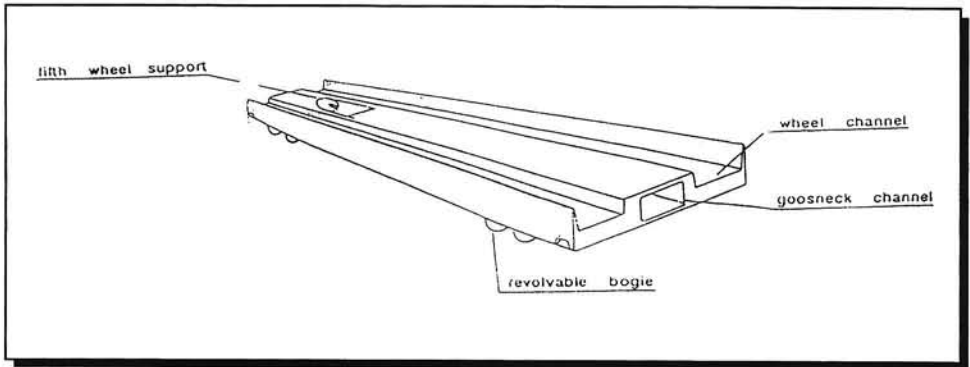
Figure 2: Empty trailer cassette

The trailer will be drawn into wheel channels, which will protect it against side movements and absorb horizontal lateral forces (**Figure 3**). The channel width will be fitted to most common trailer wheels and the distances between them. The depth of the channels has to be sufficient to take lateral loads not only from the rubber tyres but also from the wheel rims.
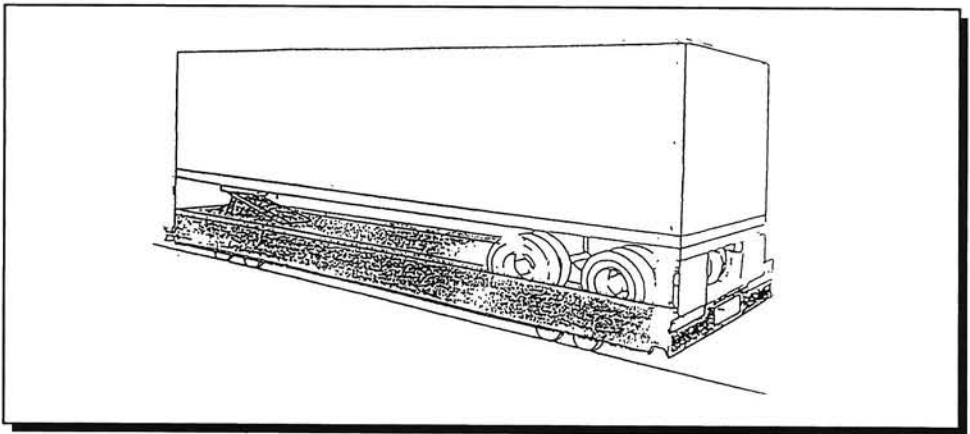
Figure 3: Loaded trailer cassette

The cassette will be fitted with built-in trestle or collapsible fifth wheel support against longitudinal movements of trailer. Anti-tipping tensions and lashin fittings will be also permanently attached to the cassette. An introduction of the trailer cassette system means a departure, complete or in part, from roll-on/roll-of handling mode. In the basic concept, the cassettes are to be hand-

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led in the same way as containers, by a shore crane or, if necessary, by a gantry crane installed on board.

The cassette design features depend on the handling system in the port terminal area. In the basic form cassettes would be handled by straddle carriers or equivalent mobile equipment with a special built spreader arrangement. It is believed that basic design will be most cost effective and will fit the majority of the port terminals. Container handling by means of straddle carriers is proven technology and is for many reasons superior to other systems.

4.3 PORT OPERATIONS IN THE FUTURE

The right organisation of terminal work and preparation of trailer-cassette units prior to vessel arrival is the important element in this system. The system will avoid shifting of units or double handling and, as far as possible, will restrict use of terminal cargo handling equipment.

The trailers are mounted on cassettes directly after arriving at the port terminal. The vehicles transported to terminal by road might be loaded on cassettes by the same towing vehicle which would be released after that operation. If trailers are delivered to terminal by railway trains, the straddle carrier, gantry crane or other discharging equipment should be used for stowing trailer directly on cassette.

When more advanced design of cassettes will be used i.e. cassettes fitted with bogies, the empty units should be stowed at a ditch-station in order to simplify trailer driving-on procedure (**Figure 4**).

The trailer-cassette units should be stowed in blocks on the quay and pushed or towed by terminal tractor to the shipside for lift-on/lift-off handling or stern/side ramp for stowage on roll-on/roll-off deck.

Generally the cassettes could be even used for transport of swap bodies, containers, cars and other cargo.

4.4 LIFT-ON/LIFT-OFF VESSELS

The basic idea of the trailer cassette is to replace the strong roll-on/roll-off deck with much simpler, cheaper, fitted with cargo securing system structures.
The proposed ship for trailer cassette transport is of the lift-on/lift-off type with cell guide structures for securing units for sea voyage as in **Figure 5**.

Most effective loading and discharging of cassettes will be performed by the terminal cranes. A gantry crane might be fitted on the ship, if required by the trade.

The cassettes will be stowed on board in the cell guide system and on special supports built in the ship structure. The design principles of the guide system are similar to the ones used on container carriers with some modifications regarding slot dimensions and support arrangements for the cassettes. The guide
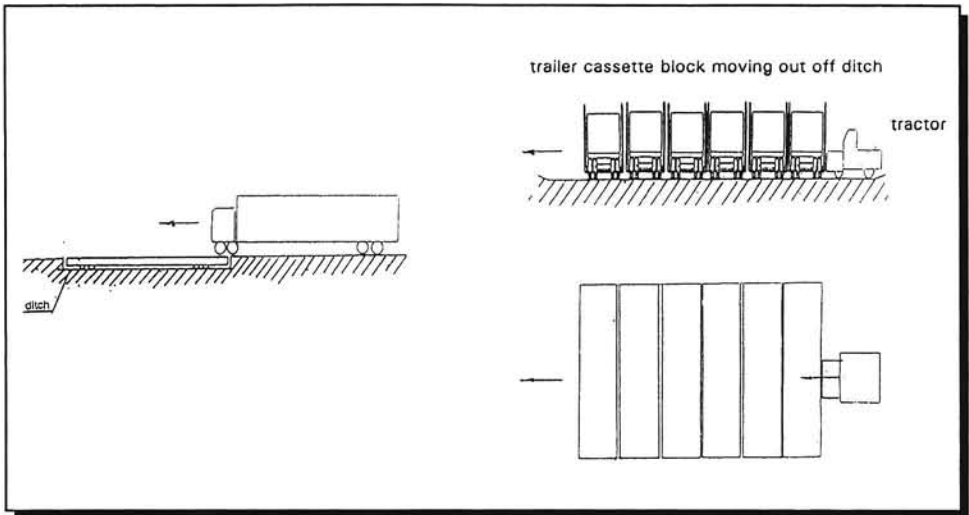
Figure 4: Stowage of trailers on cassettes
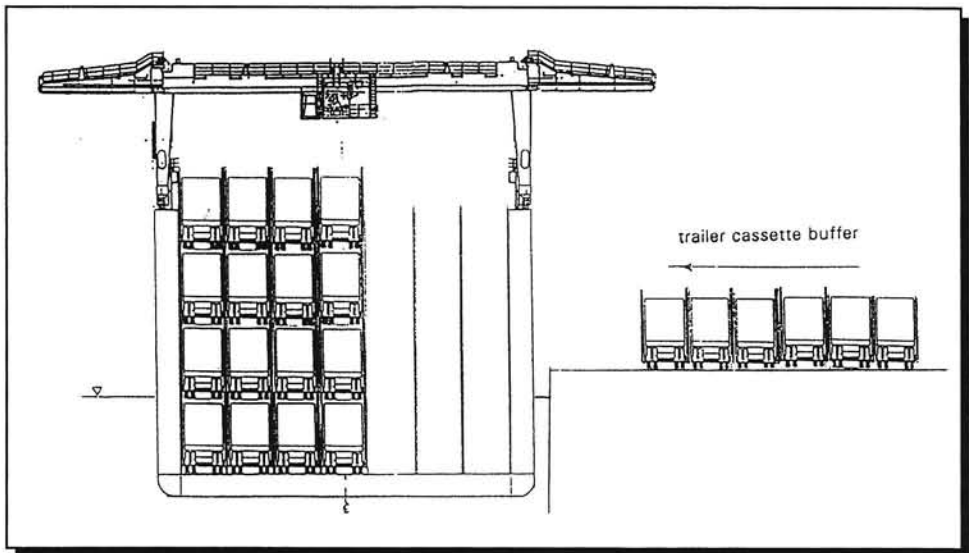
Figure 5: Section of cellular vessel for trailer cassette carriage

system would be adjustable in order to stow other unitised cargo as container of various length and width. Such flexibility is rather expensive but might pay in the long term.

As can be seen in **Figure 5,** the trailer cassettes fill up the whole depth of the ship and, consequently the stowage factor is much higher than on a roll-on/roll-off carrier. Furthermore, a cellular carrier built with lower block coeffi-

cient has better capacity utilisation than a roll-on/roll-off ship. The shape of roll-on/roll-off decks in the forward part of the ship is less suitable for block stowage of cargo and considerable deck areas and hold volumes are left empty. The ship would be "hatchless" type which could additionally decrease both capital and operational costs (**Figure 6**).
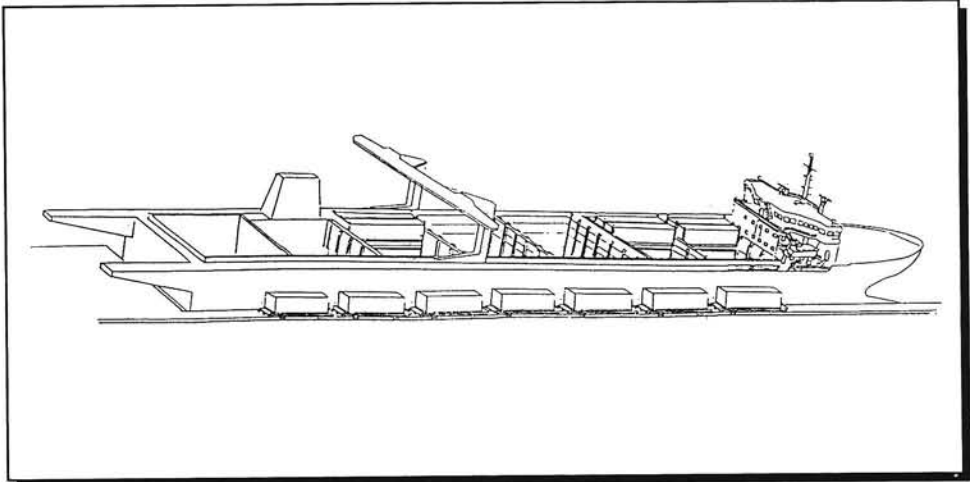
Figure 6: Cellular vessel for trainer cassette carriage

It must be pointed out that the future vessels in the shortsea trade will have higher speed, and a slimmer hull shape for good fuel economy requirements and better propulsion performance in adverse weather conditions.
Cargo handling production rates of lift-on/lift-off mode are generally higher, in comparison to roll-on/roll-off systems, and it would improve efficiency of the ship by reduction of port time.

4.5 FUTURE DEVELOPMENT

The development of a new cargo handling system is a long process but it must be realised that the deficiencies of the conventional systems will be not acceptable in the future especially with introduction of high speed vessels of above 40 knots.

An Alternative System for Shortsea Shipment of Road Vehicles

The proposed trailer cassette system requires further studies and development work of:

a) Trailer securing system;
b) Coupling and uncoupling of towing vehicle;
c) Structural design to minimise own weight;
d) Adaptability to intermodal transport systems;
e) Adaptation to different port terminal handling techniques;
f) Lifting arrangement for grip arm or container spreader;
g) Empty stacking;
h) Adaptation of cassette system for roll-on/roll-off deck.

The cassettes might be developed in the following phases:

1) Basic model with fittings for detachable axle/wheel arrangement and gooseneck channel for tractor attachment;

2) Frame with fittings as in a) and with a fixed single bogie allowing movement in the longitudinal direction;

3) Frame with fittings as in a) and with gooseneck channels and revolvable bogies at both ends allowing movements of the cassette in any direction. Gooseneck channels will be also fitted with coupling for bogie steering, tandem and parallel trailer train coupling, special fittings for securing to roll-on/roll-off deck with actuator system, if required;

4) Automated Guided Trailer Cassette (AGTC) - advanced model with fully automated cargo unit handling system (shore-to-ship and vice versa), thiristor electronic control system governed by the programmable logic controllers connected to industrial PCs.

4.6 TRAILER CASSETTE SYSTEM FOR ROLL-ON/ROLL-OFF VESSELS

Using one more piece of cargo carrying equipment for road vehicle transport on roll-on/roll-off ships seems to be a not quite logical solution. But this must be considered an unavoidable phase-in period of a new system and there are certainly some advantages as listed below:

* Securing of trailers to cassettes is carried out in terminal;
* Trailer cassettes are block stowed on board and no manual lashing is required;
* Better utilisation of deck area;
* Cassette blocks can be built up in the terminal and moved by one terminal tractor;

* Road hauliers can depart directly after trailer stowage on cassettes;
* Higher safety during sea voyages.

The existing roll-on/roll-off ships require some adaptation for trailer cassette stowage on board but the modifications are in a reasonable range, and might comprise:

* Fittings in roll-on/roll-off decks for securing of block stowed cassettes;
* Side port and ramp for alternative cargo handling over ship side.

5 COMPARISON OF THE CONVENTIONAL AND THE NEW CONCEPT VESSELS

5.1 MAIN PARTICULARS OF THE VESSELS

Table I briefly summarises the differences between the main particulars of conventional and the new type of vessels which have the same cargo carrying capacity of 135 trailers.

Vessel		A1	A2	B1	B2
Vessel type		Conventional - Ro-Ro	New concept low speed	High speed Ro-Ro	New concept high speed
Length O.A.	(m)	145.00		181.30	
Length B.P.	(m)	135.00	122.00	170.00	135.00
Breadth	(m)	20.70	20.70	22.00	20.70
Depth	(m)	12.20	19.00	13.70	19.00
Draught	(m)	6.60	6.80	6.00	7.00
Trailer number		135	135	135	135
Service speed	(kn)	17.5	17.5	27.5	27.5

Table I

The A1 roll-on/roll-off vessel is a typical conventional design and belongs to a large group of the trailer ships, employed in shortsea trade. Vessel B1 has been designed by one of the Scandinavian shipyards to meet requirements on speed for future North Sea operations. The main particulars for the new concept ships A2 and B2 have been preliminarily evaluated based on the hull geometrical restrictions and weight estimation. The A1 ship can be compared with A2 ship and B1 with B2. It should be noted that the cellular ships A2 and B2 are shorter

than roll-on/roll-off ships A1 and B1. Breadth of a cellular vessel is better utilised, as transversal space between cassettes would be limited (100-150 mm), to assure free access for the crane spreader only. A comparable roll-on/roll-off ship has three fixed decks, lower depth, but cargo on the weather deck is more exposed to sea and weather conditions. The proposed design of a cellular trailer ship is an open type vessel, where hatch covers are not fitted. Trailers are stowed four or five high and increased hull depth protects the cargo. A fifth layer will be stowed above the weather deck safely secured in the guide system against movement in severe sea states. The roll-on/roll-off vessel with her strong fixed decks is a heavy ship while a cellular vessel is generally much lighter. Even if lift-on/lift-off ship weights of cassettes are added (approximately 5 tonnes per cassette), the total weight (light ship plus cassettes) will be lower than a roll-on/roll-off ship. It must also be mentioned that the structure of a fixed roll-on/roll-off deck weights 0.28 - 0.40 tonnes/sq.m, and a cassette can be constructed with uniform weight of about 0.15 tonnes/sq.m.

5.2 CARGO HANDLING

Cargo handling costs for roll-on/roll-off vessels are a heavy burden for every operator and are one of their main costs. However, cargo handling costs vary considerably, depending on terminals, the stevedoring company as well as the agreement between the operator and the stevedoring company. Generally handling costs consist of:

* Loading and discharging tariffs which are fixed for each type of cargo units i.e. container, trailer, car, other towing vehicle or volume and/or weight of break bulk cargo;
* Lashing and securing procedures;
* Lashing material costs, including capital costs, repairs and maintenance;
* Cargo carrying equipment costs (container, trailer, cassette, bolster, etc.);
* Tracking equipment costs.

It is very difficult to gather reliable and comprehensive statistics on cargo handling costs and their components for comparable liner operators. Competition between the operators does not allow them to disclose their cost scenarios. Every operator also has his own cost subdivision and statistics. Generally, cargo handling costs for roll-on/roll-off ship are in range of 40 % or more of the total costs. All operators complain about high expenses and try to rationalise their terminal work by application of bigger cargo units, for instance paper rolls stowed on cassettes of total weight 60-80 tonnes, better stowage (side by side) on roll-on/roll-off deck in order to partly avoid manual securing of cargo, etc. Cargo handling costs bound directly to the port terminal (excluding equipment capital and tracking costs) can be broken down as follows:

* Loading and discharging   83 %
* Lashing materials and securing of cargo   17 %

Many stevedoring workers are involved in cargo securing work on roll-on/roll-off decks, often during expensive night shifts. Loose lashing equipment is a problem for any operator, as it has to be steadily replaced, maintained and repaired.

Cargo handling for the proposed system is aimed at simplification and automatization of lashing and securing procedure of cargo, and at moving this work to an other time sequence in terminals, i.e. prior to a ship's arrival in port. The design of the cassette incorporates wheel protectors against lateral movement of the vehicle, and attachable securing devices are minimized. It is obvious that stevedoring work should be remarkably reduced in such systems. The guide system fitted on the cellular vessel will totally eliminate manual securing of cargo units on board the ship.

Assuming that 3 sets of cassettes are needed for one ship, extra capital cost should be added for 2 sets only, as one set replaces the roll-on/roll-off deck:

2 x 135 cassettes x 5 t/unit x 2.5 USD/kg = 3,375,000 USD

Therefore, the capital cost for a cellular carrier system is assumed to be about 7% higher than for a roll-on/roll-off ship.

The cost comparison for the conventional system and the new concept has been related to a single trailer move over the sea. The ship's operational costs are calculated for 80 % utilisation of ship capacity.

Vessel	A1	A2
Vessel type	Conventional Ro-Ro	New concept low speed
Bareboat charter	39%	41.7%
Bunker	5.5%	5.5%
Stevedoring	36%	18%
Port dues and charges	8%	10%
Crew	8%	8%
Other	3.5%	3.5%
Total costs	100%	86.7%

Table II

Generally, cargo handling efficiency is higher for lift-on/lift-off mode than roll-on/roll-off and it is supposed that the logistics of the new system will be in superior to the conventional one. Assuming that following productivity:

* Roll-on/roll-off system   15 moves/hour
* Lift-on/lift-off system   20 moves/hour

The cargo handling time for a round trip for 100 % ship capacity utilisation will be:

* Roll-on/roll-off system   135 trailers x 2 / 15 moves/hr = 18 hours
* Lift-on/lift-off system   135 trailers x 2 / 20 moves/hr = 13.5 hours

The 4.5 hour difference can be considered in various scenarios:

* Adding a port to round voyage schedule;
* Saving bunker consumption owing to decreased vessel speed;
* Better adaptation of vessel arrival/departure time at some terminals avoiding expensive handling shifts;
* Other rationalisations in logistics.

6   CONCLUSIONS

The new ship concept for European trade described here is aimed atincreasing competitiveness with road and rail transport systems. In order to win this battle it is necessary to study the whole transportation chain of cargo from manufacturer to consumer before any decision is taken regarding investment in new vessels. The type of vessel will depends on cargo units transported. The roll-on/roll-off ship type, developed in the 60s and 70s turned out to have high cargo handling costs and deficiencies in safety. During the last two - three years a new trend towards high speed ships of 30 to 50 knots has been observed (even considered for North Atlantic trade), with the aim of substantial reductions in transit time. Capital and operating costs (especially high fuel consumption) should be compared with decreased vessel sea times. There is doubtful benefit if no improvements are made in port operation and cargo handling and securing. Port times should be limited as far as possible by shifting all required cargo handling work from ship to quay side, before vessel arrival. Furthermore, cargo carrying equipment should fit sea road and rail transport systems.
The purpose of the trailer cassette system is to improve port logistics performance.
Organisational improvement in trailer flows in and out of ports by direct loading and discharging of cassettes and simultaneously building cassette blocks will lead to shorter handling times. Automated lashing of trailers to cassettes will limit stevedore work. Higher efficiency of lift-on/lift-off handling systems in com-

parison with roll-on/roll-off mode and complete lack of manual cargo securing on board should be the decisive factors in the proposed system. Full automatization of port operations and integration of the ship with quayside handling, supplemented by high speeds at sea should be the aim of the future sea transport system.

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MODAL SPLIT ANALYSIS IN GREEK SHORTSEA PASSENGER/CAR TRANSPORT

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MODAL SPLIT ANALYSIS IN GREEK SHORTSEA PASSENGER/CAR TRANSPORT

ABSTRACT

The purpose of this paper is to investigate the problem of split in modality for passengers and vehicles in the specific contextof the Greek coastal shipping system. Transport modes considered are conventional passenger/car ferries (P/C vessels), fast (30-50 knot) vessels, and air transport. For a variety of reasons, monumental changes are about to take place within this system over the next decade. These centre primarily on the deregulation of the market that as a result of European Union integration, and on the introduction of vessels capable of carrying passengers and cars at high speeds. As a result of an EU directive, the Greek coastal market be fully deregulated by the year 2004, with the result that owners will able to set up routes with minimal governmental interference. The question is, of course, how passenger demand will evolve within such a new environment, and how the various competing modes of transport will fare. This paper is an attempt to systematically analyse scenarios that might be the possible outcomes of these changes.

1 INTRODUCTION

The purpose of this paper is to investigate the problem of modal split for passengers and vehicles in a specific context, that of the Greek coastal shipping system. The transport modes considered are conventional passenger/car ferries (P/C vessels), fast (30-50 knot) vessels, and air transport. For a variety of reasons, large changes are about to take place within this system over the next decade. These centre primarily on the deregulation of the market that is a result of the European Union integration, and on the introduction of vessels capable of carrying passengers and cars at high speeds. This paper is an attempt to systematically analyse scenarios that will be the possible outcomes of these changes.

By EU directive, the Greek coastal market shall be fully deregulated by the year 2004. This means that owners will be able to set up routes with minimal governmental interference. In addition, air transport will also become increasingly deregulated in the years ahead. But how will passenger demand evolve within such a new environment, and how will various competing modes of transport fare?

This paper attempts to answer these questions by examining various scenarios for the following modes of transport: conventional ferries (passenger/car), hydrofoils, other fast vessels (passenger only), other fast vessels (passenger/car), and air transport. The methodology used is applied to an illustrative subset of the entire network and is based on the "logit" model and the "generalised cost" concept. The cost components used are the fares and the time value of the trip. The time values have been derived from a "revealed preference" dataset. The paper describes the various assumptions made in data collection and model formulation, and discusses the results of the analysis and the additional research needed in this field. Policy recommendations are finally offered for an improved operation of the system in view of the monumental changes that are about to occur.

This paper is one of the products of a large project on Greek Coastal shipping, carried out by NTUA on behalf of the Hellenic Industrial Development Bank (ETBA) during 1993, and in the context of the SPA programme of the EU (Regional Development Plan). The project, known as the ETBA project, carried out a comprehensive investigation of all major aspects of the system, including the topic covered here. Complete details can be found in Psaraftis (1993).

This paper is structured as follows. **Section 2** gives an update on the status quo of the system, vis-a-vis the description in a paper that was presented at the previous Roundtable Conference. **Section 3** performs the modal split analysis. **Section 4** provides some information on the economic viability of fast ships. Finally **Section 5** makes some concluding remarks and offers some policy recommendations.

2   STATUS QUO UPDATE.

The basic characteristics of the Greek coastal shipping system were presented in the previous Roundtable Conference in Delft (November 1992), and were published in the Proceedings of that conference (paper by Psaraftis and Papanikolaou (1992)). However, as that paper was written both before the ETBA project had started, and, before the passing of the EU Regulation on maritime cabotage (7 December 1992), some of the data and hypotheses presented in that paper are now obsolete. Thus, before we proceed with our analysis, we deem it necessary to give a brief update on the status of the system, with a focus on these elements that are more relevant for our analysis. The basic reference for this material is the ETBA final report (Psaraftis, 1993), which describes all this in more detail:

1) *Lines and routes.* The Ministry of Merchant Marine (MMM) classifies the 102 official lines of the network in 5 classes: (a) 16 main passenger/car ferry (P/C) lines, (b) 30 secondary P/C lines, (c) 11 local P/C lines of the

Argosaronikos bay, (d) 39 other local P/C lines, and (e) 3 main and 3 secondary freight (ro-ro) lines. Within this "line" system, the number of individual routes and schedules that are traveled is on the order of several hundreds.

Some of these lines extend to ports in Italy (Brindisi, Bari, Ancona, and Trieste), although from a legal standpoint the services to Italy are not subject to internal cabotage legislation (e.g., ships can fly foreign flags, even if Greek-owned).

2) *Fares*. With the exception of First Class fares, which are in principle free (with a theoretical maximum of 4 times but in practice 2.8 - 3 times the level of the corresponding Third Class fare), all other fares are uniform for all ships and established every year by the MMM for all pairs of ports. Fares include Second Class, Third Class, Tourist Class, and fares for vehicles (cars, buses, trucks, and motorcycles). Hydrofoils and catamarans have special fares for the routes on which they operate, all (still) regulated by the MMM. There are services in which the official fare with or without a cabin is exactly the same, cabins being allotted to passengers on a first-come first-served basis, many times onboard the ship (in which case the tip to the steward plays the role of the fare supplement).

At first glance, the fare structure seems reasonable in terms of fare levels. A more careful examination however reveals that levels are largely arbitrary, depending more on what they were the year before, and less on the result of a transparent cost analysis. As an example, the fare to distant Kastellorizo is 8,639 GRD (2nd class), while that to Sitia (Crete) is 8,750 GRD, even though the latter destination is much closer to Piraeus. Such a difference could be explained by socieconomic criteria, but such criteria are not explicitly defined.

In other examples, the direct 2nd class fare to Hydra is 2,665 GRD, less than the 2,499 GRD fare if one goes to Hydra via Aegina (999 GRD from Piraeus to Aegina and 1,500 GRD from Aegina to Hydra). The fare from Sifnos to Paros is 1,469 GRD if one travels on a small wooden boat, and only 748 GRD if one travels on ferry (2nd class). The catamaran fare to Mykonos is 6,709 GRD, higher than the 2nd class conventional fare (4,470 GRD), but lower than the equivalent 1st class fare (7,988 GRD),and much lower than the airfare to Mykonos, which is 15,900 GRD for an economy class ticket.

The rule of thumb that the triangle inequality (Fare (A-B) ≤ Fare (A-C) + Fare (C-B)) holds for most of the network seems to be true, but in general there seems to be no consistent logic in the fare structure, nor does there exist a well-defined algorithm or procedure for fare determination.

3) *Fleet*. The Psaraftis and Papanikolaou (1992) paper referred to 1988 fleet data. Having now fleet data that go at least to 1992, we can make some brief observations. The first is that the mean age of large (1,000 GRT or more) P/C vessels increased by 4 years (to 25) in the 4 years from 1988 to 1992. The second is that the situation is worse for the smaller conventional P/C vessels (between 100 and 999 GRT), with a mean age of 28 years, and even worse for the small (100 to 500 GRT) general cargo (feeder) ships, with a mean age of 35 years (in 1992). There is a mandatory withdrawal age of 35 years for P/C ships (which, interestingly enough, does not apply to ships on the Italian service routes). Thus, at 2004, many ships that operate today within the system will have been withdrawn from service.

In 1992, hydrofoils had a mean age of about 15 years, while the three catamarans in the system (one of which was seriously damaged in 1993 and may never again be engaged in service) were virtually new. Although hydrofoils have been traditionally restricted to protected waters, 1993 saw the deployment of hydrofoils to several new lines, including many of the Central Aegean islands where the sea is sometimes rough during the summer.

4) *Passenger and vehicle traffic*. With about 12 million passenger movements in 1990 (see **Section 3** for estimates in subsequent years), Greek coastal shipping is one of the biggest in Europe. With few exceptions (short periods of temporary decline), passenger traffic has steadily grown every year over the last 30 years, from approximately 3 million movements in 1964, to about 5 million in 1970, 8 million in 1980, and 8.5 million in 1985. There was a period of decline from 1981 to 1983, with a local minimum of 7.5 million.

The heaviest traffic is generated within the short-distance routes of the Argosaronikos system, with traffic that is more than double in passenger movements than that of the long-haul Piraeus- Crete lines. The biggest growth in recent years has been experienced in the Volos-Euvoia-North Sporades lines, mainly due to the massive influx of hydrofoils in that area, and in spite of the decline in conventional vessel passenger traffic that resulted because of this entry.

Vehicle traffic has also grown, in many cases more steeply than passenger traffic. The Piraeus - Crete line is the leader for both cars and trucks, with car movements experiencing a 48% growth between 1981 and 1990, more than double the equivalent passenger growth rate. The introduction of large P/C vessels has been the main reason for such demand.

Competing with sea transport of passengers in many mainland and island destinations is air transport, provided by Olympic Airways and its "commuter" subsidiary, Olympic Aviation. Growth between 1980 and 1992 has been mixed, with the peak of about 5.3 million annual trips in 1985, and a lowest level of about 3.2 million trips in 1991 (the year of the Gulf war). A few of these destinations are also served directly by foreign airlines (charter or regular flights).

5) *Legal regime*. The most significant recent development in the legal arena has been the passing - by the Council of the EU - of Regulation No. 3577/92 (7 December 1992), regarding the freedom of service in maritime cabotage trades. Such regulation (hereafter referred to as "the Regulation") stipulates, among other things, that Greece's coastal shipping market becomes fully deregulated and open to other EU-flag ships by Jan. 1, 2004. The 11 year waiting period (already reduced to less than 10 years) was intended to provide Greece with the necessary time to prepare for the opening of the market to competition.

Describing the Regulation vis-a-vis the national legal regime, or the probable impacts of the removal of cabotage privileges, or finally what should be done to prepare for 2004, is beyond the scope of this paper. The ETBA final report (Psaraftis, 1993, **Section 3**) and a companion paper to the present paper (Sturmey et al, 1994) deal with these issues in more detail. However, as the adoption of the Regulation is the actual reason behind the analyses reported in our paper, we shall be referring to it and to some of its provisions whenever this is necessary during the course of this paper.

With these preliminary considerations, we now proceed with our analyses.

3   MODAL SPLIT ANALYSIS

In the summer of 1993, the Italian company Tirrenia Navigazione introduced the fast monohull GUIZZO in the line between Civitavecchia (mainland Italy) and Olbia (island of Sardinia). The GUIZZO, built by Rodriquez Aquastrada, is a state-of-the-art fast ship, capable of carrying 450 passengers and 126 cars at speeds up to 43 knots. The trip (124 nautical miles) is traveled in 3.5 hours, of which 3 hours are at the maximum speed. Two daily trips were planned for the summer high season, dropping to one at lower traffic seasons. The GUIZZO was scheduled to operate only 11 weeks per year (July- October), and charged for cars a fare only 15% over the equivalent conventional fare.

Such a low high-speed supplement is also charged by the wave-piercing catamarans that cross the English Channel. Both cases, although completely

different in terms of vessel design, enjoy remarkable capacity utilisationrates, being generally preferred by the public over the conventional, slower ferries.

In view of the EU Regulation, the appearance of such ships in Greece is expected in the comparatively near future. As of today in Greece there are no fast vessels that can also carry vehicles, conventional P/C ships have a real monopoly on those passengers who travel with their cars (captive demand). The rest of the fast ships operating today are hydrofoils and catamarans, neither of which can carry cars. And although hydrofoils have carved their own special niche in the market, catamarans have been less successful. Technical factors such as sea worthiness have probably little to do with this state of affairs (other than a catamaran collision with a pier in 1993). Their meagre presence is mostly attributed to the existing system of route licensing, which, in one case, granted a license to a catamaran on the condition that it served a 10-port route. It is obvious that such a condition destroys any speed advantage of these ships over conventional ships and makes their operation uneconomic.

Since the EU Regulation presumably will make route licensing more rational, a natural question to ask is what portion of passenger demand will shift to fast ships (including fast ferries), when these, in fact, are permitted to operate within the system. Given that the passengers would be able to choose among several competing modes, what will be the modal split? It is the purpose of this section to try to answer this question. Note that by "mode" here we mean not only the general distinction between sea and air, but also the fine grain distinction among the various types of vessels, of which more later.

Another (albeit related) question is what is the economic viability of these fast vessels. This question is addressed in **Section 4**.

Performing the modal split analysis is by no means an easy task, for a number of reasons. First, the coastal shipping network in Greece is huge (138 ports, 34 airports, thousands of inter-port links). Second, one has little or no idea of what will actually happen during the 10 years to 2004 in terms of the fleet, introduction of new technologies, port expansion, and development of legislation, to mention just a few of the crucial factors. Third, it is not immediately clear how the Greek traveler values his or her time, which is perhaps the most critical parameter that one needs to know in order to assess how much more the traveler is willing to pay in order to travel faster.

Some additional difficulties exist (for instance, lack of origin-destination (O-D) flow data). These difficulties will be described furhter in this paper. Last, but not least, we know of no similar analyses examining coastal shipping problems with such difficulties. Most analysis involves freight (for which the issue of fast transport is different), and/or much simpler network configurations (for instance, the analysis for the Channel Tunnel).

In the face of this complex situation, the approach that we adopted consists of the following steps:

STEP 1: Choose a workable (but hopefully relevant) subset of the entire network for the analysis;

STEP 2: Make aggregate demand projections on this network up to 2004;

STEP 3: Make some assumptions on what kinds of transport modes provide service on this network, and for each evaluate the transit times for the relevant links of the network;

STEP 4: Make some assumptions on the fares charged by each mode;

STEP 5: Calculate the monetary value of the time of the passengers;

STEP 6: Run the logit model to determine the modal split on each branch of the network;

STEP 7: Interpret results and perform sensitivity analysis.

The main advantage of such an approach is that it bypasses the problem of trying to *predict* inherently unpredictable scenarios, and produces a flexible tool, by which "what if" *assessment* of scenarios can be performed. Such a tool can readily be applied to larger networks and alternative scenarios (not only for Greece) once the appropriate data have been assembled.

We now describe the work involved in each of these steps, bearing in mind that the complete detailed analysis is reported in Psaraftis (1993).

STEP 1: Choose a workable (but hopefully relevant) subset of the entire network for the analysis

In making such a choice, the following conditions must be satisfied:

a) There should be a correspondence between ports and airports, so that a comparison between sea and air transport is meaningful;

b) The range of distances between network nodes should be relatively broad;

c) The selected sub-network should represent a non-trivial part of the entire network in terms of traffic volume.

In this vein, we have decided to examine a 9-port, 6-airport network, distributed in 6 geographical "zones" as follows:

Zone	Region	Ports	Airports
11	Attiki	Piraeus, Rafina	Elliniko
21	Mykonos	Mykonos	Mykonos
31	Santorini	Thira	Thira
41	West Crete	Souda, Rethymno	Hania
42	Iraklio	Iraklio	Iraklio
43	Lasithi	Ag. Nikolaos, Sitia	Sitia

Notice first that each zone has at least one port (and sometimes two), and one airport. So condition (a) above is satisfied. Also, inter-zone distances for this network range from 69 nautical miles (nm) (between zones 31-42) to 221 nm (between zones 11-43). So the range of distances is indeed broad.

In terms of size, and even though 9 ports are only a small fraction of the 138 ports in the system, in 1990 total passenger traffic among the 9 selected ports was 19.2% of total Greek coastal traffic. Also in 1990, total traffic among the 6 selected airports was 27.3% of total Greek domestic air traffic. So from this perspective, the selected sub-network is certainly non-trivial.

STEP 2: Make aggregate demand projections on this network up to 2004.

By "aggregate demand" we mean that at this stage we shall not break down demand by mode, ie how many passengers will go by fast ships, how many by air, etc. This will be done later (Step 6). On the other hand, we want to take full advantage of existing data regarding flows of passengers in the network, including the choice of mode made by these passengers.

Before we proceed, and as an aside to our analysis, we state that in Psaraftis (1993), a projection of total passenger demand for sea transport on the entire network and up to year 2010 was made. After several regression analyses, it was determined that the best fit to historical data (1964-1989) is the one described by the following equation:

$$TOTAL\text{-}PAX = \exp(1.271 + 0.0414 * (Y - 1963))$$

where TOTAL-PAX is the total passenger trips by sea in year Y. The $R**2$ of this equation is 0.95, and the t-statistic on the coefficient of 0.0414 is 21.06, both acceptable.

The above equation projects about 16.5 million trips in year 2000, about 19.5 million trips in 2004, and about 25.5 million trips in 2010.

Returning now to Step 2, this step involves two sub-steps. First, create origin-destination (O-D) tables for this network for a number of years in the past, and second, use these to forecast origin-to-destination demand on the network up to 2004.

Creating the O-D tables for the sub-network was a rather tricky task. The first difficulty was that no such data was directly available in the databases of MMM's Statistical Service or anywhere else (as much as a lot of other data was available). To circumvent this problem, the direct assistance of this service was requested, and after a series of estimates on how flows at each port split among different routes, an "expert estimate" of the O-D table of passenger trips by sea in the sub-network for 1990 was finally made (see **Table I**). Psaraftis (1993) provides more details on how this table was produced.

From/To	11	21	31	41	42	43	Total
11		145,879	201,373	357,060	372,855	9,538	1,086,705
21	140,459		28,603				169,062
31	203,281	27,757			14,712		245,750
41	349,526						349,526
42	387,970		11,332				399,302
43	10,890						10,890
Total	1,092,126	173,636	241,308	357,060	387,567	9,538	2,261,235

Table I: O-D table for passengers traveling by ship, 1990

Doing the same for passenger trips by air in 1990 was far easier, for this data was directly available from Olympic Airways (see **Table II**).

In addition to passengers, O-D tables for vehicles are necessary, for a portion of the total passengers (those who travel with a vehicle) do not have the choice between sea and air transport (captive demand), and these passengers must be identified. Here we assume that a person traveling with a vehicle has already made the decision to do so and thus does not have the choice of taking the airplane (this assumption is true for a truck driver, but may not necessarily be true for a motorcycle driver, a car driver, or a bus passenger, all of whom conceivably can take the plane and use another vehicle at their destination).

From/To	11	21	31	41	42	43	Total
11				148,572	260,554	830	537,119
21	66,231		4,592		1,664		72,847
31	65,466	4,358			2,067		71,891
41	140,226						140,226
42	249,578	1,784	1,940				253,302
43	816						816
Total	522,317	70,000	70,197	148,572	264,285	830	1,076,201

Table II: O-D table for passengers traveling by air, 1990

Using a similar methodology to the one described for passengers, O-D tables were produced for trucks, buses, cars, and motorcycles traveling in the sub-network in 1990 (these tables are not reproduced here but are available in Psaraftis (1993)).

To estimate now the passengers traveling with these vehicles, an estimate of how many passengers are carried by each vehicle is necessary. We used the estimate made by Martedec S.A. of Piraeus (in the context of a NATO project on Greek coastal shipping) that each truck carries one passenger, each bus 40 passengers, each car 2.5 passengers, and each motorcycle one passenger. On this basis, Table III shows the O-D table of passengers traveling with a vehicle in the sub-network in 1990.

On the basis of Tables I, II, and III, the O-D table of total passengers traveling without a vehicle in the sub-network in 1990 can be constructed. This is Table IV, and consists of all passengers traveling by air, plus those sea passengers who travel without a vehicle. It is clear that if a(i) is a specific inter-zone entry in Table i (i = 1 to 4), then a(4) = a(1) + a(2) - a(3).

From Tables I to IV it can be seen that from all passengers who traveled without a vehicle in the sub-network in 1990, 43% used the airplane and the rest (57%) took the ship. Overall, 68% of the passengers went by ship, and 32% went by plane.

Of course, making a projection to 2004 just from 1990 data is impossible, so in principle we need to repeat this procedure for several years prior to 1990. Published coastal shipping data in Greece exists from 1964 on. Unfortunately

Modal Split Analysis in Greek Shortsea Passenger/Car Transport

From/To	11	21	31	41	42	43	Total
11		37,685	35,173	159,265	206,644	4,703	443,470
21	33,892		876				34,768
31	35,116	735			561		36,412
41	145,806						145,806
42	200,804		541				201,345
43	3,989						3,989
Total	419,607	38,420	36,590	159,265	207,205	4,703	865,790

Table III: O-D table for passengers traveling with a vehicle, 1990

From/To	11	21	31	41	42	43	Total
11		172,052	229,505	346,367	426,765	5,665	1,180,354
21	172,798		32,679		1,664		207,141
31	233,631	31,380			16,218		281,229
41	343,946						343,946
42	436,744	1,784	12,731				451,259
43	7,717						7,717
Total	1,194,836	205,216	274,915	346,367	444,647	5,665	2,471.646

Table IV: O-D table for passengers traveling without a vehicle, 1990

however, individual route data is not available in a uniform way, and MMM's Statistical Service was unable to provide such information for prior years, as it did for 1990. To circumvent this new obstacle, it was decided to produce some *co-efficients*, which express the data in the 1990 O-D tables as functions of passenger and vehicle flows into the ports of the sub-network. Then we would use these same co-efficients to produce the O-D tables from port passenger and vehicle flows in prior years.

Of course, the assumption that these co-efficients stay the same is a debatable assumption. However, given that no major changes in the network have occurred in the past, we feel that it is an assumption that can be justified (lacking a better way to proceed).

No similar problem existed for the air transport O-D data, as this was readily available from Olympic Airways for the period of interest.

Having all these O-D tables for the period 1964-1990, the next substep is to project these into the future. A critical assumption here is that the possible introduction of new technology ships within the network in the future will not generate new demand (other than what would be generated irrespectively; ie... even if these ships are not introduced).

This is also a debatable assumption, and one that may be patently false, as demonstrated by several cases in the past (see effect of hydrofoils in the Volos-Euvoia- North Sporades trade, as mentioned earlier). However, counter-examples also exist. In Psaraftis (1993), an analysis of the Argosaronikos system (the heaviest in hydrofoil traffic) in the period 1977-1990 showed that the effect of hydrofoil entry into that market in the mid-seventies was only a shift of demand from conventional ships to hydrofoils, with no documentable generation of new demand. In fact, growth in the above period was only 18% for the Argosaronikos system, as opposed to 111% for the entire network, a clear sign of demand saturation. So in this case hydrofoils did not generate new demand.

Being unable to say whether or not this will be the case for our sub-network, we chose to be conservative and assumed zero generation of new demand because of the possible introduction of fast ships. Of course, our methodology can still be applied if an alternative assumption is used.

Based on this, regression analyses were conducted individually for all inter-zone links of the sub-network, so as to project demand on those links. The results (see Psaraftis (1993) for details) can be summarized in the following two tables: **Table V** is the equivalent of **Table III**, and shows the O-D flows of passengers accompanying a vehicle in 2004. **Table VI** is the equivalent of **Table IV**, and shows the O-D flows of passengers without a vehicle in 2004.

One immediate observation is that projected flows to 2004 are by no means simple multiples of those flows in 1990, as flows in distinct links are projected to grow in a different way.

In 1990, only two modes of transport were present on the sub-network, conventional P/C vessels (capturing the entire demand of passengers with vehicles (**Table III**) and also receiving a share of the demand of passengers without vehicles, **Table IV**) and air transport (receiving the rest of the demand of passengers without vehicles, **Table IV**).

From/To	11	21	31	41	42	43	Total
11		70,762	78,306	251,449	313,767	13,384	727,668
21	69,948		1,871				71,819
31	85,571	1,442			1,147		88,160
41	238,525						238,525
42	296,953		935				297,888
43	13,671						13,671
Total	704,668	72,204	81,112	251,449	314,914	13,384	1,437,731

Table V: O-D table for passengers traveling with a vehicle, 2004

From/To	11	21	31	41	42	43	Total
11		275,338	372,470	703,576	787,292	33,697	2,172,373
21	282,204		64,254		4,544		351,002
31	377,819	64,757			25,590		468,166
41	680,042						680,042
42	771,730	5,238	22,030				798,998
43	34,418						34,418
Total	2,146,213	345,333	458,754	703,576	817,426	33,697	4,504,999

Table VI: O-D table for passengers traveling without a vehicle, 2004

Having produced the O-D tables for 2004, we are now ready to make some assumptions on the modes of transport that will be available on the sub-network at that time.

STEP 3: Make some assumptions on what kinds of transport modes provide service on this network, and for each evaluate the transit times for the relevant links of the network.

We assume that a total of five (5) modes of transport will be available in this network in 2004:

Mode 1: Air transport;
Mode 2: Conventional P/C vessels;
Mode 3: Hydrofoils;
Mode 4: Surface effect ships (passenger only);
Mode 5: Fast P/C vessels.

Note first that whereas all modes potentially cater to passengers traveling without a vehicle (those of **Table VI**), modes 2 and 5 cater only to passengers traveling with a vehicle (those of **Table V**).

The second remark is that not all modes are assumed to provide service to every inter-zone link of the network. For instance, it would be unreasonable to assume direct hydrofoil service between Piraeus and Crete, or any type of service between Hania and Iraklio in Crete.

The modes that are assumed to be operational for each link of the sub-network are as follows:

Link 11-21: All modes;
Link 11-31: All modes except mode 3;
Link 11-41: All modes except mode 3;
Link 11-42: Modes 1, 2, and 5;
Link 11-43: Modes 1, 2, and 5;
Link 21-31: All modes;
Link 21-42: Mode 1;
Link 31-42: All modes.

No modes are assumed to operate (at least directly) on other links of the sub-network.

The following additional assumptions have been made:

1) A passenger's trip starts from the time he or she leaves home to the time he or she reaches the trip's ultimate destination;

2) A 30-minute waiting time is uniformly assumed for all modes at both ends of the trip for embarkation and disembarkation;

3) Times from a traveler's home to the port (or airport) of origin and from the port (or airport) of destination to the traveler's ultimate destination have been estimated for each case separately, by making some assumptions on the "centroid" of the location of either end of the trip. The centroid is assumed to be close to the centre of the corresponding metropolitan area,

and trip times between the centroid and the corresponding port or airport have been calculated separately for each case;

4) To calculate ship transit times, the following average speeds have been assumed: Conventional P/C, 14 knots. Hydrofoil, 30 knots. SES and fast ferry, 40 knots.

Notice that the assumed speed for conventional P/C ship is rather low. This is to reflect the fact that in the existing network of lines, these ships make several stops from zone 11 to zones 21 and 31, and the fact that the trips from zone 11 to zones 41, 42, and 43 are usually made overnight, with an average speed that is very close to the assumed. Overall, the sailing times implied by this speed are very close to the actual ones.

For the fast ships, non-stop services among zones were assumed, and this reflects the speed values assumed.

Inter-zone flight times are given in **Table VII** below, and inter-zone sailing distances are given in **Table VIII** below. Based on these assumptions, it is straightforward to calculate the trip times for all relevant combinations of modes and inter-zone links.

STEP 4: Make some assumptions on the fares charged by each mode.

Full information exists on the fares charged by the two modes that were operational in 1990, for all links of the network served by each. **Table VII** shows that in 1990 Olympic Airways had two fare increases (trip times are also shown in that table). Our analysis uses as airfare the average of the three fares that prevailed.

Link	1/1-7/5	8/5-24/9	25/9-31/12	minutes
11--42	8,700	11,200	12,200	45
11--41	7,400	9,500	10,400	45
11--21	6,000	7,700	8,400	45
11--31	7,600	9,700	10,700	55
11--43	11,800	15,100	16,600	85
42--31	5,500	7,100	7,700	40

Table VII: Airfares for three periods in 1990 (GRD) and trip times in minutes

Table VIII shows the 2nd-class and passenger car fares charged by conventional P/C ships for the various links of the network. All fares are in GRD (1990) and include all relevant taxes and supplements. The last column in **Table VII** shows inter-port distances in nautical miles.

From	To	2nd	Pass.	Distance
Piraeus	Hania	5,080	9,349	146
Piraeus	Rethymno	5,364	9,349	161
Piraeus	Iraklio	5,364	9,349	175
Piraeus	Ag. Nikolaos	6,866	10,765	197
Piraeus	Thira	3,926	12,276	127
Piraeus	Mykonos	3,137	8,970	94
Rafina	Mykonos	2,647	7,366	70
Mykonos	Thira	2,639	7,327	64
Thira	Iraklio	2,326	6,705	69
Thira	Ag. Nikolaos	2,082	8,311	84
Ag. Nikolaos	Sitia			24

Table VIII: Second class and passenger car conventional P/C fares in 1990 (GRD)

Notice that no fares are given between Ag. Nikolaos and Sitia in Crete. This is so because no traffic between these two ports is examined, Sitia's traffic from other ports going through Ag. Nikolaos.

For fares that will be charged in 2004, the following baseline assumptions are made:

1) All mode 1 and mode 2 fares remain constant in 1990 GRD prices;
2) All mode 3, 4, and 5 fares are 15% higher than the equivalent mode 2 fare.

Of course, both sets of assumptions are debatable. In particular, the second assumption may be characterised as not very strong (15% is too low). However, 15% was the increase used by both the GUIZZO and the HOVERSPEED GREAT BRITAIN, so it would be reasonable to want to see what would happen if this

were applied to Greece as well. In addition, in Step 7 we shall examine alternative increases and see what happens then.

The assumption of fare constancy (in 1990 terms) in modes 1 and 2 is also debatable, as either of these two modes may decide to adopt a different pricing policy as 2004 approaches. We shall discuss these alternative scenarios and their implications later on.

STEP 5: Calculate the monetary value of the time of the passengers.

How much a passenger values his or her time is a critical factor in the analysis, for this would ultimately determine the traveler's willingness to pay in order to make the trip faster. The relevant question for our problem is whether we can say anything for the value of time of passengers using this particular network.

There are two ways to ascertain somebody's value of time. The first, and generally the best, is the "stated preference" method, in which the traveler answers a detailed questionnaire in order to explicitly define his or her utility function of time versus money. Unfortunately, this method is very expensive and time consuming, and, as such, was not used here.

The second method is the "revealed preference" method, and consists of using historical data on travelers' modal choices in order to draw conclusions on how much the traveler values time.

In Greece, Lioukas (1982, 1993) used a logit model for travelers using rail transport. In his latest study, conducted in the context of the Athens-Piraeus subway system, he derived a value of about 800 GRD per hour (1993 prices).

Of course, it is far from clear whether such a value is applicable for the case of coastal shipping in Greece. In Japan, Akagi (1991) showed a value of time on the order of 3,000 Yen per hour on the average. Obviously, it would be inappropriate to use such a value for our analysis.

The only alternative left was to see if we could derive an appropriate value of time using existing data on the Greek coastal shipping system. As such, we decided to use the 1990 data on the sub-network (**Tables I to IV**), in which there is a clearly revealed preference of those passengers traveling without a vehicle, between air transport and conventional P/C ship.

To use this data, we assume that for a specific trip the travelers' preferences are according to the following multinomial logit model: (1)

$$f_i = \exp(a_i + bp_i + ct_i)/\sum_k \exp(a_k + bp_k + ct_k)$$

where f_i is the fraction of travelers using mode i, p_i is the fare charged by mode i, t_i is the trip time using mode i, and a_i is the "preference constant" of mode i, reflecting possible natural biases in favor of or against that mode. b and c are the same for all modes, and are both negative.

For two modes i and k, we can see that: (2)

$$\ln(f_i/f_k) = \Delta a_{ik} + b\Delta p_{ik} + c\Delta t_{ik}$$

where: $\Delta a_{ik} = a_i - a_k, \Delta p_{ik} = p_i - p_k \, \kappa \alpha \iota \, \Delta t_{ik} = t_i - t_k$.

This expression means that an increase of the fare by one unit can be offset by a reduction of the trip time by b/c. Alternatively, the ratio c/b is the amount the traveler is willing to pay in order to reduce trip time by one unit. Therefore, the value of time we want is the ratio c/b.

A linear regression analysis of (2) with the 1990 data (looking only at passengers traveling without vehicles- **Table IV**), and with the additional assumption that $\Delta a = 0$ (there is no initial documented bias in favor of either mode) produces the value of c/b = 415 GRD/hr.

It should be noted that the $R**2$ for this analysis was not that spectacular (0.54), implying that there are probably more factors affecting traveler preference and behavior than those examined by this model (fare and trip time). For instance, it is certainly true that different classes of passengers have different values of time (a businessman who travels by plane has a different value of time from a tourist who enjoys being on the deck of a ship during the entire morning, or from a traveler who enjoys an overnight journey in a cabin). Having no way to measure such differences, we had to settle with the "average" value of time calculated above. We shall use such a value with caution, knowing that it is only an average, and one that probably overestimates the value of time of some travelers (those traveling by ship) and underestimates the value of time of other travelers (those taking the plane).

To validate this model, we applied the value of 415 GRD/hr to the O-D data shown in **Table IV** (passengers without vehicles, 1990) to produce what the logit model gives for total passengers traveling without a vehicle and who prefer sea transport for 1990. We then added the passengers captive to sea transport (those of **Table III**), and produced **Table IX**. A comparison with **Table I** shows generally acceptable results.

From/To	11	21	31	41	42	43	Total
11		145,767	182,363	341,807	409,816	7,289	1,087,042
21	143,650		22,784				166,433
31	185,167	21,806			11,661		218,634
41	331,072						331,072
42	412,494		9,224				421,718
43	8,229						8,229
Total	1,080,611	167,573	214,371	341,807	421,477	7,289	2,233,129

Table IX: Validation of modal split: "predicted passengers traveling by ship, 1990 (compare with Table I)

We finally note that comparing the 415 GRD/hr value with the value of Lioukas (1993), 415 GRD/hr of 1990 are equivalent to about 625 GRD/hr in 1993, which is lower than (although same order of magnitude with) the 800 GRD/hr produced by him.

STEP 6: Run the logit model to determine the modal split on each branch of the network

Having calibrated the logit model by calculating an appropriate value of time, and having validated it by comparing Table IX with Table I, we now run it for 2004 as follows.

First, as to what the value of time will be in 2004, we assume that this will grow (in constant 1990 prices) as the rate of annual growth of Greek gross domestic product. Assuming a 1.5% average growth (in real terms), this value becomes about 510.6 GRD/hr in 1990 prices (unless otherwise noted, all our analysis is expressed in 1990 GRD). This asumption is plausible, for a person will probably value time more if he or she makes more money.

So we examine modal split in 2004 with a value of time equal to 510.6 GRD/hr (1990 prices). Note however that in 2004 the number of possible modal choices in our sub-network is 5 and not 2, as in 1990. Since the value of 510.6 was derived assuming two modes, a question is whether we can use it for the 3 additional modes assumed in 2004. Another question is whether we can use this value for those passengers traveling with a vehicle. Such passengers,

having no choice but to use the conventional P/C ship in 1990, have the fast P/C ship as an alternative in 2004.

There is no foolproof way to address either of these two questions. In fact, in a strict sense, the correct answer to both questions is "no," particularly to the second one (somebody traveling with his car will generally have a different value of time from somebody traveling without it). However, the average value of 510.4 GRD/hr is about the only piece of information on travelers preferences we got, and short of scrapping this analysis altogether, we decided to use it in our analysis as best we could. "As best we could" means a number of additional assumptions concerning the way the modal split calculations are made. These are as follows.

a) In 2004 there will be no capacity constraints on the number of available ships or aircraft to meet projected demand on each link of the sub-network;

b) The value of time for all passengers in the system (traveling with or without vehicles) is 510.6 GRD/hr (1990 prices);

c) The fare assumed to be paid by each passenger traveling with a vehicle (those of **Table V**) is the second class fare, plus 1/2.5 the corresponding private car fare. This assumption is reasonable for passengers traveling with their private cars (since on the average each car carries 2.5 persons), but neglects possible fare differentiations for bus, truck or motorcycle travelers. These are estimated to be minor. For these passengers, modal split is made between 2 modes, 2 and 5 (binomial logit model) and is shown in **Tables X and XI** below;

d) The most important assumption concerns how the modal split should be made for passengers traveling without a vehicle. All 5 modes are present here, and a straightforward way to run the model would be to apply the multinomial logit formula with all 5 modes present, and let the results fall where they may. The initial set of runs were in fact made this way, and showed fast ships and air transport combined capturing from 70% to 88% of total passenger traffic without vehicles if the value of time is 510.6 GRD/hr and if the fast fare surcharge goes from 15% to 100%. If the fast fare surcharge is kept constant at 15%, this combined percentage ranges from 88% to a striking 99.7% of the passenger traffic without vehicles, the latter case (in which conventional ships receiving almost zero passengers without cars) happening if the value of time is tripled. Judging these results to be unrealistic, we decided to adopt a different philosophy on how the modal split is made, as follows.

Instead of a multinomial model (split among 5 modes), we used a binomial model in a pairwise sequential fashion. The first split was between air and all

ships combined. The second split was between conventional P/C ships and and all fast ships combined. The third split was between hydrofoils and other fast ships combined (SES and fast P/C ships). The fourth split was between SES and fast P/C ships. Notice that each split (except the fourth) is between a distinct single mode and a set of other modes combined. The time and fare parameters of the combined modes were assumed to be those of the one among these modes for which the "generalised fare" (fare plus trip time multiplied by value of time) was the lowest. This is tantamount to assuming that the traveler makes his choice in a sequential fashion, and at each step he or she always compares a mode with the best (in terms of generalized fare) among all other modes still under consideration.

There is no a priori way of telling what selection biases are introduced by this scheme, or whether these biases are systematic. This is so because there is no systematic ranking of the modes according to their generalised fares (as much as there is one according to their trip times and another one according to their fares). However, from the results (and from a comparison with the multinomial logit runs) we speculate that the biases are primarily against the fast ships. In that sense, we consider these runs (coupled with the assumption that the fast ships generate no new additional demand) to be on the conservative side with respect to the future of these ships.

Tables X to XVI summarize the results of these runs as follows.

1 Passengers traveling with vehicles (modal split of Table V passengers)

From/To	11	21	31	41	42	43	Total
11		44,413	48,706	150,869	185,143	7,830	436,961
21	43,857		1,188				45,045
31	83,225	916			724		54,865
41	143,115						143,115
42	175,202		590				175,792
43	7,998						7,998
Total	423,397	45,329	50,484	150,869	185,867	7,830	863,776

Table X: Passengers who will travel by conventional P/C (mode 2)

From/To	11	21	31	41	42	43	Total
11		26,349	29,600	100,580	128,624	5,554	290,707
21	26,091		683				26,774
31	32,346	526			423		33,295
41	95,410						95,410
42	121,751		345				122,096
43	5,673						5,673
Total	281,271	26,875	30,628	100,580	129,047	5,554	573,955

Table XI: Passengers who will travel with fast P/C (mode 5)

2 Passengers traveling without vehicles (modal split of Table VI passengers)

From/To	11	21	31	41	42	43	Total
11		62,805	86,778	152,819	150,107	5,911	458,420
21	65,163		19,463		4,544		89,170
31	86,213	19,754			7,015		112,982
41	149,233						149,233
42	150,504	5,238	6,054				161,796
43	6,037						6,037
Total	457,150	87,797	112,295	152,819	161,666	5,911	977,638

Table XII: Passengers who will travel by air (mode 1)

Modal Split Analysis in Greek Shortsea Passenger/Car Transport

From/To	11	21	31	41	42	43	Total
11		85,913	122,772	177,190	184,671	8,195	578,741
21	89,139		26,524				115,663
31	121,973	26,921			10,892		159,786
41	173,032						173,032
42	185,160		9,400				194,560
43	8,370						8,370
Total	577,674	112,834	158,696	177,190	195,563	8,195	1,230,152

Table XIII: Passengers who will tavel by conventional P/C (mode 2)

From/To	11	21	31	41	42	43	Total
11		35,470				0	35,470
21	36,801		10,411				47,212
31		10,567			4,150		14,717
41							0
42			3,582				3,582
43							0
Total	36,801	46,037	13,993	0	4,150	0	100,981

Table XIV: Passengers who will travel by hydrofoil (mode 3)

From/To	11	21	31	41	42	43	Total
11		10,194	42,307				52,501
21	10,577		2,992				13,569
31	42,301	3,037			1,193		46,531
41							0
42			1,029				1,029
43							0
Total	52,878	13,231	46,328	0	1,193	0	113,630

Table XV: Passengers who will travel by SES (mode 4)

From/To	11	21	31	41	42	43	Total
11		10,194	42,307	122,118	138,746	6,207	319,572
21	10,577		2,992				13,569
31	42,031	3,037			1,193		46,261
41	119,252						119,252
42	139,113		1,029				140,142
43	6,340						6,340
Total	317,313	13,231	46,328	122,118	139,939	6,207	645,136

Table XVI: Passeners who will travel by fast P/C (mode 5)

Modal Split Analysis in Greek Shortsea Passenger/Car Transport

To get the total picture for modes 2 and 5 (which are the only modes catering to both categories of passengers), we also have:

From/To	11	21	31	41	42	43	Total
11		130,326	171,478	328,059	369,814	16,025	1,015,702
21	132,996		27,712				160,708
31	175,198	27,837			11,616		214,651
41	316,147						316,147
42	360,362		9,990				370,352
43	16,368						16,368
Total	1,001,071	158,163	209,180	328,059	381,430	16,025	2,093,928

Table XVII: Total passengers who will travel by conventional P/C (mode 2), sum of **Tables X and XIII**

From/To	11	21	31	41	42	43	Total
11		36,543	71,907	222,698	267,370	11,761	610,279
21	36,668		3,675				40,343
31	74,377	3,563			1,616		79,556
41	214,662						214,662
42	260,864		1,374				262,238
43	12,013						12,013
Total	598,584	40,106	76,956	222,698	268,986	11,761	1,219,091

Table XVIII: Total passengers who will travel by fast P/C (mode 5), sum of **Tables XI and XVI**

STEP 7: Interpret results and perform sensitivity analysis.

As these results concern only a limited application of modal split (sub-network and not entire network), they should be interpreted with caution. For instance, the percentages of each mode depend not only on passenger preferences, but also on our very assumption on what links of the subnetwork are served by each mode. So these results should only be considered an output of a "what if" analysis, and not as predictions of what will actually happen in 2004. At the same time, we consider useful to perform a sensitivity analysis on some of the parameters so as to obtain some additional insights. Sensitivity analysis concerns two main parameters: The fare differential between conventional and fast ships (assumed in the baseline scenario at 15%), and the value of time (assumed in the baseline scenario equal to 510.6 1990 GRD/hr).

In 1990, of those passengers who traveled in the sub-network without a vehicle, 43% traveled by air, and the rest (57%) by conventional P/C ship. In total, 68% took the ship, and 32% used the plane.

In 2004, for those who will travel without a vehicle, 32% will take the plane, 40% will go by conventional P/C ship, 3.3% will take the hydrofoil, 3.7% will use SES, and 21% will go by fast P/C ship. For those who will travel with a vehicle, 60% will go by conventional P/C, while 40% will go by fast P/C.

These percentages, if interpreted narrowly, may be misleading. For instance, for passengers who travel without vehicles, the small hydrofoil and SES percentages (as compared to that of the fast ferries) are mostly due to our assumption on what links of the subnetwork are served by these modes and less on actual preferences. In fact, SES and fast P/C have the same speed and charge the same fare, so on one should expect a tie of these modes on the links served by both. This happens indeed (Compare **Tables XV and XVI**). However, not all links are served by both modes, by our own assumption, and that is why the overall shares of mode 5 are higher than those of mode 4.

In addition, these percentages do not differentiate between short and long-haul routes. If we are more careful, we can see that hydrofoils raise their percentage on short-haul routes and other new technology ships do so for longer-haul routes.

The general observation from these runs is that the overall percentage of traffic that goes to the new technology ships (modes 3, 4 and 5) can be significant. This is mainly against the airplane for passengers without cars and against conventional ferries for passengers with cars. One possible reason for this is the small (15%) fast fare surcharge assumed. Irrespective of whether these ships can survive on such a small fare (this will be examined in **Section 4**), one natural question is what happens to modal split if the fast fares become higher?

To investigate this, we examine what happens if the fast ship fare is 30%, and 50% over the conventional one (ceteris paribus). The results are again differentiated between passengers without vehicles, and passengers with vehicles:

For the former pasenger category, if the fast fare surcharge is 30% (50%) the shares of each mode become: Air, increase to 34% (36%); conventional ferry, slight increase to 41% (41%); hydrofoil, decrease to 2% (1.9%); SES, decrease to 3.1% (2.8%), and fast ferry, decrease to 19.9% (18.3%). For passengers traveling with a vehicle, the share of the conventional ferry increases to 64% (68%), while that of the fast ferry goes down to 36% (32%). In other words, the main beneficiary of a more expensive fast ship fare is the airplane for passengers traveling without a car and the conventional ship for passengers traveling with a car.

We next examine what happens if the value of time is twice or three times what was originally assumed (with a 15% fast fare surcharge).

For passengers without cars, if the value of time is doubled (tripled), the new shares are: Air, increased to 35% (37%); conventional ships, decreased to 36% (31%); hydrofoil, decreased to 2.4% (2.6%); SES, decreased to 3.6% (3.4%); and fast ferry, increased to 23% (25.4%). For passengers with cars, the shares are: Conventional ferries, dropped to 55% (49%), while fast ferries increase their share to 45% (51%).

We see that if the value of time increases, for both passenger classes the main loser is the conventional ferry, while the main beneficiary is the fast ferry and the airplane. Interestingly enough, the other two fast ship modes see their shares slightly decrease.

4 ECONOMIC FEASIBILITY ANALYSIS

In view of the promising results of the previous section with respect to the possible share of passenger demand that new technology ships might be able to attract in 2004, a pertinent question is what is the economic potential of these vessels. Clearly, a modal split analysis would be incomplete if the economic viability of these vessels is not also assessed. Although such an analysis is not the central focus of this paper (see Psaraftis (1993) for complete details), we provide here a summary of its main results.

The project team collected (and/or estimated) technical and economic data (not reproduced here) for the following categories of new technology vessels:

1) The fast monohull GUIZZO (mainland Italy - Sardinia);
2) The swath AEGEAN QUEEN (under design at NTUA- see Papanikolaou et al (1991));
3) The wave-piercer catamaran HOVERSPEED GREAT BRITAIN (Channel service);
4) The swath PATRIA (Tenerife service);
5) The SES CORSAIR 900 (under construction in Germany);
6) The hydrofoil KOMETA (in service in Greece).

Of these, vessels 1, 2, 3, and 5 can carry cars, while vessels 4 and 6 can only carry passengers.

A parametric analysis was performed on two important parameters: The vessel's capacity utilisation (ranging from 30% to 70%, with 60% assumed as the baseline value), and the company's required return on investment (ranging from 0 to 40%, with 20% assumed as the baseline value).

The vessel's economic performance depends not only on the above parameters, but also on the route it serves, as well as the operating scenario for that route. For instance, if the MMM imposes a mandatory requirement of provision of year-round service, the ship would have to collect higher fares to stay viable than if no such requirement were imposed. So we formulated seven possible scenarios, the following:

Scenario a: Route Piraeus - Mykonos (94 nm), 2 roundtrips per day for the 3 summer months, 1 roundtrip per day for 8 months, 1 month out of service;

Scenario b: Same as scenario a, but 2 roundtrips per day for 11 months, and 1 month out of service;

Scenario c: Same as scenario a, but route is Piraeus - Santorini (126 nm);

Scenario d: Same as scenario b, but route is Piraeus - Santorini;

Scenario e: Same as scenario a, but route is Piraeus - Iraklio (175 nm);

Scenario f: Same as scenario b, but route is Piraeus- Iraklio;

Scenario g: Same as scenario e, but 1 daily roundtrip for 11 months and 1 month out of service.

The purpose of scenarios b, d, and f is not so much to examine the performance of these vessels if the two daily roundtrips of the summer are extended during the rest of the year, but to simulate a scenario in which the shipowner can remove his ship from service during the 8 months of the off-season, and employ

the ship outside the Greek system. The assumption is that this alternative employment would be equivalent in terms of revenue.

We also note that some of these scenarios do not match some of the vessels. For instance, the AEGEAN QUEEN cannot make the two roundtrips to Crete (scenarios e and f), due to lower speed. Similarly, the PATRIA and KOMETA (that do not carry cars) are not examined at all on this route.

There are 34 vessel- scenario combinations. All are shown in **Table XIX**. The table shows two fares for each vessel- scenario combination:

(i)   The (minimum) required passenger fare to break even (on a net present value sense) over the ship's lifetime (codenamed RFR, and expressed in 1990 GRD);

(ii)   The passenger fare that maximises revenue, assuming a binomial logit modal split between the vessel and a conventional ferry charging the conventional fare (codenamed MAX, and also expressed in 1990 GRD).

Psaraftis (1993) provides more detail on how both fares are calculated. MAX is obtained by taking the derivative of the logit equation and then iteratively solving a set of non-linear equations. No retaliation is assumed from conventional vessels.

Also shown in the table are the 2nd class conventional vessel fare, and the airfare for each route.

Several remarks can be made from this table. First, and with the possible exception of the PATRIA and the KOMETA, all other vessels require fares considerably higher than both the conventional fare and their own revenue maximising fare. These fares become prohibitive (compare for instance with airfares) for scenarios a, c, and e, which require the maintenance of a year- round service.

By contrast, if the year- round service requirement is lifted (scenarios b, d, and f), the RFR's drop considerably.

The above scenario assume a 60% utilisationand a 20% required return on investment. If the utilisationis increased and/or the rate of return is decreased, the RFR's drop somewhat (see Psaraftis (1993 for the full sensibility analysis).

The above results certainly do not paint a particularly rosy picture for the future of fast ships in Greece, and neutralize, to a significant extent, the promising results of the previous section. They boil down to the realisation that although fast ships can attract a significant share of passenger traffic if the fares they charge are modest (15% to 50% over the conventional fares), the economic viability of such vessels is likely to be problematic because they need much

	Scenario	a	b	c	d	e	f	g
Ship	Fare							
GUIZZO	RFR	10,453	7,477	11,226	8,250	12,408	9,432	14,640
	MAX	2,825	2,825	3,403	3,403	4,668	4,668	4,668
AEGEAN QUEEN	RFR	5,757	3,936	6,011	4,191			7,123
	MAX	2,686	2,686	3,194	3,194			4,316
HOVERSPEED	RFR	8,092	5,521	8,439	5,869	8,973	6,402	10,901
	MAX	2,732	2,732	3,254	3,254	4,449	4,449	4,449
PATRIA	RFR	5,339	3,566	5,497	3,724			
	MAX	2,693	2,693	3,230	3,230			
CORSAIR	RFR	9,723	6,682	10,246	7,145	10,896	7,854	13,177
	MAX	2,825	2,825	3,403	3,403	4,668	4,668	4,668
KOMETA	RFR	5,158	3,575	5,432	3,849			
	MAX	2,590	2,590	3,054	3,054			
2nd class fare		3,137	3,137	3,926	3,926	5,364	5,364	5,364
Airfare		10,558	10,558	11,620	11,620	12,550	12,550	12,550

Table XIX: Economic performance of vessels for each scenario

higher fares to break even. As these fares are often close to the level of air transport fares, very few people would accept them, rendering the overall operation problematic.

Several factors contribute to this outlook, and to the extent that some or all of these factors change, the outlook itself can change for the better. These are the following:

a) *Low level of conventional fares.* If those were higher, the prospects would be better. In fact, MAX is not a linear function of the conventional fare. As conventional fares are under the strict control of the MMM, the prospect of deregulation of these fares by 2004 could relieve some of the pressure from new technology vessels. See also b below.

b) *High relative cost of fast ships.* By "relative" we mean per unit passenger capacity, as compared to conventional ships. As conventional ships in Greece are mostly conversions and not new designs, this relative cost of fast ships is even higher. Of course, the strict control of the fares by the MMM is one of the reasons for this state of affairs, for keeping fares at low levels provides little incentive for a shipowner to buy a new ship. This situation seems to be changing lately, as several shipowners have ordered newbuildings for their fleet. Even though most of these new ships will go to the Italy- Greece services (which are not governed by the same fare structure as the internal cabotage services), this will eventually bring pressure to the MMM to deregulate fares sooner rather than later.

c) *Low value of time in Greece.* It is interesting to report that the income maximising fare for the GUIZZO in Italy is at about the same level as the actual fare charged (Psaraftis (1993)). This is assuming a value of time for Italy about 3 times the Greek level. So the GUIZZO, although probably subsidised in her early runs, is more profitable in Italy than it would be in Greece, for the traffic could bear the higher rates more easily. Of course, a higher value of time in Greece can be associated with (and be the result of) a substantially higher income per capita.

d) *Operating scenario controlled by the MMM.* Above we saw that if these vessels are required to provide a year- round service, their economic viability is much lower. The same would happen if the MMM sets un- reasonable conditions as prerequisites for granting licences to such ships (for instance, calling at 10 ports, as we noted earlier). It is our view that in 2004 the MMM will have no right to impose such conditions on fast ships, even though it will (as per the EU Regulation on cabotage) retain such authority for a select subset of the network, on which "public services" will be imposed and provided. Psaraftis (1993) and Sturmey, et al (1994) provide more details on this issue.

At the same time, the outlook can get more complicated if the other modes (1 and 2) cease to adopt a "do-nothing" fare policy (as we assumed) but formulate a fare structure that is explicitly designed to make life even more difficult for new technology ships. The analysis of the impications of such policies (which may contain elements of gaming and oligopolistic price equilibrium theory) are left for a future phase of this research.

5   CONCLUDING REMARKS

Several remarks can be made from this table. First, and with the possible excep- tion of the PATRIA and the KOMETA, all other vessels require fares considerably higher than both the conventional fare and their own revenue maximising fare.

These fares become prohibitive (compare for instance with airfares) for scenarios a, c, and e, which require the maintenance of a year- round service.

By contrast, if the year- round service requirement is lifted (scenarios b, d, and f), the RFR's drop considerably.

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The above results certainly do not paint a particularly rosy picture for the future of fast ships in Greece, and neutralize, to a significant extent, the promising results of the previous section. They boil down to the realisation that although fast ships can attract a significant share of passenger traffic if the fares they charge are modest (15% to 50% over the conventional fares), the economic viability of such vessels is likely to be problematic because they need much higher fares to break even. As these fares are often close to the level of air transport fares, very few people would accept them, rendering the overall operation problematic.

Several factors contribute to this outlook, and to the extent that some or all of these factors change, the outlook itself can change for the better. These are the following:

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c) *Low value of time in Greece.* It is interesting to report that the income maximising fare for the GUIZZO in Italy is at about the same level as the actual fare charged (Psaraftis (1993)). This is assuming a value of time for Italy about 3 times the Greek level. So the GUIZZO, although probably

subsidised in her early runs, is more profitable in Italy than it would be in Greece, for the traffic could bear the higher rates more easily. Of course, a higher value of time in Greece can be associated with (and be the result of) a substantially higher income per capita.

d) *Operating scenario controlled by the MMM.* Above we saw that if these vessels are required to provide a year- round service, their economic viability is much lower. The same would happen if the MMM sets unreasonable conditions as prerequisites for granting licences to such ships (for instance, calling at 10 ports, as we noted earlier). It is our view that in 2004 the MMM will have no right to impose such conditions on fast ships, even though it will (as per the EU Regulation on cabotage) retain such authority for a select subset of the network, on which "public services" will be imposed and provided. Psaraftis (1993) and Sturmey, et al (1994) provide more details on this issue.

At the same time, the outlook can get more complicated if the other modes (1 and 2) cease to adopt a "do-nothing" fare policy (as we assumed) but formulate a fare structure that is explicitly designed to make life even more difficult for new technology ships. The analysis of the impications of such policies (which may contain elements of gaming and oligopolistic price equilibrium theory) are left for a future phase of this research.

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SHORT-SEA SHIPPING:
VIA OPTIMA?

By R.J. Martens

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SHORT-SEA SHIPPING:
VIA OPTIMA?

ABSTRACT

Various positive elements of maritime transport, such as environmentally friendly and under-utilised infrastructure capacity, have been recognised and have resulted in the integration of maritime coastal transport in the European transport policy.

The objective of this paper is to function as a catalyst for thought and action on the topic of intermodal services by sea, with a focus on short-term practical solutions. Shortsea shipping is defined in this paper as proximity intermodal shipping by sea, without taking into account the size of the vessel.

Research indicates that, based on the current competitive position, around 5% of the current international road transport (more than 4 million tonnes out of a total of 86 million tonnes in 1986) of The Netherlands could be transported by sea from a transport cost perspective. However, shippers and consignees still select road transport. It appears that costs are important, though the quality of the services (frequency, schedule, reliability, safety of cargo) have to meet a certain threshold level before shippers and consignees become interested in an another transport option.

This paper focuses on these elements from the perspective of a new, private, organisation stepping into the intermodal shortsea market.

The main conclusion of this paper is that an intermodal shortsea operation has a better commercial future if it is developed as an integral part of a total corridor system approach - an organisation offering the market all possible transport modes.

This corridor organisation "Via Optima" uses a pro-active approach, applying the principle of dedicating account managers to clients. The transport providers, including port terminals, reserve a minimum part of their equipment for this corridor organisation, all under the same name.

Support can be given to a commercial successful implementation of such a corridor organisation by supporting the establishment of a "Geographical Transport Information System (GTIS)" - which provides detailed market information, supporting the establishment of a "Bureau (for) Shortsea Shipping" - focused on improving the perception of the shortsea sector, and giving policy

attention to matters concerning customs, pilotage, port licenses and duties, as well as supporting technical improvements on the longer term.

1 INTRODUCTION

In 1991 the Directorate-General Shipping and Maritime Affairs (DGSM) from The Netherlands commissioned the Maritime Economic Research Centre and NEA to carry out a study in order to identify a number of trade-routes, using Dutch ports, where shortsea shipping is in a better competitive position vis-à-vis road transport[1].

The report stated that the international road transport to and from The Netherlands totalled 86 million tonnes in 1986. Of this total around 32 million tonnes was identified to be:

a. Related to coastal regions;
b. Characterised as cargo that could be transported by sea; and
c. Significant in transport volumes.

On the basis of this volume the study carried on with a detailed analysis of the cargoes involved, with respect to parcel sizes, transport prices, "perishability" and other cargo characteristics.

* 0 and 1   (agricultural products);
* 8   (chemicals); and
* 9   (other products).

Of this 4.3 million tonnes, 3.1 million tonnes is transported on five trade-routes. These five trade-routes are:

1. Netherlands - St. Petersburg	44,000 tonnes
2. Netherlands - Finland	444,000 tonnes
3. Netherlands - Spain/Portugal	1,378,000 tonnes
4. Netherlands - Middle & South Italy	799,000 tonnes
5. Netherlands - Eastern part Mediterranean	606,000 tonnes

Using this as a basis, DGSM prepared in 1992 the policy paper "Filevrij over zee". This paper provides a framework for the shortsea shipping strategy of the Dutch government. The first element identified as necessary was a further investigation into the thresholds confronted by the shortsea shipping sector to become more competitive as an intermodal transport supplier and the formula-

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[1] *Mariniseerbare Ladingen, MERC/NEA, 1991, Rotterdam.*

tion of recommendations improving this competitive position, as well as the identification of the trade-route potentially to be used in a pilot project.

This study was commissioned to Frederic R. Harris, the Maritime Economic Research Centre and Maritime Systems Technology late 1992. The study concluded in June 1993 with the report Groene Golf" (green wave).

This paper is largely based on this report, and it uses preliminary results of a Frederic R. Harris "Research Paper", prepared by two students (Peter Postema and Wouter Kesseler) of the Transport College from the Erasmus University in Rotterdam. Their research focuses on the organisation of intermodal transport in general and to what extent shortsea shipping can learn from the development of land-based intermodal transport.

This paper is further divided in three sections:

In **Section 2** a broad outline of the market environment, with regard to changing logistic structures, is presented. This outline provides the market framework within which the new intermodal operator has to operate.

In **Section 3** the most prominent thresholds for shippers and consignees to use shortsea shipping as an alternative to road transport are presented, as identified in the Groene Golf study.

In **Section 4** concept solutions are proposed for a hypothetical introduction of a pilot project on a transport-route. The concepts are presented for further investigation but also to be assessed and potentially to be implemented if such a pilot project would be regarded an efficient learning path for the further development of intermodal services by sea and to increase the cohesion of economies in the European Union.

2   THE MARKET ENVIRONMENT

2.1 CAPTIVE MARKET

The objective of The Netherlands is to enhance the competitive position of The Netherlands as the European Distribution Land (EDL). To achieve this objective it is a necessity to maintain and expand the role of all the transport modes.

However, also in The Netherlands, the land transport modes will most likely not be in a position to encompass the forecast intra-European transport demand. Furthermore, the (land) access to the port, especially the Port of Rotterdam,

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runs the risk to become suboptimal, which could well result in a decrease of the use of the port for import - or export - of commodities.

The (existing) familiarity with the maritime sector in The Netherlands, the existing port infrastructure and access to the sea could result in a significant development of intermodal maritime services in The Netherlands. This could then maintain/increase the position of The Netherlands in intra-European trade.

So there is a policy support for a improvement of the competitive position of intermodal maritime services vis-à-vis road transport.

A number of studies so far have resulted in merely an estimate of traffic flows. Shipowners, also, have very little precise and comprehensive information at their disposal regarding captive traffic flows. The lack of this kind of information has led several major shipowners to set up their own information service (B.A.I. Company[2]), enabling the shipowners to monitor the traffics and their fluctuations.

When focusing on The Netherlands, analyses of the international trade relations indicate that, based on transport costs, currently between 1.5 and 4.5 million tonnes of road cargo could be transported by sea[3]. That seems not to be significant in relation to the current volumes. But one consideration should be added.

Sea transport currently does not grow as fast as road transport. The road transport sector is increasing its competitive position continuously. More cargo, today transported by sea, could very well be transported by road tomorrow. Assessments indicate that potentially 10 to 18 million tonnes of sea cargo could move to the road[4].

This, however, does not include the competitive position of rail. The statement that the maritime sector could very well lose cargo to the road sector might be, in a sense, not the whole truth. The increasing market share of intermodal rail services in Europe certainly is a result of attracting cargo from the road to rail. The question, however, if rail has also gained from sea, has to be raised.

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[2]B.A.I. Company: Bretagne, Angleterre, Irlande company

[3]Report *Groene Golf*, Frederic R. Harris, MERC, MST, 1993

[4]Report *Mariniseerbare Ladingen*, MERC/NEA, 1991

As an example we can mention Haulmark European Transport, a major UK container intermodal operator. Haulmark[5] has launched new, long-haul container intermodal door-to-door services between the UK and France, Spain and Italy. The concept behind the services is that of using the shortest possible sea-routes combined with longer overland rail hauls, or exactly the opposite of what the discussions in Europe with regard to the future of shortsea sector entail until now.

Keeping this in mind, it still can be concluded that the result of increasing the competitive position of shortsea shipping is a market hovering between 10 and 20 million tonnes annually for The Netherlands. In view of the expected growth of intra-European transport this can only grow.

2.2 LOGISTIC CONCEPT CHANGES

The environment in which transport has to operate has changed significantly and will change further and will therefore continuously change the 'product' requirements of transport.

Various developments led to the transport of smaller parcel sizes with a higher frequency, resulting in more sophisticated transport requirements.

* Shorter life-spans of products and shorter delivery times resulted in a change of logistical concepts, e.g. resulting in central distribution and value added logistics;

* The internationalisation of production processes - global sourcing - leaded to an increase of international containerised transport, resulting in an increase of logistic co-ordination requirements, e.g. electronic parts production and assembly;

* The trend of "internationalisation" - shifting part of production capacity to other trade blocks - results in significant changes of transport volumes and structures, e.g. passenger car transport to Europe.

Also a number of other developments resulted in changing logistical solutions.

* The increasing power of shippers and consignees, due to economic concentration;

* The internationalisation of the marketplace;

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[5]Containerisation International, October 1993

* The increasing international competition not only results in lower prices but also in higher customer service levels.

Through the availability of fast communication methods is has become technically (though not always commercially) possible to fully organise, co-ordinate, and control the logistic process.

Until now these developments have led to more 'individualised' transport. As road hauliers were among the first actors to recognise this individualisation (through their direct contact to the client), they have been successful in increasing their market share vis-à-vis other transport modes.

As a result of this attention to logistics within companies, it is interesting to note that there are some changes in sight in the client's organisation.

The market can be differentiated broadly into two categories of customers. On the one side there are the industrial customers and on the other side the consumer market customers.

In the first - industrial customers - it is still shipping/traffic managers who handle the sea freight function, and who decide which forwarders and/or shipping lines to use. Senior management in industrial manufacturers often regard shipping as a necessary evil, and consequently they are not interested in it. Even shipping costs may be deemed to be not very important, since they are passed onto customers as components of CIF prices.

In contrast, in manufacturers, or importers of consumer products, the approach to transport and distribution is different. The reasons are that the distribution/logistics requirements are higher (just-in-time) and that a difference in transport costs may have a significant influence on the profit margin.

Consequently, in the latter group a trend can be identified showing that transport is becoming more important. Shipping/traffic departments are replaced by logistics departments, usually headed by more senior people than traditional shipping managers. Such people are reputed to be more sophisticated, and often have specialised backgrounds.

This trend can only expand as transport costs is recognised as a significant element of the total product.

Within this business environment intermodal sea transport has to find its market niche.

3 THRESHOLDS

In **Section 2** we saw that there is around 4 million tonnes of road cargo transferable to the sea. What are the current threshold for shippers and consignees then not to select shortsea shipping[6]?

First, an important element with which prospective intermodal operators are confronted is the lack of precise and comprehensive transport market information. To ensure commercial success, it is necessary to formulate very clear marketing plans. These plans should include market segmentation, a clear product and pricing strategy and a clear sales strategy covering channel, coverage and promotional activities.

Segmentation could mean: identifying distinct groups of shippers sharing similar characteristics (geographic location, traffic corridors, traffic density - potato exporters from The Netherlands to Italy) and cargo safety requirements. Key questions in segmentation are: Is the revenue potential adequate to justify market entry? What service and product attributes are most highly valued? Is the market concentrated among a few leaders? Who is deciding on the transport mode?

This analytical step is an important prelude to positioning the new intermodal product for long-term commercial success. In addition this should be a continuous effort in order to ensure market responsiveness. To answer these crucial questions solid supporting data is needed to develop a detailed understanding of the market segments - "know your client". This data is usually not available (clearly put forward by shipowners and line operators to Frederic R. Harris during the "Groene Golf" study).

Second, it is the demand side's (shippers and consignees) current negative perception of the maritime sector. When specifically asking for it, the shortsea sector does offer multi-modal or even intermodal services. Albeit, they do not actively market these capabilities. Therefore, the shortsea sector can be characterised as re-active. However, shortsea is in competition with more pro-active sectors: the road haulier and rail sector.

Third, the quality of service factors - frequency, timing of departures and arrivals, and reliability - are decisive factors, more important then rate charges, in

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[6]This section is based on findings of the "Groene Golf" study. The methodology used was geared to find, short-term, answers why shippers and consignees are not selecting transport by sea, from the point of view that answers and solutions had to be practical in order to influence the decision process of the shipper/consignee on the short term.

the decision whether or not to use intermodal transport[7]. Within this context, the issues of customs (not in many countries applied as seamless to the transport flow as in The Netherlands), and pilotage (is there a need for obligatory pilotage for liner vessel captains) form also part of the quality of service provided.

A fourth important aspect forms the question who the responsible party in the door-to-door transport is; each party involved in a part of the transport process is only responsible for his particular part of the transport process. One aspect of this responsibility issue is formed by the port terminals with respect to the 'control' of the cargo. When the cargo is underway, be it on the truck or on the vessel, there is a form of inactive control: the parties have been informed that the cargo is underway. However, at the terminal, only active control ensures the interested parties that the cargo is 'safe'. Another aspect of this responsibility issue are insurance rates, more often than not higher when a number of parties is responsible for the cargo in the door-to-door transport process. Finally, relatively more documentation is often required in the situation that multiple parties are responsible.

Fifth, another important element in the selection of the transport mode and transport company is the effect of habituation. In any circumstance, clients will be affected by this element. However, solutions can not be found on the short term. The shortsea sector has to develop the same kind of long-term relations with clients as the other transport modes.

Sixth, the 'problem' of transfer of cargo from one mode to another requires handling. Since most handling equipment is geared to deep-sea vessels, a relative high handling rate is charged to shortsea shipping. This can form an important bottleneck for the selection of shortsea shipping. However, the example of the Dutch container terminal operators in the ports, where the handling rates were differentiated according to the transport mode involved (deep-sea or inland water vessel) shows potential for the shortsea sector.

These problem areas can be considered as more general problem areas, independent of the transport route and markets.

Other elements, though some of them are already mentioned, such as total transport costs, total transport time, customs documentation (differing between land and sea transport modes), reliability, cargo safety, requirements of the client, and availability of transport services are more related to a specific trade route and, more importantly, related to the 'to be transported commodity'.

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[7]Report *Towards a really combined transport*, INRO-TNO/NEA, 1990 Delft

4   CONCEPT SOLUTIONS

4.1 INTRODUCTION

In **Section 3** the most important bottlenecks from a market perspective to grow intermodal shortsea services were presented. In summary these are:

* Lack of precise and comprehensive commercial market information;
* Shippers' and consignees' current perception of the maritime sector;
* The maritime sector's re-active policy;
* The decentralised responsibility for the transported cargo;
* High handling costs;
* Habituation effects; and
* Documentation.

In this section I will discuss each of these problem areas and propose concept solutions for a hypothetical introduction of a pilot project on the transport-route Spain/Portugal to and from The Netherlands/Belgium. This route is selected on the basis of the potential level of so-called 'transfer' cargo and on the basis of being a parallel route to the land-based routes. I will call this service "Via Optima". These concepts are presented for further investigation but also to be assessed and potentially to be implemented if such a pilot project would be regarded an efficient learning path for the further development of intermodal services by sea and increase the cohesion of economies in the European Union.

4.2 MAKING THE RIGHT START

This is, probably, the most important element of all actions to be taken in establishing "Via Optima".

In **Section 2** the conclusion was that there is a trend towards 'individualised' transport solutions. The other conclusion was that the recognition of logistics/transport as an important element in the positioning of a product has resulted in an ongoing trend of the introduction of more senior people than the traditional shipping managers. In the design of a successful intermodal transport service it will therefore be important to determine who among the transport providers is in the best position to package, price sell, and service the product for each targeted segment.

Detailed market research is therefore required - "Know Your Client". However, two remarks have to be made. First, the 'individualisation' of the client requirements will lead to higher costs for the transport provider to understand and offer

the client the right transport solution. Second, it appears that the transport providers are competing for the same clients.

Because of these remarks it is regarded that an international strategic alliance, or another form of co-operation, could be an option to deal with these matters in a commercially viable way. As such, the proposed corridor organisation - mentioned here - forms the backbone of pursuing an improved competitive position of the shortsea shipping sector.

Concept Solution I: Corridor Organisation

The proposed corridor organisation consist of sales personnel (account managers) only, with offices on both sides of the transport corridor "Via Optima", assuming responsibility for the total door-to-door transport process. It offers all transport modes (road, rail, sea and IWT). Importantly, it also provides terminal capacity on both sides of the corridor.

Each (existing) transport/terminal provider has an arrangement with the corridor organisation. Based on the market research a captive market is determined. A minimum level of transport and terminal capacity is reserved (all under the same name: Via Optima) for use by the corridor organisation. Transport and/or terminal capacity above the reserve capacity can either be hired from members of the 'corridor alliance' or from outside, depending on availability and price.
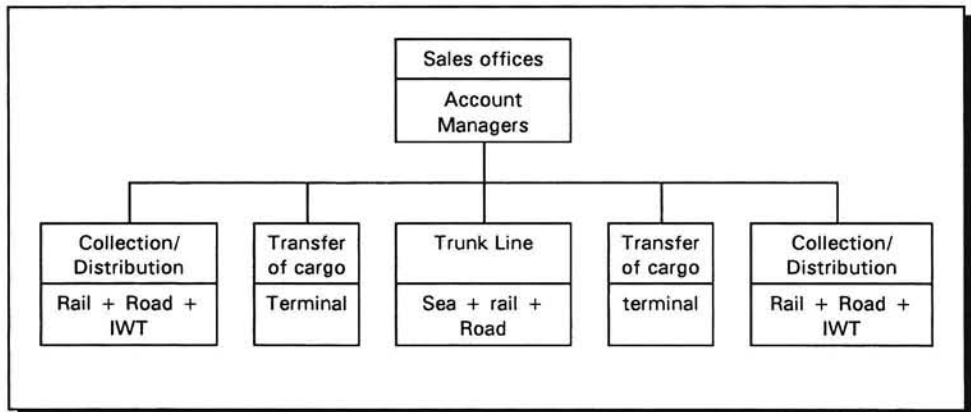
Figure 1: Via optima organigram

All actors in the transport link are connected to the sales office by EDI links. Each client has a connection to the system for tracking and tracing purposes, but no ability to change items in the system. Also service organisations, like customs on both ends, are connected.

A client's JIT procurement strategy requires the timely arrival of ordered components. In case the modal scheduling is inaccurate, alternative routings need to be available so as to ensure the arrival of the parts. The corridor concept creates in this context a win-win situation. Also, as each client tends to require different logistical concepts for its commodities, different transport solutions should be available. This concept provides these different transport solutions as well as the ability to offer 'confection' and 'tailor-made' transport.

Another positive element of the concept is the use of account managers (or client manager). As a result, the client has only one person to deal with in the total transport process. Furthermore, this account manager can offer the client all types and forms of transport solutions, creating the perception of a 'client dedicated', or even 'commodity dedicated' approach of the transport provider. He or she is also high educated and as such on par with the educational/cultural level of the client.

Furthermore, carrier selection determines the use of a mode. The amount of cargo is of influence on negotiation power (small is beautiful but big is powerful). Also other positives can be reached, e.g. priority use of transport capacity, less administrative requirements. However, it all leads to a pressure on the transport rates. Developing the corridor concept could well counteract this pressure by offering these clients value-added through the provision of multiple transport solutions.

Of course, multiple, organisational solutions within this corridor concept are possible, and the one presented only is of relevance as an example.

However, overall, this concept concentrates the responsibility, facilitates transport providers to acquaint their existing clients with shortsea shipping. Moreover, it also contributes positively to the 'habituation' issue, since examples of successfully using shortsea shipping can be found in-house (within the corridor organisation) and client's experiences can be used for promotional/marketing activities towards other clients, and last but not least, this corridor organisation has a pro-active character, and as such contributes to changing the perception of the maritime sector from a re-active sector towards a pro-active sector.

4.3 SUPPORTIVE CONCEPT SOLUTIONS

In order to increase the commercial viability of the corridor organisation concept, or in a broader perspective to improve the competitive position of intermodal maritime services, a number of supportive concept solutions are presented here based on the findings of section 2 and 3.

Concept Solution II: Geographical Transport Information System

Above it was mentioned that market information is essential for the development of a successful transport organisation.

In my opinion, those beneficiaries of the development of shortsea shipping, such as governments and ports (as they benefit from increased volumes shipped by the shortsea sector), should support shipowners, line operators and the corridor organisation with providing access to detailed information. It can be considered a necessity for these companies to apply a pro-active commercial policy and for example to plan fleet renewal. The development of a "Geographical Transport Information System" (derived from the commonly known GIS datasystems) could well provide the private operators/organisations with the required information.

Concept Solution III: Framework Issues

1. *"Bureau Shortsea Shipping"*

In any event, the perception of the shortsea sector can be improved. The message that the shortsea sector meets the transport (service) requirements has to be conveyed to the clients. Concentration of this type of efforts has proven to be a useful method[8]. A "Bureau Shortsea Shipping could play an active role in conveying the right messages, on the one hand to influence the governmental policies, and on the other hand to positively influence the perception of the shortsea shipping sector.

2. *Combined Terminals*

It has to be stated that one of the prime targets for decreasing the total transport cost is decreasing the handling costs at the terminal for shortsea shipping use. However, usually shortsea shipping uses the same terminal, and thus the same equipment, as the fourth generation container vessel. This result in high unit rates.

Already a high number of specialised container terminals for Inland Water Transport are established, in development or planned. These terminals, within seaports located almost adjacent to the deep-sea terminal, have a far lower financial break-even point due to smaller gantry cranes at a quay with a lower water level.

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[8]The Dutch government has openly requested the inland water transport sector to reach consensus on issues relevant to potential government support, thereby giving proof of the fact that the sector is viewed as one party. Combining forces therefore seems to beneficial to achieve results in favour of the sector.

Although a number of these, already built, terminals can not be used by shortsea shipping, it is recommended to include an analysis if a new terminal is planned whether a 'Combined IWT and Shortsea' terminal is feasible, rather than a dedicated IWT terminal.

Within this context, not only locations in seaports come to mind, though also terminals located more inland.

Furthermore, technical innovations, geared to lowering handling costs and/or geared to increase handling speed, are continuously in the limelight, and rightfully so.

3. *Policy Support*

The objective of the European Community is to increase the market share of environmentally friendly modes of transport vis-à-vis road transport.

However, from a economic transport point of view this objective should not be pursued by creating bottlenecks for the road transport but through supporting the other modes of transport to become more competitive.

Changing the perception of shortsea shipping as being coastal shipping into intermodal services by sea can therefore be considered not only a task of the sector itself, but also a task for the national governments and the European Commission in view of the adopted European transport policy. The establishment of the "Bureau Shortsea Shipping" could therefore be supported both by national governments and by the European Commission.

Aspects of influence on the price level and commercial viability of shortsea shipping are:

a. Port Licenses,

Shortsea operators often have to acquire port licenses, backed up by a financial guarantee. This situation has an adverse effect on their cash-flow situation, especially for a small, just starting, company. Port Authorities and/or Governments could, potentially, be helpful in this respect.

b. Port Duties,

Although port duty structures differ from port to port, it is still unusual to base port duties only on the cargo transferred in the port, but is more frequently based on vessel size. For developing a shortsea supportive policy it is felt that defining port duties on the basis of cargo transferred

in the port is more in line with the intention to develop cost structures based on the actual use of infrastructure and energy.

c. Other Port related Costs,

As mentioned in **Section 3**, pilots are often obligatory, though from a safety point of view not required if an experienced captain is in charge of the vessel. In view of this, special licenses should be given to those captains, without any costs.

d. Other Issues,

The customs have to perform their tasks. However, if possible, their task should be performed in a way that the transport process is seamless in character - don't stop the cargo. In this respect, it is recommended that customs become an integral part of the transport organisation. The proposed corridor organisation should therefore establish close ties to the customs on both sides of the corridor. Also, exchange of customs procedures know-how between the two involved customs organisations could well improve the total system.

Documentation is another issue, and should be standardised between modes of transport. Also related to this aspect is the issue of passing international waters when using the sea mode versus the situation using land modes. Within the context of the corridor organisation concept it is felt necessary that a fully standardised documentation system, independent of the transport mode (and if legally possible also independent of using land or sea modes) is developed and implemented.

4.4 CONCLUSION

In conclusion it can be said that, with the right support, there is a window of opportunities for the shortsea sector when they develop a clear intermodal product. The best commercial approach is considered to establish a corridor transport organisation, like "Via Optima", combining all possible modes of transport inclusive of the terminals.

Policy support is required both with respect to the short term, geared to organisational type of thresholds, and with respect to the longer term, geared to technical improvements of the cargo transfer, and the transport modes.

It is felt that the 'corridor concept' contributes to cohesion of the European economies as one of the elements would be the transfer of know-how in the corridor organisation.

WATER-BASED MULTIMODAL TERMINALS: AN ECLECTIC SITE EVALUATION MODEL

By L. Clinckers, E. Declercq, C. Peeters and A. Verbeke

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WATER-BASED MULTIMODAL TERMINALS: AN ECLECTIC SITE EVALUATION MODEL

ABSTRACT

Traditional solutions are modelled on optimal location or focus on mathematical modelling with a high degree of accuracy, resulting either in an optimal point or in a region, having an acceptable deviation from the optimal location. The dominant decision factors in these models are related to distances and transportation costs. But in the case of multimodal terminals for shortsea shipping or inland navigation, other factors may prevail in the decision-making process.

In this paper, an integrated decision model for strategic site selection will be discussed. The selection of optimal locations for inland navigation in Flanders will be used to demonstrate the practicality of the decision model.

1   INTRODUCTION

A general policy framework concerning the transport of goods and passengers has been made by the Commission in various publications during the last few years. These publications include, among others:

* COM(90) 218 final, June 27, 1990: *Green Paper on the Urban Environment*;
* COM(91) 452 final, November 7, 1991: *Single Market Communication Europe 2000*;
* COM(92) 46 final, February 20, 1992: *Green Paper on the Impact of Transport on the Environment*;
* COM(92) 231 final, Brussels June 11, 1992: *Guidelines for the development of a European Transport Network*;
* 1992: White Paper: *The Future Development of the Common Transport Policy. A global approach to the construction of a Community framework for sustainable mobility*;
* 1993: White Book: *Growth, Competitiveness, Employment: The Challenges and Ways forward into the 21st Century*;
* 1993: Trans European Networks: *Towards A Master Plan for the Road Network and Road Traffic*.

The development of *Trans-European-Networks* (TENs) which include the different modes of transport perform an important role in the implementation of the Commission's program.

The terms and principles of the TENs are expressed in the Treaty of Maastricht (Title XII and Article 129 b-d and Title XIV and Article 130 a-e) and the Presidency of the European Council in Edinburgh on 11/12 December 1992 (Conclusion, part C, Annex 3). In general, the main principles include:

* The increase of cohesion among Member States;
* The improvement of mobility;
* Facilitating trade.

As a first step, individual working groups were set up within DGVII (the Union's Directorate General for Transport of the European Commission) in order to develop Trans-European-Networks for the different modes, i.e., road haulage, trains, shortsea shipping, inland waterways or air transport.

The Commission also commissioned other working groups related to ports and the creation of networks for energy transmission and telecommunications. The Commission's objective was to co-ordinate the efforts of Member States in making the movement of goods and passengers throughout the Union more efficient .

Different networks for the transport of passengers and commodities should be integrated in a future phase into one single, multimodal transport network. The network should cover the entire European Union and link the different modes of transport.

A transport network covering the entire Union requires the equal treatment of all transport modes. Policy makers should also take into consideration all modern standards of business logistics. This overall strategy should be implemented by the individual Member States according to the principle of subsidiarity[1].

Policy concerns regarding the protection of the environment will lead to both a reduction of road haulage and by the promotion of environment friendly transport modes to absorb the expected increase of commercial transport in the union. Environmentally friendly modes of transport such as short sea shipping (SSS) and inland navigation (IN) have only recently been fully recognised as a useful alternative for commercial transport given a number of logistical con-straints related to time, efficiency and transportation costs.

The integration of SSS and IN in existing transportation chains is a very impor-tant condition for their further development. This integration is required to fully

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[1]The principle of subsidiarity was expressed in Article 3b of the Treaty of Maastricht. The Member States have the responsibility to identify the precise detail of their individual contribution and to propose projects (of interest to the European Union) which contribute to the objectives of the European Union.

exploit the potential of both modes as regards "just-in-time" (JIT) and "in-time" (IT) concepts.

However, this urgently needed integration requires more than the mere introduction of innovative ship designs or techniques for transhipment[2]. The location of the terminal for the transhipment of goods also plays a major role in the development of an integrated "water-based" transportation network that is competitive with road haulage[3].

The identification of optimal locations for the development of multimodal terminals requires a new approach to site selection. Conventional principles such as the minimisation of distances and/or transportation costs need to be replaced by a more eclectic approach whereby these determinants will be included as two determinants in a set.

In 1993, *Policy research Corporation N.V.* conducted a study on the optimal location(s) for multimodal terminals. This study was commissioned by the Flemish Community, Department of the Environment and Infrastructure, Administration for Water Infrastructure and Maritime Transport. The main purpose of the study was to provide information to public policy makers on the optimal location of multimodal terminals. It also aimed to develop an integrated decision model to evaluate these potential locations[4]. This paper discusses some results of the study and the foundations of an eclectic site selection model.

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[2]See e.g. Prof.Dr.ir. N. Wijnolst, ir. H.B. van der Hoeven, ir. C.J. Kleijwegt & ir. A. Sjöbris: In*novation in Short Sea Shipping: Self-loading and -unloading unitload Shipsystems, S-Curve Shifts in the Handling of Unitloads,* Delft University Press, Delft, The Netherlands 1993; See also several articles in Prof.Dr.ir. N. Wijnolst, Prof.Dr. C. Peeters & Drs. P. Liebman : E*uropean Shortsea Shipping: Proceedings from the First European Research Roundtable Conference on Shortsea Shipping,* 26-27 November 1992, Technical University Delft, The Netherlands, Lloyd's of London Press, London, 1993.

[3]The stimulation of Multimodal Inland Port Terminals was also advocated in an in depth study on the competitive position of SSS in Europe. See Policy Research Corporation N.V. An*alysis of the Competitive Position of Short Sea Shipping: Development of Policy Measures,* study co-financed by: Directorate-General for Transport (DGVII), Commission of the European Union and Department of the Environment and Infrastructure, Ministery of the Flemish Community, August 1993.

[4]Policy Research Corporation N.V. O*nderzoek naar de mogelijkheden voor het inplanten van multimodale terminals in het Vlaamse Gewest,* study in opdracht van het Vlaamse Gewest, Department Leefmilieu en Infrastructuur, Administratie Waterinfrastructuur en Zeewezen, May 1993. An English summary of this study is available: Fl*anders: the optimal location for multimodal inland navigation terminals,* summary of the study, commissioned by the Ministry of the Flemish Community, Department of the Environment and Infrastructure, Administration for Water Infrastructure and Maritime Transport, June 1993.

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2   AN ECLECTIC APPROACH TO STRATEGIC SITE SELECTION

The study on the optimal location for multimodal terminals for IN included three core elements:

* The *identification* of attractive areas for the establishment of multimodal terminals, through the use of a new, advanced software package;
* A *SWOT-analysis* (Strengths - Weaknesses - Opportunities - Threats) for each possible location, including information on both internal and external criteria;
* The design of a *manual for project evaluation*, which should be used by public policy makers whenever specific new projects need to be assessed (eclectic approach).

The assessment of various possible locations, suggested by the Department, was performed through the use of a number of criteria, both external and internal ones, see **Figure 1**. These parameters constituted the basis for respectively the OT and SW analysis of potential locations. The analysis of internal parameters resulted in an assessment of various possible areas in terms of their strengths and weaknesses in respect of the physical transportation of goods. The analysis of the external parameters led to insight regarding the opportunities and threats characterising specific sites and is thus of equal importance for site selection. It should be emphasised that the classification of criteria as "internal" or "external" in **Figure 1**, may sometimes be ambiguous. The main determinant for this classification was the answer to the question: "should terminal operators be able to influence the impact of this criterion on the viability of his terminal operations at the time when this criterion becomes relevant the decision process (i.e. either before or after the investment decision)?" The overall evaluation of each location required the integration of the different components mentioned above, and resulted in *decision profile charts* with a presentation of relevant data on all sites, in this case both the ones suggested by the Department and a number of alternative ones. The positioning of the different sites was performed using an integrated decision model.

This integrated approach consists of three steps, resulting in an overall assessment of every potential location. The first step is the *single parameter approach* whereby every location is ranked according to a single parameter. This provides the possibility to develop partial comparisons of different locations on the basis of single parameters considered crucial, such as "centrality" (see **Section 3**).

The second step is the *location approach* whereby every location is assessed according to the different parameters simultaneously. A detailed *profile chart* is developed at this stage for every potential location. In this stage, the performance of the location to every parameter is measured and ranked according to a scale, varying from + + (excellent) to -- (unacceptable). If a parameter has no

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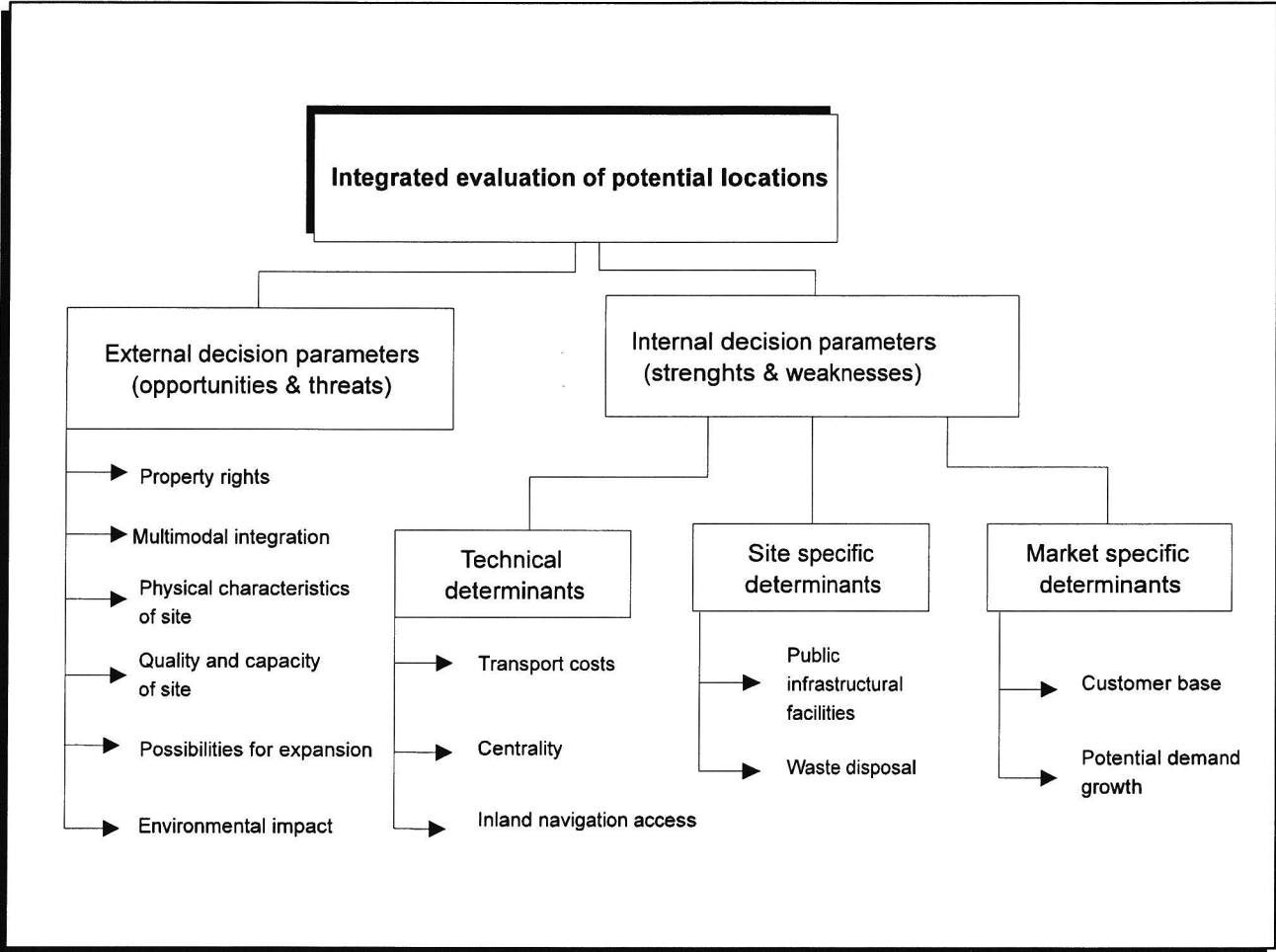
Figure 1: Criteria for the evaluation of locations for multimodal terminals in Flanders

relevance for a particular location, a neutral value (N) is given.

The third and final step is the *integrated approach*, whereby an overall evaluation is performed of each potential location. An adapted version of the SWOT-model (Strengths, Weaknesses, Opportunities and Treats) is used to visualize the results, see **Figure 2**.
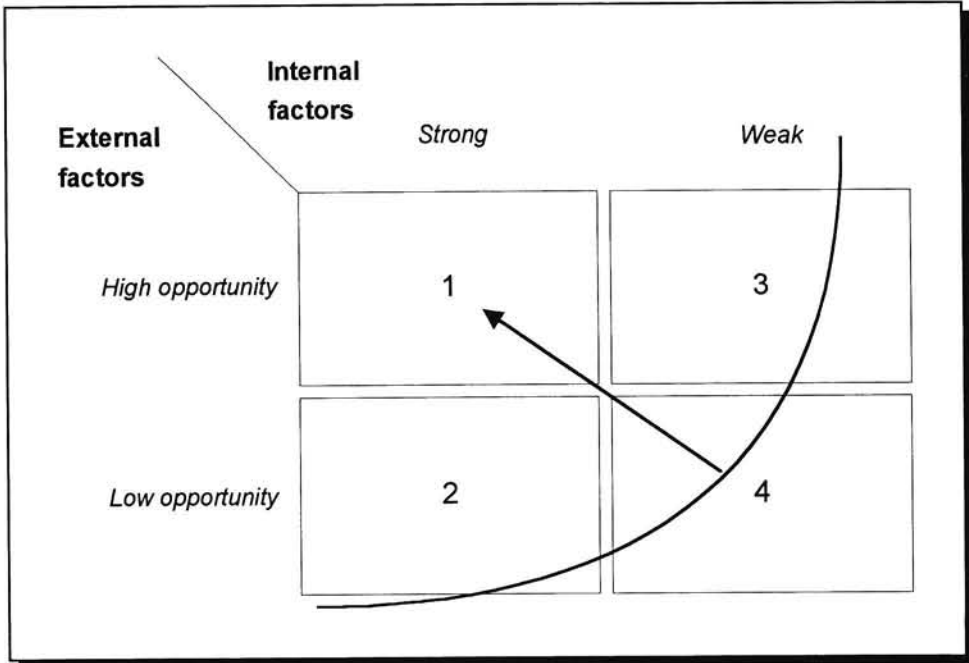
Figure 2: Integrated evaluation model

This integrated model includes a dual evaluation:

* **Horizontal evaluation (internal factors);**
  Internal parameters are decision factors that can be influenced directly by the terminal operator. These parameters are related to logistical and operational management. Thus, these parameters can be considered as internal and can therefore be positioned on the horizontal axis:
  - *strong*: positioning of locations that are characterised by a weighted overall score on internal parameters that is higher than the average for all locations;
  - weak: positioning of locations that are characterised by a weighted overall score on internal parameters that is lower than the average for all locations.

* **Vertical evaluation (external factors);**
  External parameters cannot be influenced by the terminal operator and are positioned on the vertical axis:
  - *High opportunity*: positioning of locations that are characterised by a weighted average overall score of external parameters that is higher than the average of all locations;
  - *Low opportunity*: positioning of locations that are characterised by a weighted average overall score of external parameters that is lower than the average of all locations.

The integrated approach results in the positioning of every potential location in the matrix. A practical selection can then be made amongst the locations which are situated in quadrant 1 because these locations received an above average score for both the internal and external parameters.

However, as will be demonstrated in **Section 4**, specific project-related criteria, such as its financial viability are obviously also important, therefore requiring a model for eclectic site evaluation that goes beyond the integrated model, presented in this section.

3 THE INTEGRATED ANALYSIS OF POTENTIAL LOCATIONS FOR IN TERMINALS IN FLANDERS

3.1 SINGLE PARAMETER APPROACH: CENTRALITY

The use of centrality indices is important from a geographic perspective. These indices provide information on the geographic positioning of each potential terminal vis-a-vis the markets to be served. The centrality of the different locations was assessed in three steps. In the first step, the centrality was calculated from a national perspective, using the performance of the Belgian main- and IN-ports in the numerator of the index. As a result, the Centrality Index (CI) of a potential location *i* can be expressed as:

$$CI_i = \sum_{j=1}^{n} \frac{P_j}{t_{ij}}$$

where: n = the number of destinations
P = the port performance of port j
t_{ij} = the transportation cost.

In the second step, the same procedure was followed, but using an international perspective, that included French, Dutch and German ports[5]. In the third step, a "weighted" CI was calculated according to both the international and national CIs.

The importance of the Antwerp and Ghent seaport areas as core distribution areas was confirmed by this analysis. All areas located in the proximity of one of these ports were characterised by a favorable index. The areas located near the 'Bovenschelde', the 'Albertkanaal' and the 'Zeekanaal' to Brussels also obtained positive scores, which demonstrated their potential for the location of a multimodal terminal.

However, the centrality indices for the various areas did not diverge very much, which indicated the central position of the Flemish region from a European perspective. It also confirmed that the Flemish region could perform a key function in an integrated European "water-based" system for the transport of goods.

Additional information as regards geographic locations can only be generated through the use of specialized mathematical models.

In the second stage of the single parameter analysis, a software package was used that included three sequential steps:

- *Step 1*: the optimal location is determined for the construction of (a) multimodal terminal(s) in the Flemish region
- *Step 2*: the boundaries are determined of a geographical area within which a sufficient approximation is obtained of the results characterizing the optimal location;
- *Step 3*: each actual location under consideration is assessed in terms of the results obtained in the first two steps.

The designation 'optimal location' implies a minimisation of transport costs associated with the movement of goods from this location to various destinations. In the model, the distance was taken into account between each alternative location and various selected destinations, both in Belgium and abroad. A (substantial) number of Belgian and foreign ports were selected as destinations, in function of their relevance for inland navigation and according to inland navigation statistics. The calculations also took into account the relative significance of the various destinations under consideration. The 'weight' of each destination was determined in accordance with the individual share of each port in the total traffic of all ports in a specific year.

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[5]Port performance, both from a national and an international perspective is measured by the quantities transported to every port, as published in the statistics of the National Institute for Statistics (NIS).

The basis of the simulation model, was the branch and bound technique with space partitioning[6]. The method included location-constraints, defined as *'regions of any shape defined by closed non-self-intersecting contour lines'*. The program calculated the optimal solution up to an accepted deviance (ε). However, in real-world applications, the identification of one single location is useless. Economic decision makers prefer the identification of a region of near-optimality was identified with a range of possible solutions up to an approxima-tion (δ). This was done in step 2 of the algorithm, where a region of near-op-timality was calculated, given a pre-defined acceptable deviation.

In the third and final step of the simulation model, each potential discrete loca-tion was evaluated according to its position relative to the region of near-op-timality. The analysis was twofold. First, its (linear) deviation from the optimal location was calculated and all locations were ranked accordingly. Second, the geographic position of every location was determined. This position could be outside the region of near-optimality, an outer - or inner approximation of the region of near optimality, the latter being the optimal result.

Mathematically, the algorithm could be defined as a finite set of points in the plane R^2. All points $a \in A$ are *destinations* interacting with a central facility, located at some unknown location $x \in R^2$ and to be determined. For every destination, the distance was calculated through the use of a norm Na as $d(x,a) = Na(x-a)$. As a result, a corresponding vector of distances could be identified for every point *x:*

$$D(x) \in \mathbb{R}_+^A \text{ ,i.e. } D(x) = (N_a(x-a))_{a \in A}.$$

This vector of distance was transformed into an objective value by way of a *globalizing function* $G : \mathbb{R}_+^A \rightarrow \mathbb{R}$, which is *continuous and boxwise op-timizable*. The latter is possible by determining a minimal and maximal value of G for every box through calculating the Upper and Lower bounds of the variables. If *l* and *u* are considered vectors in $\mathbb{R}_+^A$ so that $l_a <= u_a$ for any $a \in A$, then both

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[6]See F. Plastria: "GBSSS: The Generalized Big Square Small Square method for planar single facility location"; *European Journal of Operational Research*, 62 (1992), 163-174 and E. Declercq, "Software development for optimal single facility location on the plane", Master's Theses, Free University Brussels (Belgium), 1991-1992.

$$LG(l,u) = MIN \{ G(x) \mid x \in \mathbb{R}_+^A \text{ s.t. } l_a \leq x_a \leq u_a \}$$

$$UF(l,u) = MAX \{ G(x) \mid x \in \mathbb{R}_+^A \text{ s.t. } l_a \leq x_a \leq u_a \}$$

could be calculated. The feasible region is then the set of potential location sites for the central facility (to be located), denoted by S, and a subset of $\mathbb{R}^2$. The feasible region can be defined as $S = H \cap P$, where H is the initial region (taken large enough to contain all relevant parts) and P is the union of closed bounded polygonal regions P_i, which in turn can be defined as the points within a closed non-self-intersecting piecewise linear boundary curve. The P_i finally, represent the different regions of interest (geographical constraints). If no such region(s) exist, P equals the whole plane. The problem can therefore be reformulated as:

$$MIN_{x \in S} \quad G(D(x))$$

Several simulation exrcises were performed, both for national and international transportation. In addition, a number of areas were selected for further analysis in function of their significance for inland navigation. These areas are concentrated around the two main inland navigation routes in the Flemish region, namely the 'Albertkanaal' and the 'Schelde'.

The different simulations demonstrated that the main geographic areas with acceptable locations largely correspond with the access routes to the main Flemish ports, see **Figure 3**. These access channels include:

- The 'Zeekanaal Ghent-Terneuzen';
- The 'Schelde-Rijn'-link;
- The 'Albertkanaal' as an access channel to Antwerp;
- The link Ghent-Antwerp;
- The 'Zeekanaal Brussels-Rupel'.

The area that stretches from 'Niel-Willebroek' to 'Lier-Duffel' was identified during the computer-simulation as the most attractive location for a multimodal terminal in the Flemish region, see **Figure 4**.

The identified area includes the channel linked with the river 'Rupel' (accessible for vessels of 2000 tons) and the 'Nete'-channel. The latter is already accessible for vessels of 1350 tons. The present strategic plan of the Department ('*Programme for the Infrastructural improvement of the Flemish inland navigation system*') foresees that this channel will also be made accessible for vessels of 2000 tons.

A ranking of the four areas was performed to allow for an optimal sequence of establishing the various terminals. The area between the 'Nete'-channel and the
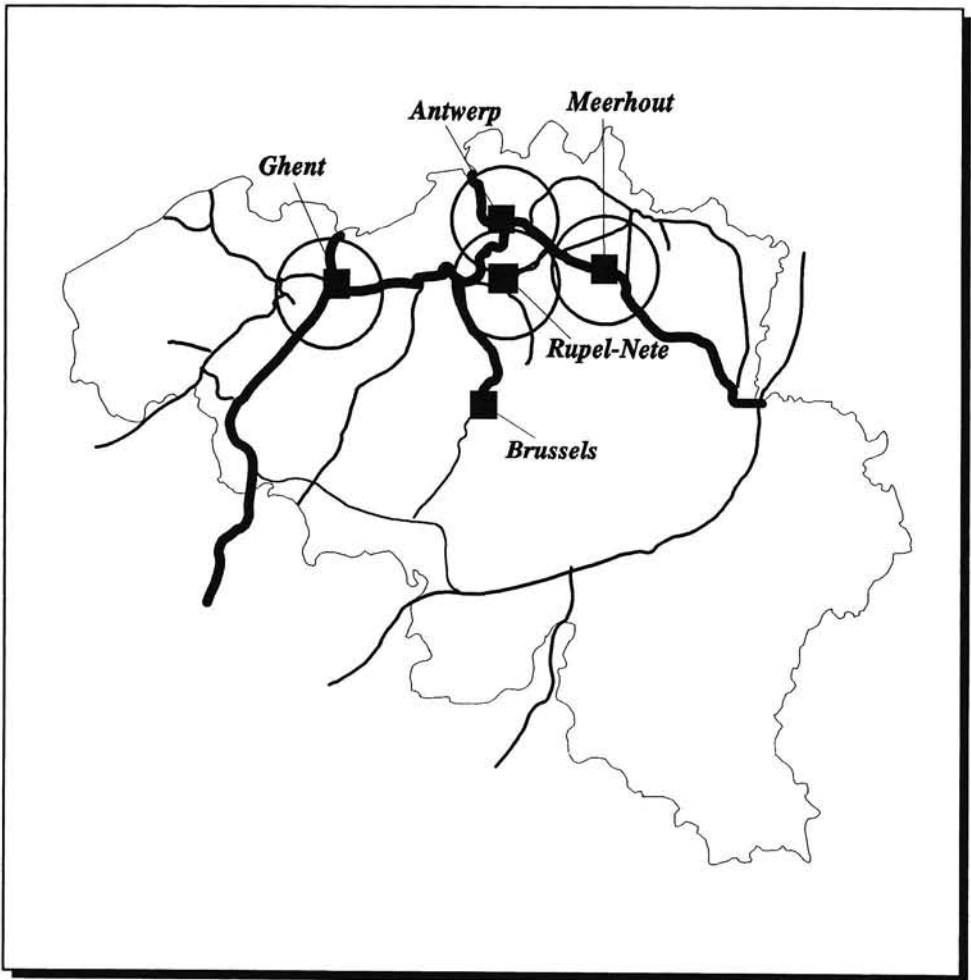
Figure 3: Identified regions of near-optimality

river 'Rupel' (and 'Zeekanaal' Brussels) unambiguously constituted the most favorable location, see **Figure 4**. The seaport area of Antwerp was ranked second. The area around 'Meerhout' and the seaport area of Ghent, which appeared to be equally attractive, were positioned as third in the ranking.

The area 'Rupel-Nete' is very attractive for establishing a multimodal terminal, from a logistics perspective. The port of Antwerp is centrally located for most inland navigation-traffic flows, whereas the port of Ghent can be viewed as a major nodal point between the north-south axis ('Bovenschelde') and the east-west axis ('Albertkanaal'). 'Meerhout' should also be considered as a potentially valuable logistical center, given that a number of multinational companies have
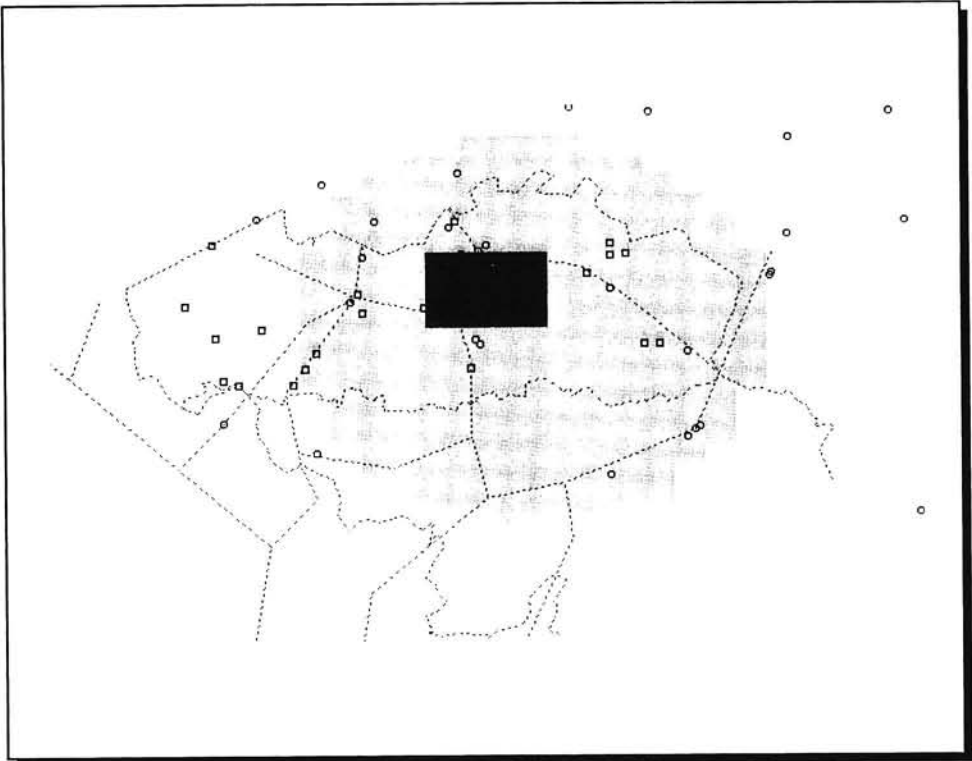
Figure 4: Computer-simulated identification of region of near-optimality

established their European distribution headquarters in this area.

The areas around Brussels, 'Genk' and the southern part of the 'Schelde' (where a terminal has already been established, namely 'Avelgem') constitute additional locations, where a terminal could be built. However, it should be recognised that these areas are somewhat peripheral and do not benefit from a central position to the same extent as the four most attractive areas. The establishment of multimodal terminals in these areas could be considered in terms of attracting specific traffic flows or pursuing regional policy goals.

3.2 SWOT- ANALYSIS

Each of the different areas discussed in the previous section contained various appropriate sites, which were assessed in terms of a wide variety of selection criteria. Profile charts were developed for each individual site, based upon in-depth information on these criteria. This information allowed to assess a variety of sites within a single area.

3.3 THE INTEGRATED ANALYSIS

The last stage of the empirical research consisted of integrating the results of the analysis on internal and external factors in a dynamic SWOT-matrix. Each potential site was positioned in the matrix, according to its 'performance' in both the strength-weakness part of the assessment (horizontal axis) and the high-low opportunities part (vertical axis), see **Figure 5**.

The sites positioned in the top left quadrant of the matrix should be considered as the most attractive ones for establishing a multimodal terminal. The most attractive locations are: 'Rupel-Nete' (24), the ports of Antwerp (8) and Ghent (23) and 'Meerhout II' (14), on the leftbank of the 'Albertkanaal'.

Public policy makers will be able to use these results, when formulating strategies for the integration of inland navigation in the overall transportation system and the selection of sites for multimodal terminals.

However, the analysis above does not taken into account project-specific elements, given the choice of a specific location. Therefore, an eclectic site evaluation model is needed to assist public policy makers in the assessment of potential projects.
The integrated evaluation of all potential locations as described above presents a ranking of potential sites according to a variety of internal and external elements. However, a project-specific appreciation of the different locations is required to come to a final decision on whether or not to develop a "water-based" multimodal terminal in a particular location. The eclectic site evaluation model which is presented next, could be a useful tool for public decision makers to rank and evaluate all additional project specific factors.

4 ECLECTIC SITE SELECTION MODEL

4.1 THE IMPACT OF PROJECT-SPECIFIC CRITERIA

Whether the final selection is made by public or private decision makers, the results of the integrated selection model should be complemented by an assessment of project-specific operational criteria which are considered relevant. These criteria may include:

* The financial viability of the project;
* The expected additional project-related traffic;
* The impact of this traffic on mobility (mobility impact study);
* The environmental impact;
* The direct and indirect return of public investments, if applicable.
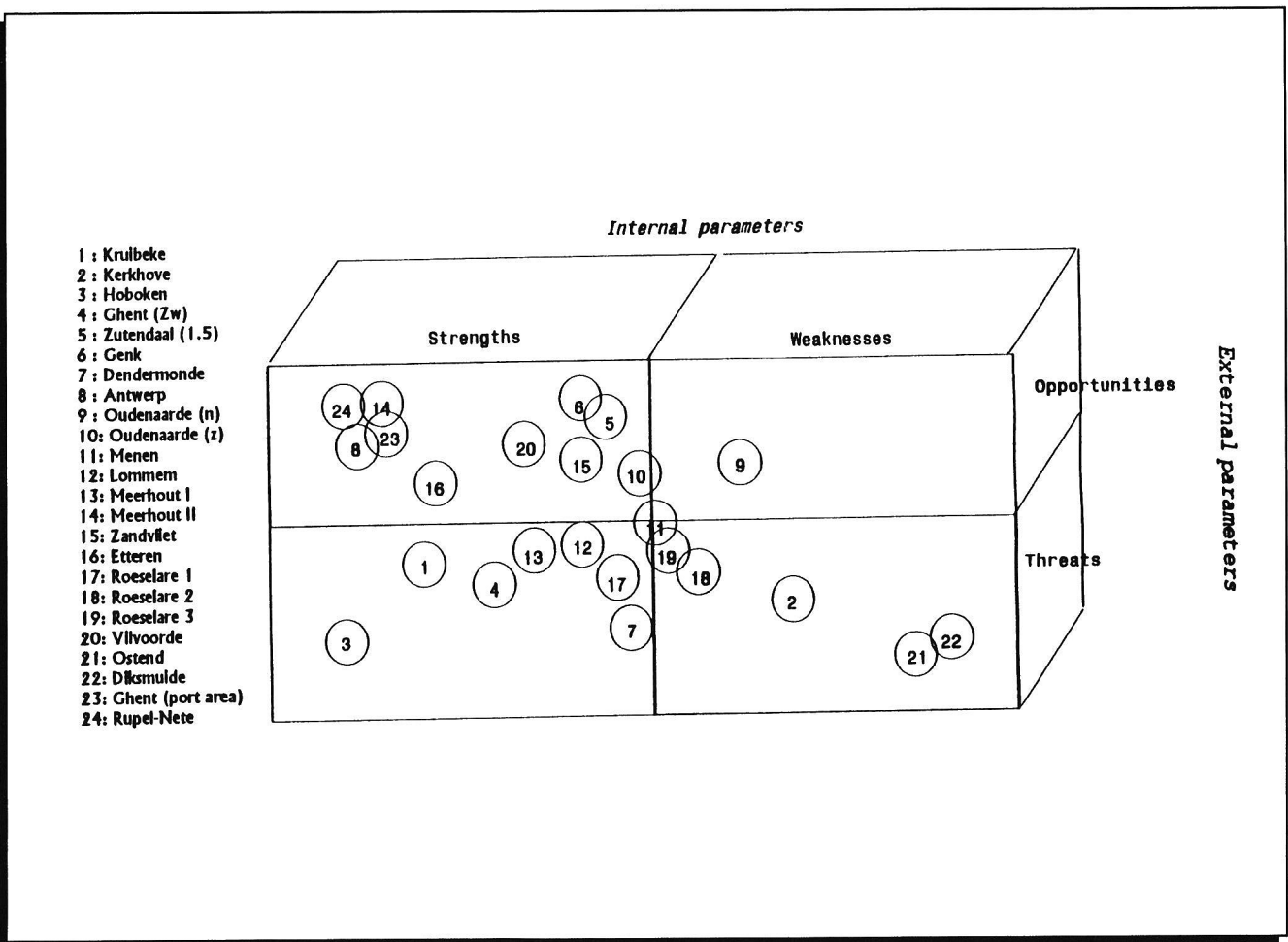
Figure 5: Integrated evaluation of potential locations

1 : Kruibeke
2 : Kerkhove
3 : Hoboken
4 : Ghent (Zw)
5 : Zutendaal (1.5)
6 : Genk
7 : Dendermonde
8 : Antwerp
9 : Oudenaarde (n)
10: Oudenaarde (z)
11: Menen
12: Lommem
13: Meerhout I
14: Meerhout II
15: Zandvliet
16: Etteren
17: Roeselare 1
18: Roeselare 2
19: Roeselare 3
20: Vilvoorde
21: Ostend
22: Diksmuide
23: Ghent (port area)
24: Rupel-Nete

Given the most attractive sites, identified in the integrated analysis (i.e. the solutions located in quadrant 1 of **Figure 5**), the eclectic site evaluation model compares the different projects according to a standardized information processing model. If a decision is to be made by public authorities, the required information as described above, should be provided by the investors demanding financial support. In this paper, the eclectic site evaluation model will be discussed from the perspective of public authorities. This is the case when public (financial support is demanded by private investors).

4.2 FINANCIAL EVALUATION

The financial viability of investments should be evaluated on the basis of the business plan used by investors for major projects. In accordance with conditional financial appraisal, methods as Net Present Value (NPV), Profitability Index (PI) and Internal Rate of Return (IRR) should be preferred over other methods such as the Pay Back Period[7].

The financial impact of projects, should be evaluated after eliminating all subsidies and the use of shadow prices should be avoided. If the financial results are not satisfactory under these stringent conditions, the economic viability of the project could be assessed taking into account additional benefits, such as:

* Time savings and increased efficiency of transhipment activities;
* The reduction of operational costs of transport as a consequence of modal shifts from the road towards IN or SSS;
* The creation of economies of scale.

4.3 TRAFFIC FORECASTS

A detailed traffic-analysis should include an assessment of:

* The generation of additional traffic (increase of volume);
* The creation of new, environment friendly traffic;
* Transfers from road haulage to environmental friendly traffic modes (modal shifts);
* A combination of the different options, mentioned above.

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[7]See J.S. Osteryoung: *Multiple Goals in the Capital Budgetting System;* in: J/L/ Cochrane & M. Zeleny: *Multiple Criteria Decisions Making,* University of South Carolina Press, Columbia, 1972; W. Behrens and P.M. hawranek: *Manual for the Preparation of Industrial Feasability Studies,* Unido Publication, Vienna, 1991; M.G. Wright *Using Discounted Cash Flow in Investment Appraisal,* McGraw-Hill, London, 1990, 3th edition.

As regards the development of multimodal terminals, the detailed analysis also requires:

*   The identification of the potential hinterland;
*   The evaluation of the market potential;
*   The identification of the modal split for the terminal;
*   The evaluation of the minimum required capacity as compared to the required degree of service, given an expected traffic potential for the terminal.

4.4 ENVIRONMENTAL IMPACT ASSESSMENT

Particular attention should be paid to the potential impact of projects on the environment. Given that one of the principal objectives of "water-based" multimodal terminals is to promote environment friendly transportation (and thus, a reduction of road haulage), it would be unacceptable to invest in projects with a (considerable) negative impact on the environment.

Such impact could , for example, an unacceptable increase of road traffic in densely populated areas or on heavily congested roads. Hence, it should always be taken into account that increased road traffic could be an unexpected spin-off due to the additional cargo flows, generated by the terminal.

4.5 CONTRIBUTION TO ECONOMIC DEVELOPMENT

The contribution of projects to economic development is one of the main determinant for public decision makers to allocate subsidies. Hence, the value of projects can be determined by considering following elements: the initial investment (subsidies), the creation of value added, the backflow to government and the creation of new employment. It is important to identify the number of times the value added which is casually linked to the project exceeds the initial public investment. This value added includes gross wages and salaries, social contributions by the employer, cash flows and taxes on the production[8]. The contribution of a project to economic development can be measured through the use of Economic Impact Studies (EIS).

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[8]This can also be expressed as: actual production MINUS intermediate imput EQUALS gross value added at market prices.

4.6 MOBILITY IMPACT STUDY

A criterion that is becoming increasingly important for public authorities is the impact of projects on mobility. This impact could be measured through so-called "Mobility Impact Studies" (MIS). As regards mobility, the objectives of private investors could diverge substantially from objectives of public decision makers. Private investors are mostly interested in mobility impact only to the extent that these have an impact on their own logistical chain. An important objective of public authorities, however, may be to improve overall mobility in the region. In other words, they are more interested in the so-called "socio-economic mobility" (SEM)[9].

The use of Mobility Impact Studies to evaluate the potential impact of projects on SEM includes following elements:

* The demand for operational capacity of the terminal;
* The possibility to use existing (infrastructural) capacity;
* An evaluation of congestion, created by the project and the consequences on travel time, both for commuters as commercial traffic;
* The identification of potential effects on public networks;
* The assessment of external costs.

4.7 STANDARDIZED INFORMATION PROCESSING

All information collected for every individual project requires finally a careful evaluation. This can be done using nXn-matrices to link the analytical results with the initial objectives. The increase of environment friendly traffic, related to the use of existing road infrastructure is e.g. one of the important matrices, see **Figure 6**. It is clear that projects which generate substantial environment friendly traffic and have only a limited (negative) impact on the existing infrastructure should be preferred over those with a high negative impact on the road infrastructure and only a limited increase of environment friendly traffic.

The results of the different matrix evaluations leads to insights as to the value of all project-related decision factors. All these values can be integrated it in a *project related profile chart*.

The method is similar for all matrices. The matrix, presented in **Figure 6** can be used to illustrate the different steps of the procedure. The use of information presented by the investor(s) such as traffic data and the assessment of possible

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[9]The concept of "Socio-Economic Mobility" was proposed by Policy Research Corporation N.V. in the manual for project evaluation, presented to the Department of Infrastructure and Environment of the Flemish Community in October 1993. The manual includes a detailed discussion of the concept of MIS and suggests how several important aspects could be assessed.

effects on mobility, allows public authorities to position the project in one of the nine quadrants. The translation of the project's performance in the 3x3 matrix into a score in the profile chart could be done as follows:

+ +   quadrant 1 and 2;
+   quadrant 4 and 7;
N   quadrant 5;
-     quadrant 8;
- -   quadrant 3, 6 and 9.

	Increase of IN traffic		
Impact on the use of existing road infrastructure	Substantial	acceptabl	small
positive	1	4	7
acceptabl	2	5	8
negative	3	6	9

Figure 6: Impact of project on environment

Although this positioning appears to have some face-validity, it should be emphasised that other classifications are also valid depending upon the situation.

This "translation" should be done for every parameter and the entire process repeated for every potential location. This approach will finally result in the creation of profile charts for every potential location.

The weighing of these various outcome for every individual project can be done in a final step, using multi-criteria analysis. Although sophisticated methods exist[10], a more user-friendly method could be applied, based on the results of the different profile charts from which the position of every project can be calculated and the project positioned in a final (eclectic) decision matrix ("matrix-positioning").

The profile chart (**Figure 7**) consists of different sections, each of which is divided into sub-sections. Once all information is translated in several nXn matrices, these matrices should be translated into scores for each criterion in the profile chart, by giving one of the five possible scores (+ + to --) a '1', the other four options consequently being '0'. This is the parameter evaluation (horizontal oriented evaluation).

In the next step, all values are considered for each of the five colons in the profile chart. The final value at the bottom is the sum of the individual values in that colon, each of which thus equals either '1' or '0'. In the extreme case, that bottom-value could be 19 if all 1-scores are in the same colon, or 0 if none of the scores is in that particular colon.
The final step in the whole process is the "matrix-positioning", where every project is positioned in a 2x2-matrix, based upon its performance both for the private investor and the public authority[11], see **Figure 8**. At this stage, the positioning of the projects is no longer qualitative, but a metric scale is introduced on the vertical and horizontal axes of the matrix which enables a "diagonal" appreciation of the different projects.

This "diagonal" appreciation is from bottom-right to top-left and the closer the project approaches the top-left corner, the better the project scores on the two axes. In other words, the projects are ranked in order of descending preference, starting at the top-left of the matrix.

The final evaluation of the project is performed at two levels, the project-specific level of the private business operator and the macro-oriented perspective of the public authority. Given that the assessment in the profile charts are characterised by values that are either positive or negative (exclude the neutral value which has no influence on this particular problem), making a sum of the positive values is the opposite of making a sum of the negative values. Thus the weight of " + + " should be equal to the weight of "--".

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[10]See e.g. Thomas L. Saaty: *Multicriteria Decision Making: the Analytical Hierarchy Process*, University of Pittsburgh Press, Pittsburgh, 1990 and Thomas L. Saaty: *Decision Making for Leaders: The Analytical Hierarchy process for Decisions in a Complex World*, University of Pittsburgh Press, Pittsburgh, 1990.

[11]It should be noted that the relation private - public authority could be replaced by an other combination, depending the situation and the criteria that were used in the profile charts.

European Shortsea Shipping

Figure 7: Profile chart of the investment

CRITERIA	++	+	N	-	--
1/ OBJECTIVES					
Reducing road-congestion	0	1	0	0	0
Creation of new IN traffic	0	0	1	0	0
Contribution to an increased integration of IN	0	0	1	0	0
2/ ECONOMIC VIABILITY					
Method of analysis	1	0	0	0	0
Financial revenues	0	0	1	0	0
(Socio-)economic revenues	0	0	0	1	0
Debt-ratio after investment	1	0	0	0	0
3/ POTENTIAL LOCATIONS					
Method of analysis	0	0	1	0	0
Quality of the information	0	0	0	1	0
Degree of compliance with public polcy	0	0	0	0	1
4/ TRAFFIC ANALYSIS					
Consistency of the information	0	0	0	1	0
Modal split (share if IN)	0	0	1	0	0
Impact on existing infrastructure	0	0	0	1	0
Quality/viability of the IN traffic	0	0	0	1	0
5/ IMPACT ON ENVIRONMENT AND MOBILITY					
Results of the Environmental Impact Study	0	0	1	0	0
Impact on general mobility	0	0	0	0	1
6/ MACRO-ECONOMIC ANALYSIS					
Creation of jobs	0	0	0	0	1
Expected purchases from supplying industries	0	0	1	0	0
Growth Pole effects of the terminal	0	1	0	0	0
SUM	2	2	7	5	3

The criteria in this table have only been included for purposes of illustration and do not necessary reflect the actual set of criteria used in a specific evaluation.

Figure 8: Eclectic site evaluation matrix

The same should be applied to the opposite values "+" and "-". Given that a neutral value (N) is obtained in case the criterion is not really relevant to a particular project, it is preferable that the weight of this value remains limited in the overall appreciation.

The sum of the contributed weighs should equal 1.

A possible weighing of the values of a hypothetical profile chart could be:

```
+ +   0.35;
+     0.13;
N     0.04;
-     0.13;
- -   0.35;
```

The colon-value is then:

$$V_c = W_c \sum_{i=1}^{n} w_i x_i$$

where:
- W_c = the weight of the colon
- n = the number of criteria, included in the profile charts
- x_i = the value of criterion i
- w_i = t he weight of criterion i
- V_c = the total value of the colon

under the constraints $x_i = 0,1$ and $c \in [1,..., 5]$.

The total value of the project is then:

$$\sum_{i=1}^{3} V_{ci} - \sum_{i=4}^{5} V_{ci}$$

Hence, the neutral value is put on the positive side of the equation. However, an alternative approach could be to shift this neutral value to the negative side, thus emphasizing the requirement that the project should have positive results. A third alternative could be to give an O-weight to the neutral value, hence, eliminating the colon in the final evaluation.

The approach described above, can be used for both a public and a private evaluation. However, differences in appreciation can be made explicit via different weights, given to the various criteria included in the project-profile chart. Here again, the sum of all weights should be equal to 1.

Private investors may pay more attention to logistical factors whereas public authorities may emphasise e.g. the effects on the socio-economic mobility or the environment. In any case, the approach leads to an eclectic site evaluation matrix where the individual projects are ranked according to their overall scores, both from a public and a private perspective.

5 CONCLUSIONS

If the process described above is repeated for all potential locations, they can all be positioned in **Figure 8**. It then becomes possible to re-evaluate specific projects in function of changes in specific parameters without having to repeat all evaluations. For example, if private investors want to reduce any potential opposition of public authorities to a particular project, they may choose to alter a number of project-specific characteristics.

However, this eclectic evaluation also gives public decision makers the possibility to make a balanced judgment regarding a particular project. If a projects obtains a "negative" score from a public point of view, but a high "positive" score from the point of view of the private investor, the authorities could still grant permission for the project conditional upon, e.g. improved environmental protection or less road haulage.

Finally, the use of the step-by-step approach, whereby every analysis leads to a particular result and the final result is *one single profile chart*, facilitates simulation-analysis with weights given to all criteria. By changing particular weights in the profile chart, elements in the eclectic evaluation can be emphasised.

GROWTH PROSPECTS OF HIGH-SPEED CAR-FERRIES UTILIZATION ON EUROPEAN SHORT-SEA ROUTES

By J.P. Dobler

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GROWTH PROSPECTS OF HIGH-SPEED CAR-FERRIES UTILIZATION ON EUROPEAN SHORT-SEA ROUTES

INTRODUCTION

The conventional type of large open-sea passenger/car-ferry was developed during the fifties on the West-European short-sea routes most of which previously were served by many passenger "mail boats" and some train-ferries connecting the British and Scandinavian railway networks with the continental ones. Of course, this development was primarily answering the seasonal requirement of a fast- growing number of tourists wanting to bring their cars for their holidays abroad.

However, from the late fifties onwards, the explosion of road haulage in Europe added a brisk, and more regular demand for crossings by lorries and trailers, thus providing the large car-ferries with a year-long employment. Consequently, from being mainly complementary to rail transportation, the ferry services became, more and more, an integrate part of the road one, despite the fact that most terminals are benefiting from a direct rail link and that an important number of "walking" passengers still are using such rail/sea/rail connections.

In southern Europe, apart the cases of Messina Straits and Bosphorus, the dedication of the passengers routes to the links between railways networks has never been as obvious than in North-west Europe as such networks were not much developed in the big Mediterranean islands nor in North Africa. Also, the passengers sea-routes generally being longer than in the Channel or the Baltic, they occasion a greater proportion of overnight crossings and entail the provision of berths and cabins in the ships plying them.

Therefore, the passenger ships used before and after the second world war on the longest of these open sea Mediterranean routes- or some of the North Sea ones- were, as far as type of accommodations and service speed were concerned, more akin the bigger liners plying the oceans than of the typical cross Channel mail boats.

The generalising of the large night car-ferry type on these Mediterranean routes came later than in the North-West European waters and was achieved during the sixties and early seventies. The growth of the road haulage was also a bit delayed in south Europe as compared with the north but was very fast and resulted in the recent appearance on certain routes, such as the Corsican ones,

of a "combi" type of ro/ro cargo vessel with berths accommodations primarily for drivers but extended to cater for other night passengers. This trend was observed earlier in the Scandinavian peninsula and British Isles/ Continent trade.

The leading of the north European short-sea passengers routes over the south ones can also be observed in the field of the development of high-speed open sea car-ferries, the subject matter of the present lecture. In this field, we need at first to define the above concept: by "high-speed" we will consider thirty knots and over, by "open sea" we will includes crossings in the 50 to 200 miles range, and, of course, a "car-ferry" is a passenger vessel having an important garage area, mainly designed for private cars, with at least one direct roll-on/roll-off access.

In the first part of the present lecture, recent developments in the whole field of high-speed vessels will be presented and, in the second, safety and operational constraints, peculiar to fast-ferries, will be reviewed. Finally, the rational and economics of the use of high-speed car-ferries on European short- but open- sea routes shall be discussed in the third part.

1 RECENT DEVELOPMENT IN THE FIELD OF HIGH-SPEED CRAFT (HSC)

1.1 STATE OF THE ART IN THE VARIOUS CATEGORIES OF HSC

1.1.1 Some preliminary remarks on HSC concept.

The feeling of "high speed" presents an evolutionary and relative character: its perception has evolved in the course of time since the Marathon runner in 490 BC; also it varies according the specific drag encountered by a mobile on the land, on the sea or on the air. When a supersonic plane is required to move at more than 1,000 Km/h to be so qualified, a train exceeding 250 Km/h is a high-speed one. For a ship the requirement appears again five time less severe as the usual limit, set at 30 knots, correspond to 55 Km/h.

Indeed, water is the element in which the drag is the strongest for a vehicle, all the more when its surface become choppy under the influence of the wind. The immersed hull drag is the main constraint to take into consideration in estimating the requested power to impel a ship at a relatively high speed in calm sea conditions; yet the brake effect of the waves has also a great influence on the actual service performances. This last remark has its importance within the framework of our subject matter as it explains why a fast ferry encounters more difficulties to reach and maintain an high speed in the open-sea conditions than in rivers, protected estuaries, fjords and coastal waters.

Therefore, the sea/atmosphere interface offers the less favourable environment for reaching high speeds and one may wonder why HSC are developed when it is obvious that, in this element, they would never compete seriously with the air plane. in this respect, it is interesting to recall the international race for high speed at sea, started a century ago, for passenger liners and warships. It shows that the HSC concept has a long history and some bright past achievements.

Before the second world war, this race has resulted, for passenger liners on the north Atlantic run, in "Blue ribbon" records exceeding 30 knots for the French "NORMANDIE" and the British "QUEEN MARY" and "QUEEN ELIZABETH". At the same period, the French escort vessel "LE TERRIBLE" sustained a trial speed of 45 knots during several hours. After the war, despite the building of the dual purpose "UNITED STATES", this race was not started anew since the economical or military interest of high speed over the Oceans, were dwarfed by the advent of the jet plane.

However, in the intercontinental mass cargo carrying activities, the sea transportation remained practically unchallenged and the relative advantage of speed was again taken into consideration during the sixties with the advent of the container cargo vessel. By the end of this decade, the US ship owning company SEALAND developed a class of container ships, fitted with gas turbines as prime mover and reaching a service speed of 30 knots. Here again, this development was stopped, this time by an economical event, the first oil shock, the direct impact of which on bunker prices rendered unprofitable the operation of such highly powered units.

Also in the sixties, within the naval framework, the speed tactical advantage was again considered for very fast patrol craft, equipped with "sea to sea" or "sea to land" missiles and used to launch a quick raid against an enemy fleet or along a hostile coast. Indeed, the same advantage remains true for nuclear submarines, whilst in the surface air-sea theatre of operation the turn of the balance again appears with the plane.

In the merchant fleet field, despite the severe competition of the plane for the passenger transportation at the turn of the seventies, it become obvious that, in front of the continuous growth of mass tourism, the passenger ship in the guise of the large car-ferry was irreplaceable for short and medium distance sea crossings, in North-West and South Europe, all the more because more and more tourists wanted to bring their car with them. However, with the bunker prices becoming very expensive during most of the decade, the speed of these large car ferries was seldom exceeding 22/23 knots even on the longest routes.

Once again the economic conditions have modified the technological scene and, during the eighties, the oil barrel price, computed in constant US $, has returned to the level experienced before the first oil shock and even below. Therefore, high speed looks again as a profitable proposition. The recent and current technical developments in the fields of HSC have to be appreciated within the changing framework of the economic and strategic constraints prevailing upon the world maritime and naval activities.

1.1.2 The various HSC categories.

1.1.2.1 A long an complicated history

The "non conventional" HSC designs currently in operation or under development, derives from researches undertaken since a long time at the crossing of aeronautic and hydrodynamic sciences and technologies. The "hydrogliders", developed by French and Italian engineers, between the two world wars can be considered as a first step in this R&D efforts. The later developments took place after the war and resulted of further cross fertilisation between air and naval

architecture and propulsion. The enclosed **Figure 1** presents a (simplified but nevertheless intricate) technological lineage tree of the recent and current HSC designs. We will not follows in detail this multifarious line network of evolution but it is worth to recall before this audience what, at present, are the main categories of HSC in operation from which are, or can be, derived fast car-ferries.

1.1.2.2 Dynamically supported HSC: the AIR-CUSHION VEHICLE and the HYDROFOIL

The prototypes of these two first categories of operational HSC have been developed during the fifties and units of the two types have been in operation from the sixties until now. The two concepts are very different but permit very high speed up to 50 knots. Both have borrowed to the aeronautics their dynamic lifting appliances: engine for the Air-cushion vehicle and wing for the hydrofoil. The aircraft influence is also felt in the light alloy material employed for the construction and in the design of the passengers accommodations and crew cockpit.

The AIR-CUSHION VEHICLE, very often referred to as "HOVERCRAFT", according its first and most known British design trade mark, is sailing on a air cushion contained by flexible rubber skirts and fitted with aircraft type gas turbo-prop engines both for propulsion and lift. It presents an amphibious character, flying just over the sea surface, but taking off and landing on concrete aprons specially built on the beaches. therefore the AIR-CUSHION VEHICLE is a kind of low flying aircraft that avoids the harbour time consuming constraints.

The HYDROFOIL directly borrows to the sea-plane its hull form and its wings but these ones are placed below the craft and permit to lift and stabilise it during its progress on the sea. The drag of the craft is very much reduced by the lifting of the hull but the immersed part of the wings are applying a braking effect. The propulsion is of a marine type, and comprises generally two variable pitch propellers coupled with high-speed diesel engines. Contrarily to the AIR-CUSHION VEHICLE, the HYDROFOIL remains a ship and as such has to deal with harbour constraints that can be troublesome due to the great draft of such a craft when it is stopped. The first generation HYDROFOILS, built in Italy and USSR, were fitted with fixed wings crossing the surface. A more recent US design offers fully immersed wings the incidence of which is permanently and automatically adjusted by a remote control system in order to provide the craft with the requested dynamic stability..

TORPEDO BOAT

OUTRIGGER CANOE

AEROPLANE

Hull form

floats

engine, propeller & wings

1930

AIR SHIP

LARGE SEA PLANE

light diesel engine

hull form

engine/propeller

floats

wings

ESCORT VESSEL

HYDROGLIDER

1940

TORPEDO LAUNCH

JET PLANE

gas turbine

1950

dynamicaly supported craft

TURBO PROP. AIRCRAFT

turbo prop./engine

AIR CUSHION VEHICULE

HYDROFOIL with cross surface wings

MISSILE LAUNCHING PATROL BOAT

1960

FAST CONTAINER VESSEL

Displacement MULTIHULL

1970

Displacement MONOHULL

HYDROFOIL with immerged wings

CALM WATER CAT

FRIGATE

S.E.S.

SEMI SUB. PLATFORM

SEMI SUPPORT MONOHULL

1980

Sailing TRIMARAN

SWATH

Side stepped MONOHULL

Wave-piercing CATAMARAN

FOILCAT

air film lubrified MONOHULL

MONOSTAB

HELICOPTER CARRIER S.E.S.

1990

QUADRIMARAN

FAST FERRY S.E.S.

Semi supported MONOHULL FERRY

semi submersible TRIMARAN

Displacement MONOHULL FERRY with aft side outrigger floats

SWATH FAST FERRY

Displacement MONOHULL FERRY with special waterline design

SEMI SWATH FAST FERRY

2000

Figure 1: HSC technical lineage tree

1.1.2.3   Multi-hulls displacement HSC

This category of HSC was pioneered in Norway during the early seventies. Originally, twin-hulls catamarans were developed and this type is still by far the more frequent despite the fact that treble-hulls trimarans have also been developed but mainly as race sailing boats. The hulls of these HSC remain immersed in calm sea conditions; thus they are full displacement vessels. Yet, the distribution of this displacement between two or more hulls enables the naval architect to optimise the design of their respective waterplane areas in order to minimise their drag, whilst offering a wide platform for the arrangement of the accommodations in the ship's superstructure.

A classical catamaran design offers a efficient base for HSC operating in protected waters but its seakeeping ability appears questionable in choppy ones. This drawback is the reason for which was developed in Australia, during the eighties, several types of large "wave-piercing" catamaran, intended to be used in open-sea conditions. The peculiarity of such a design consists in the central Vee-bow placed between the two hulls well forwards and slightly over the water line. When the catamaran is encountering a wave at sea, this device penetrates the water transforming the craft into a trimaran for a while, thus bettering its sea keeping ability at least in a well formed regularly spaced wave system.

Another design derived from the twin-hulls concept is the SWATH (Small Waterplane Area Twin Hulls) of which the seekeeping ability is very much enhanced by immersed floats connected by pillars to the craft main structure. However, to realise HSC according this idea presents some difficulty: the power required to compensate for the pillars drag is very big and the horizontal stability of the immersed floats only can be obtained by fitting on the floats a variable fins system, the operation of which is permanently controlled by a computer program. Another disadvantage of the SWATH is its important draft, a constraint for shallow water and port operations.

1.1.2.4   Surface Effect Ships and other hybrid HSC

As the advantages and disadvantages of the various categories of non-conventional HSC are different, it was logical to try to combine the firsts and avoid the seconds in developing some hybrid designs. The Surface Effect Ship (SES) appears to-day as the most popular hybrid HSC.

A SES is a dynamic supported HSC that results of a cross fertilisation between the Air-Cushion Vehicle and the Catamaran. It sails on an air cushion contained on both sides by twin-hulls and, at fore and aft ends, by flexible rubber skirts. Its seakeeping and route keeping abilities are better than the one of both its "parents", whilst at a given power and for a same commercial load, its maxi-

mum speed capability on a calm sea stays in between : less good than the Air-Cushion vehicle but better than the Catamaran.

The "FOILCAT", a brand name of the Norwegian shipyard WESTAMARIN, offers an other combination, this time between a Catamaran and an Hydrofoil. Each of the two hulls is fitted with immersed wings.

1.1.2.5   A newcomer the MONOHULL HSC

After several decades of research devoted to non-conventional HSC, we are witnessing, since some years, a comeback of the more conventional solution of a displacement monohull vessel. A single hull presents many advantages for the naval architect: a satisfactory route and seakeeping abilities and enough internal space for easily fitting up on board the propulsive and generating sets with all their auxiliaries. It is a lot more easy to arrange two high power propulsive sets, each comprising a gas turbine and a waterjet in a monohull than in a Catamaran or a SES, non to mention the SWATH. Three such sets can also be considered, a proposal impossible within a twin hull arrangement and requiring a Trimaran for a multi-hull solution.

During the seventies, when the bunkers were very expensive, many efforts were carried out to enhance energy savings by optimising the hull lines and the propeller design in order to reduce the drag of a conventional ship. At a time of low oil prices, the results of these efforts permit to better the propulsive efficiency of high power machinery, thus minimising the cost of high speed for monohull and reducing the advantage of the non-conventional solutions. Thus, since the mid-eighties, the economics of the ratio power/speed have become favourable for the monohull HSC designs.

Of course cross fertilisation between monohull and non conventional designs have also taken place. Several recent Italian and Spanish monohull HSC designs derive from OFFSHORE racing motor boats and their Vee-shaped hulls are semi-dynamically supported at full speed with the bow completely out of the water. A French shipyard proposes a very slender full displacement hull, the stability of which is obtained by mean of two aft side outrigger fins, each supporting a float.

1.2   COMPARATIVE MERITS OF THE VARIOUS HSC CATEGORIES

1.2.1   Main fields of HSC utilization

The development of the various types of HSC was undertaken to answer different requirements of prospective military and civilian users. Fast patrol boats

have the favour of many navies but the sophistication of the non conventional HSC brings their reliability into question. Therefore, neither Air-Cushion Vehicle-despite their amphibious capability- nor the hydrofoils have encountered much success in their respective military careers. S.E.S are looking more promising for mine hunting and off-shore patrol, specially when they are long enough to obtain an improved sea-keeping ability, allowing the carriage and the operation of a light helicopter. For instance, such is the case for the French prototype AGNES 200.

Finally, it is in the passenger transportation field that HSC have found their main uses since the sixties. Most of the existing units are small fast ferries, used for relatively short-trips in protected waters such as the Norwegian fjords, the Russian rivers, some parts of the Greek archipelago or the Pearl River estuary/Macao/Hong-Kong area. These units generally are not exceeding 40 meters and carry up to 250/300 passengers in aircraft-type seats and cabins. Cars are not carried by these small HSC of the Air-cushion, hydrofoil, catamaran, and SES categories.

Fast Passenger and car-ferries have appeared in the late seventies for strait crossing. The biggest (length 55/60 m) Air-cushion vehicles, of the British HOVERCRAFT or the French NAVIPLANE types, operating on the Dover/Calais route were able to carry more than 400 passengers and 50 to 60 cars. In calm sea conditions, their speed reaches the 50/60 knots range but, when the sea is turning rough, they have to slow and the crossing becomes quite uncomfortable.

Recently, these Air-cushion vehicles have been progressively replaced by the Australian designed SEACAT "Wave-piercing" Catamarans on the strait of Dover. The current SEACAT type is longer- 74 m- but slower- 35 knots than the big HOVERCRAFT. Its passenger capacity is lower-350 seats- but its car capacity - 80- is bigger; therefore, its Passengers/car ratio at 4.38 is better, for a car-ferry, than the one of its predecessor at 6.67.

The seakeeping ability of a wave-piercing Catamaran, is certainly better than the one of an Air-cushion vehicle but on a choppy sea the ride is far from being comfortable. It appears that these fast car-ferries composes a first generation the use of which is somewhat restricted to short crossings, such as the Dover strait, during which the exposure to possibly bad open sea condition is limited to a time short enough to limit the sea-sickness phenomenon to a limited number of passengers.

Big HSC catamarans fitted with Motion Dampening system (MDS) such as the ones ordered by the Swedish owner STENA in Finland or the JUMBO CAT proposed by the Norwegian shipbuilding group KVAERNER, or large SES present-ly at the design stage in Netherlands and Italy, may provide an answer for the longer open sea routes that are the next step forwards in the development of fast car-ferries utilisation. Yet, the monohull appears as a very strong contender

since the entry in service in the summer 1993, on the route linking Italian main-land and Sardinia, of the "GUIZZO", prototype of the AQUASTRADA brand name HSC designed by the Italian RODRIQUEZ shipyard, a most experienced builder of Hydrofoils.

1.2.2 Pros and cons of the major HSC categories for the design of fast open-sea car-ferries

The subject of the present Round Table being short-sea shipping, this lecture shall focus on this last generation of fast car ferries able to operate, if possible, on a year round basis, along open-sea routes with a length comprised in the 50/200 nautical miles range. This range covers most of the European passengers routes served by large classic car-ferries, when the short crossings over the various straits is excluded.

At present, most of the relevant HSC designs are at the project or prototype trial stage; accordingly, a comparison cannot be carried out on actual experiences and measurements but on empirical approach based upon the information gained during the long years of development of these designs on the performance of much smaller units. Such exercise may look over ambitious and its results have to be considered as preliminary ones.

Despite these reservations, it was considered worth to present such a tentative comparison the scope of which is limited to the HSC categories, already employed or possibly to be employed to carry passengers and cars on the open-sea. The comparative criteria are the following ones:

* *Speed*: capability to reach, in calm sea conditions, a service speed of 40 knots or more;

* *Energy saving*: relative importance of the corresponding power require-ment;

* *Minimisation of slowing-down*: expected reduction of the service speed when encountering rough weather (Two cases: force 3 and force 5);

* *Ride quality*: (with the use of stabilisers and/or MDS when available)) for the same two case;

* *Comfort*: infrequency of motion sickness symptoms among the passenger for the same two cases;

* *Capacious charteristics*: capability to carry about 400 passenger and at least 100 cars;

* *Easiness*: for steering and operation;

* *Reliability*: more or less frequent maintenance and repair operation;

* *Strength*: for the hull structure;

* *Limited draft*: for access to secondary port facilities.

The method of appraisal of these various criteria is essentially qualitative, therefore the notation from 0 (bad) to 5 (very good) is more subjective than objective. Also, such a multicriteria analysis suppose that the weigh of each is equal when for a given service, the peculiar constraints of which are to be taken into consideration, it is probably never the case. The results are presented in **Table I**.

Criteria	Air cushion vihicle	Hydrofoil	Wave-piercing catamaran	SWATH	SES	Monohull
Speed	5	5	4	3	4	4
Energy saving	5	3	3	0	4	3
Minimization of slowing down						
Force 3	2	3	4	5	4	5
Force 5	0	1	2	5	4	4
Seakeeping						
Force 3	1	2	3	5	4	5
Force 5	0	1	1	4	3	4
Comfort						
Force 3	1	2	3	5	4	5
Force 5	0	0	1	4	3	4
Capaciouness	3	2	5	5	4	4
Easiness	1	2	4	3	2	5
Reliability	1	3	5	4	3	5
Strength	1	3	4	3	2	5
Limited draft	5	1	3	0	4	4
Overall Appraisal						
Force 3 case	25	26	38	33	35	45
Force 5 case	21	2	32	31	32	43

Table I: Comparison of various HSC categories prs cons for fast car ferry operation

The result of this comparison conducted among the various HSC categories, give a clear advantage, for their utilisation as fast car ferries on open sea routes,

to the monohull category. The wave-piercing Catamaran came to the second place and the SES rank third. It should be underlined here that the performances of the Catamaran -wave piercing or not- may be very much bettered, as far as seakeeping ability and passenger comfort are considered, by the fitting of a reliable remote control automated MDS.

For SES it is fair to remark that no unit of the requested size has been built up to now and that the seakeeping ability of such HSC should be better for a car ferry with a length in the 75/90 meter range than for the present navy-oriented prototypes. In this respect, it is to be regretted that the building in an Italian shipyard of a SES fast ferry for 750 passengers and 180 cars has been stopped in 1992 for financial reasons.

The SWATH concept is very interesting for a cruise ship, but its speed/power ratio appears so uneconomic that the operation of a fast ferry, built according such a design, don't have a chance to become a profitable venture, even at the present low bunker prices. At least for the time being, the Air-cushion vehicle and the Hydrofoil appear, excluded of the competition. Despite their good performance in protected waters or on short strait crossings, the first one cannot conformably withstand a rough sea for some hours, whilst the use of the second as a car ferry has never been seriously considered.

2   SAFETY AND OPERATIONAL CONSTRAINTS

2.1 SPECIFIC SAFETY PROBLEMS OF PASSENGER HSC.

2.1.1 I.M.O. building and operational rules applied to these craft

At the time of the appearance of first Passenger Air-cushion vehicle in the United-Kingdom waters, the British marine safety authorities considered impossible to apply to such a craft the I.M.O. SOLAS rules in force for passenger ships and decided, instead, to put them under the Civil Aviation safety by-laws but for the navigation lights that were to be of the marine type and located as on a ship. Obviously such a craft "flying" on waves crest is more likely to encounter a ship than an aircraft!

The HSC problem was discussed at length during the seventies in the I.M.O. Maritime Safety Committee and resolved in 1977 by the adoption of the rules contained in a resolution numbered A. 373. These rules were drafted having in mind the Dynamically Supported Craft, and accordingly are also known as "DSC Code". Despite being clearly directed to Air-cushion vehicles and Hydrofoils, the two passenger HSC categories that, at the time, were considered as the more

likely to operate outside the protected waters zones, these rules also are applied to displacement types HSC, such as Catamaran and Monohull.

Yet, two important restrictions are imposed by these rules: the maximum number of passengers is set at 450 and the craft shall not operate farther than 100 nautical mile from a refuge port. Also limited is the total duration of a trip and these craft are forbidden to sail under too adverse weather conditions. These restrictions are the counterpart of the exceptions offered by the DSC rules as compared with SOLAS ones for passengers ships.

These exceptions are numerous but the main ones concern the possibility to extensively use for the construction light alloys instead of steel, and the limitation of on-board rescue means and fire fighting systems. For passengers rescue, as for fire fighting, it is considered that the safety is insured by the capability to rely on outside salvage and assistance means, whose intervention can be summoned quickly enough by the regional SAR Centres.

Since 1991, a complete revision of the rules applicable to passenger HSC has been undertaken by I.M.O.. This revision has been finalised, at working commission level, in February 1994, but has still to be approved, later in the current year, by the I.M.O. Maritime Safety Committee. The new document will be called "HSC Safety rules Code". Despite the fact that it is not yet in force, its provisions are more or less already applied to the new craft under construction or at the design stage. It is worth mentioning that the minimal speed considered for applying these new rules to a ship has been set at 25 knots, a limit rather low, when considering the state of the art and the fact that some classical car-ferries are already reaching a service speed in the 23/24 knots range.

The new rules are very comprehensive and complicated. They introduce a "B category HSC" without restrictions as regards the number of passengers and limitation for the distance of the nearest refuge port. For such units, the safety rules are nearing the ones of SOLAS Convention for passenger vessels as regard the prevention and fighting of water ingress or fire by the means of the board. In certain casualty conditions (for instance, fire or collision) a disabled HSC should have the capability to reach a refuge port. A new set of rules concerns the suitable binding of seats and other furniture in passengers accommodations in order to overcome the stresses resulting of a sudden slowing down of the craft.

Moreover, taking into account the current rapid evolution in the field of fast ferries, the I.M.O. rule makers have decided to proceed with a new revision of the HSC rules as soon as lessons can be learned from the experience in operation of several new units currently in trial, construction or in order. Such revision will probably results on a further reduction of the exemptions to the SOLAS rules concerning conventional passenger ships

2.1.2 HCS impact on navigation safety.

This experience also shall prove precious for a matter, the importance of which still has fully to be taken into consideration, i.e. the problem of the insertion of a growing flotilla of HSC on an increasing number of open-sea routes. The coexistence, on the same surface, of craft sailing at 40 knots and over, with the current merchant ships, plying mostly between 10 and 20 knots, and the even slower fishing and pleasure boats, is something to be considered carefully.

The example of the Dover Strait area, where these different types of traffic intensively mixed, can be deem reassuring since no major accident, involving an HSC, has been recorded up to now. This has been attributed to the great manoeuvrability of the various types of HSC, for the pilot of which, an ordinary slower vessel appears as an easy to avoid fixed obstacle. Nevertheless, Dover Stait is not only is the area, in which the maximum density of maritime traffic can be found, but also the one where the traffic control from the shore is the more advanced. Dover MRCC, on the British side, and CROSS Gris-Nez, on the French one, are permanently monitoring the longitudinal Vessel Traffic System (VTS) movements and transverse crossings. However, despite their policing influence, near-misses involving HSC have been on the increase recently. This dangerous trend can be explained by the fact that some HSC pilots are becoming overconfident in the manoeuvrability of their craft.

The likely multiplication of HSC on other open-sea routes, not presently covered with VTS, will certainly create navigation safety problems; such is already the case in the Pearl River/Macao/Hong-Kong area. In these much travelled waters, about forty collisions between HSC and other vessels, have been registered during the recent years. Seven of these events have been severe enough to result in human casualties.

Thus, It is obvious that the current trend towards larger and faster passenger/car HSC and the multiplication of their crossings have to be scrutinised from the viewpoint of navigation safety. Technically speaking, It can be envisaged to create new and longer VTS extending even to high-sea areas by supplementing coastal radars by satellite relays and GMDSS type radio beacons placed on-board ships.

From a legal and political viewpoint, the things certainly are more complicated. Yet, it would require, in Europe, very few casualties of the MOBY PRINCE magnitude, involving one (or two) fast passengers ferries, for starting a campaign in the media questioning the responsibilities of the national maritime Administration and the EEC "Policy for a safer sea". It may prove difficult, after a collision having resulted in hundreds of human casualties, to explain to the public opinion why a world-wide compulsory routing exists for aircraft and has not been implemented for sea craft even on a regional basis.

Of course, compulsory high-sea VTS cannot be limited to HSC and has to be extended to all vessels passing in the area. The ships - apart the submarines-manoeuvring only in a two dimensions space, some kind of virtual "level-cross-ings" would have to be arranged for other traffic cutting the HSC tracks, spe-cially by night or poor visibility. Yet, to impose to a ship to alter her route or even slow down, is considered by most captains and shipowners as an infringe-ment to the principle of the Liberty of the sea and an unacceptable limitation to their freedom of decision.

In the coastal waters, at the approaches of ports served by a fast ferry service, the river-based State enjoys already all the necessary power to decide that some lanes at some specific hours should be reserved to HSC. Indeed, the enforce-ment of such prescriptions specially as regards fishermen, boating and yachting people shall certainly prove difficult.

Nevertheless, the coming into service of a quickly growing number of fast passenger/ car ferries (and at a later stage of fast ro/ro and container cargo ships such as the Japanese Super Techno-Liner Liner) in the European short-sea trade, will certainly requires from the Authorities responsible for navigation safety, a drastic reappraisal of the coastal state role and the development of its interventions. The "laissez-faire" cannot be a long term solution and the choice would be either to impair the profitability of fast ferries in putting restrictions as regards their possibility to run at full speed in certain zones or to restrict, up to a reasonable extend, the freedom of the other users of the sea.

2.2 PORT CALL CONSTRAINTS FOR FAST CAR-FERRIES

2.2.1   Problems deriving from special features of HSC

Most of HSC designs prevent the use of the current conventional car-ferry terminal installations existing in the main ports of call. Of course, such is the case for Air-Cushion vehicles, the landing of which take place in special aprons on the beach, but it is also true for big Catamarans and S.E.S. due to their large breadth and the height of their garage deck. SWATH are adding to these con-straints, their very important draft that prevent the use of numerous berths in secondary ports.

Pure Monohull HSC are more likely to be accommodated in existing car-ferries terminals; however, some designs that includes outrigger floats cannot be directly berthed along a quay side and will required special mooring equipment.

2.2.2 Time consuming constraints of port operations.

A fast ferry, running full speed for two hours at 40 knots and over, would loose much of its advantage over the classic type, sailing at about half this speed, if its port operations- boarding of passengers and loading of vehicles, sailing from the berth, exit from one port, entry in the other, berthing and mooring, dis-embarkation of passengers and vehicles - are requesting the same duration than for its slower competitor. Such a ferry is part of an overall system, of which each other component also should be geared for the speediest operation.

Therefore, the location of the fast ferry terminal in the port installations is very important: a berth with a short and direct access from and to the pass presents much advantages, subject however to easy land connections to the highway and sometimes the railway networks. Mooring and release operations can be shortened by introducing automated equipment. Passengers boarding and dis-embarkation should be arranged as for Jumbo jets in an airport with the fastest- but nevertheless efficient- security control procedure and machinery.

The main difficulty for the shortening of calls is the rolling-on and rolling-off of the vehicles. The exercise can be made easier when a ferry possesses both a fore and aft accesses since the cars are not loosing time in turning. Such an arrangement is not generally possible for most of HSC; however, it can be considered feasible to provide, in certain Monohull designs, a side access in the fore part of the garage deck. To park the vehicles just outside the terminal to prepare a smooth and swift loading of the cars in the garage should not be too much of a problem as long as the number of cars to be loaded will not exceed 200 units. Finally before the departure of a fast ferry, the cars have always to be fastened, even when the weather looks very nice, in order to prevent the consequences of a possible sudden slowing down.

2.2.3 The advantage of dedicated fast ferries terminal.

All the points just discussed demonstrate that it is desirable, as far as possible, to provide a dedicated terminal for the servicing of fast-ferries at a point of vantage both for sea and land accesses. Only in such a dedicated facility, the various above mentioned port operations can be fully streamlined and optimised. A duration of call in a terminal matching the particulars of given type of fast-ferry can be reduced to 45 minutes or even half an hour. However, In designing such a dedicated terminal, it should be taken into consideration the probability to receive, after some years, bigger HSC than the currently considered units.

Time saved in the process of embarking/disembarking passengers and cars is very precious as it enhances the global performance of the whole system or, alternatively, can secure a margin for reducing the actual speed during the crossing either to improve the comfort of the passengers or to reduce the

energy consumption. What it is really important for the client is the total time he spend for the trip, from his arrival to the embarking terminal to his departure from the disembarking one.

3 THE RATIONAL AND ECONOMICS OF THE USE OF FAST CAR-FERRIES ON EUROPEAN SHORT SEA ROUTES

3.1 WHAT IS BEHIND THE DEVELOPMENT OF FAST FERRIES?

3.1.1 General remark.

Apart the mere attraction of speed, a quite irrational feeling which, however, may be a motivation of choice for some sport-minded clients, it is obvious that the development of fast ferries should be based on more solid motives. Both passenger and shipowner motives have to be considered. Of course the driving forces result from the combination of the client requirements, on one side, and the shipowners technical and financial constraints on the other.

3.1.2 The ferry passenger requirements.

From the passenger viewpoint, fast ferries main attraction is the time saving. A lecture, presented at CRUISE + FERRY 93 CONFERENCE by MM. O. VEDERHUS and H. HEIJVELD, has discussed the "Market potential for fast ferries between Italy and Greece". The authors mention in their paper the result of a market research, conducted among a sample of 300 passengers travelling on a conventional ferry between Bari and Patras: 96 % of the respondents answered that they would have chosen to travel with a fast ferry if this could reduce the time of crossing by half and if fares would be equal to the ones of the conventional vessel.

However, this very high percentage was falling to 85% when it was presumed that the crossing would have to be done mostly indoors without possibility to walk on the deck. Here, it should be underlined that the Bari/Patras is a "long" ferry route of 300 nautical miles requiring a crossing duration of seven and half hours at a service speed of 40 knots. The problem of confinement is certainly less severe for shorter crossings with a duration of two to four hours.

The sensitivity to fare prices has also been tested by this market research and the result showed that, among the customers interested by using a fast ferry, a large majority would be willing to pay 10% more for such a crossing and nearly a third would accept a fare increase of 25%.

Of course, time saving attractiveness has two aspects, shortening the total duration of the door to door travel, including the time spend to reach the boarding port and to arrive at the final destination from the disembarking one, and reducing the exposure to the inconveniences the sea crossing itself, specially the sea-sickness. The first motive is more effective for long crossings, whilst the second appears more valid for shorter ones.

The above general remarks have to be put in the perspective of the various segments of the present car-ferry passenger population: the regular commuters and the occasional passengers, both categories being subdivided in walkers, drivers and bus users. The regular commuters are found on the shortest and generally domestic routes not exceeding a range of 20/ 25 nautical miles, the hubs of which are large coastal cities. This type of commuting ferry service is very frequent in Scandinavia, but exists also in South Europe, for instance in the Naples Bay, in the Athens/ Pireus/ Saronic Gulf area or on the Bosphorus and Marmara sea.

The numerous fast ferries used in these multifarious services are catering only for walking passengers, whilst car drivers and bus users are using conventional small car- ferries, also carrying lorries and trailers. These car-ferries services connecting island and coastal road networks are generally operated in narrows between the nearest possible crossing points. The introduction of fast car-ferries on such very short routes is not required by the clients nor considered by the operators as the time saving would be too small taking into account the incompressibility of the duration of the multiple embarking and disembarking operations

Indeed, the occasional passengers also exists on board these commuting ferries but they are mainly to be found on longer routes crossing large straits or deserving big Mediterranean islands, namely Balearic ones, Corsica, Sardinia and Crete. The "walking "passenger sub category, travelling for business, pleasure or family reasons is very sensible to the shortening of the crossing time. Often user of fast trains on land, he is also a client of the aircraft for long distance travel and would certainly consider to use it for short sea crossings.

When such crossings are not exceeding 100 nautical miles this passenger will be attracted by a fast ferry service offering a "city centre to city centre" service. For farther links with the port hinterland a good direct connection between fast trains and fast ferry services also may offer a surface transportation combination more attractive than the flight if the fare is cheaper and the total trip duration not much longer, if the duration of the trips to and from the airports, the waiting time before boarding and frequent flight time schedule delays are taken into account.

Yet, on these routes as on longer ones, car and bus passengers provide the mainstay of the car-ferry clientele, as the air transportation cannot offer a credible alternative for carrying their vehicles. Yet, most of these passengers are tourists and this traffic presents an highly seasonal character. These individual or group tourists, going to or coming from, their holidays resorts, are the most likely to be interested by the time saving offered by the use of fast ferries on the sea portion of their travel. However, these users of large conventional night car-ferry long crossings are accustomed to find on board many amenities such as restaurants, night clubs, free-tax shops that cannot be provided in the much smaller space offered by fast ferries where the passenger, for safety reason should remain seated during the whole trip.

Consequently, the attractiveness of time saving could be progressively reduced for the fast-ferry passenger by a growing feeling of boredom, even of claustrophobia, when the crossing duration largely exceed three hours. Of course, like in long-distance air flights, meals and drinks will be served and films presented.

Yet, on the longer routes, the competition will come from the large conventional night car-ferry, the internal arrangements of which are at present more and more intended to turn the crossing in a overnight mini-cruise. Only the experience shall test the competitiveness of the fast-ferry with its much larger and luxurious, but much slower, predecessor. It appears that the competition will become very severe for the newcomer on routes in the 150/200 nautical miles range and many observers consider that the fast-ferry maximum attractiveness would be found for crossing lengths between 50 and 150 nautical miles.

3.1.3 The shipowners' growing interest for fast car-ferries.

Until a recent time, the operators of conventional car-ferry have considered, that HSC designs were not likely to offer them a safe and profitable alternative to the various vessel types they were operating on their day crossings and, all the more, on their night ones. The coming into service of the large HOVERCRAFT able to carry 50 cars on the Dover/Calais route, has not changed very much their opinion as they were considering as marginal its possible impact on their enormous market. The things have begun to change with the advent on the cross-Channel routes of the Wave-Piercing Catamarans of the SEACAT and CONDOR types, despite the teething troubles encountered by these Australian designed and built machines.

The domestic Italian car-ferry operator TIRRENIA has shown its interest in HSC solutions by accepting in 1991 to charter, for a trial period, both one SEC 750, a SES prototype proposed by Cantieri Navali S. E. C., and one AQUASTRADA, a Monohull prototype proposed by the shipyard RODRIQUEZ. Both were intended for the Civitavecchia/Olbia 128 miles route, between Italian mainland and Sar-

dinia. The most ambitious project, the SEC 750, intended to carry 750 passengers and 180 cars at 50 knots has not been completed as previously mentioned, but the RODRIQUEZ steel Monohull, named "GUIZZO" after a kind of flying-fish, designed to carry 450 passengers and 114 cars at 42 knots, has entered in service for the summer peak season, in July 1993 and, was considered as a success since three further AQUASTRADAs have been ordered.

For the service between the Balearic Islands and the Spanish mainland, the domestic ferry operator TRANSMEDITERRANEA has ordered two light alloy Monohull HSC to the shipyard BAZAN. These units, due to enter service for the 1994 summer season will carry 450 passengers, but only 76 cars, at a service speed of 34 knots, somewhat lower that the one provided for their Italian counterpart.

Another fast but smaller light alloy Monohull ferry is presently under completion by the French shipbuilding Group LEROUX & LOTZ. This prototype, dubbed CORSAIRE 6000, ordered by EMERAUDE LINES will accommodate 400 passengers but only 42 cars. This unusually high PAX/CAR ratio is explained by the fact that the vessel is intended for the route between Saint-Malo in Brittany and the Channel Islands, much patronised during the summer season by non-motorist day trippers. The distance is about 50 nautical miles and a service speed of 32 knots was deemed sufficient. It is obtained with a relatively modest power developed by diesel engines coupled with waterjet.

The biggest North European private ferry operator, the STENA group, has placed in the summer 1993 a Wave-Piercing Catamaran on the Holyhead/Dublin service, a 61 miles route. The interest of STENA for fast ferries was soon confirmed by the placing of an order with the Finnish shipbuilding group FINNYARS for two 124 meters length gas turbines and waterjets propelled Catamaran able to carry 1500 passengers and 375 cars at a full power speed of 40 knots. More economical service speeds also can be obtained by other combinations of the four propulsive sets the two power ranges of which are different.

These units, by far the biggest fast car/ferries ever seriously considered are intended for the STENA Irish sea service. however the may also be placed on other medium to long cross-Channel or cross-Baltic routes. If, due to their mere size and probably also to the fitting of some MDS, these "JUMBO CATS" can ride smoothly the North- West European often choppy seas, their entry in service would herald a new era of high-speed mass sea transport.

3.1.4 The motives behind the Shipowners' interest.

As can be seen by the above mentioned extensive range of fast car-ferries in service or in order, the large ferry operators are at present very interested by the alternative offered by HSC designs. Most of them are waiting to be sure that the

experience in service of, at least, some of these various prototypes will become, after some months, favourably conclusive as regards their mechanical reliability, their seakeeping ability, and the navigation safety. Then, if the answer is positive, the economical and financial cost advantages that the fast ferry presents as compared with the conventional one, shall not fail to have an overwhelming influence on the future technological development of the short sea passenger transportation.

The cost advantages of the fast-ferries in both fields of investment and operation derive from the possibility for a much smaller vessel to offer a daily passenger and car transport capacity, more or less comparable to the one of a far bigger one. This capacity is also more flexible as the sailing frequency is increased. As regards the initial investment and despite the requirement for a very powerful propulsive plant, the cost of a much smaller vessel with streamlined and simplified accommodations may be three to four time less than the one of the conventional unit having the same daily carrying capacity.

Of course, this initial cost comparison has to take into account many variables such as the length of the crossing or the respective speeds of the compared units. In this last respect, it is worth to underline that to increase, for instance, the fast ferry service speed from 35 to 45 knots would result in bettering such a comparison, only if this greater speed results in permitting one daily round trip more. Should this be the case the increase in the fast ferry initial cost will be relatively small as compared with the benefit derived from the extra daily transport capacity. Yet, the required supplementary power investment would be worthless if the sea conditions encountered on the route prevent too often the fast ferry to sail at its maximum speed.

Another important factor to consider is the type of conventional car ferry that the fast one may replace. The investment cost differential will be less if it is a day ferry than if it is a night one. In the lower part of the 50/150 nautical miles range of crossings, the displaced unit would certainly be a day tripper when in the highest part of the said range it would be a far more expensive vessels with cabins and more lavish and spacious public spaces.

In the field of operational costs, bunkering ones will be more expensive for the fast ferry but, for the time being, this disadvantage is reduced in a period of low oil barrel price. Certainly, the crewing costs are the item that offer the greatest saving for a the fast ferry as compared with the conventional one. A 450 passengers HSC can be operated by 15 to 19 people among which only three Officers. this complement is to be compared with 90 to 120 for a conventional vessel, depending of the importance of the catering service. This advantage is particularly important for the shipowners on European short sea routes where it is generally compulsory to employ national crews on ferries service. To this direct cost advantage it should be added a very important indirect one: a fast ferry crew is not staying overnight on board; thus; no cabin, galley, mess or

cafeteria has to be provided for them in the ship accommodations. This of course contribute to reduce the initial cost but also the crew catering ones.

3.1.5 The European short-sea routes for fast car-ferries

We have seen that the various presently developed passenger/ car HSC, which can be considered by the their type of aircraft accommodations as day ferries. They operate, for instance, from 6 a.m. to ll p.m.. Such craft will find their operational "niche" in the crossings the distance of which is situated between 5O and 15O nautical miles. A further condition is, of course that they rank among the most travelled routes for motorists with a marked seasonal peak. The interest of this last condition is the peak-shaving ability offered by the greatest flexibility of the fast car-ferry as compared with the bigger conventional unit. The **Table II** and **Table III** present these selected routes.

Area	Crossing	Distance (miles)	Passengers (thousands)	Cars (thousands)
West Mediter-ranean Sea	Malaga/Almeria/Melilla	114	423	76
	Barcelona/Palma	130	408	67
Corsica	Toulon/Ajaccio	145	107	35
	Nice/Calvi/Ile rousse	98	175	56
	Nice/Bastia	122	163	56
	Genoa/Bastia	108	87	32
	Savona/Bastia	105	175	63
	La Spezia/Bastia	85	240	84
	Leghorn/Bastia	65	355	124
Sardinia	Civittavecchia/Olbia	125	1000	200
Adriatic and Onian Sea	Pescara/Split	114	1000	200
	Bari/Split	145	1000	200
	Bari/Dubrovnic	110	1000	200
	Otrante/Igoumenitsa	100	1000	200
	Brindisi/Corfou	123	1000	200
Aegian Sea	Pireus/Cannea	150	1400	200
	Pireaus/Naxos	120	700	40
	Volos/Stakos/Pelagos	80	700	70

Table II: The more suitable European short-sea routes for passenger/car HSC services, (North Europe)

Area	Crossing	Distance (miles)	Passengers (thousands)	Cars (thousands)
Baltic	Swinoujsie/Copenhagen	120	150	40
	Swinoujsie/Ystad	95	400	100
	Travemunde/Gedser	120	790	122
	Travemunde/Trelleborg	54	1056	165
	Sassnitz/Trelleborg	95	957	135
	Visby/Nynashamn	80	535	123
	Visby/Oscarshamn	65	300	80
	Vasa/Umea	87	625	75
	Ronne/Copenhagen	100	700	70
Belts/Kattegat/ Skagerak	Arhus/Kalundborg	50	1055	240
	Grena/Varberg	64	400	90
	Grena/Halmstad	66	350	77
	Frederikhav/Göteborg	50	3190	486
	Frederikhav/Moss	120	220	45
	Frederikhav/Larvik	105	830	118
	Hirsals/Kristiansan	70	850	163
North Sea	Harwich/Hook of Holland	116	1040	140
	Sheerness/Vlissingue	124	800	125
	Felixtowe/Zeebruge	84	421	60
	Dover/Zeebruge	76	933	141
	Dover/Ostend	61	1891	247
English channel	Dieppe/Newhaven	64	833	137
	Havre/Portsmouth	90	794	209
	Caen/Portsmouth	95	400	100
	Cherbourg/Portsmouth	86	642	192
	Cherbourg/Poole	60	438	114
	St. Malo/Guernsey	55	250	30
	Poole/St. Hélier	100	500	110
	St. Malo/Portsmouth	142	500	127
	Roscoff/Plymouth	96	507	123
Irish Sea	Rosslare/Pembroke	67	400	90
	Rosslare/Fishguard	54	760	170
	Holyhead/Dublin	61	610	115
	Holyhead/Dun Loaghaire	56	1110	190

Table III: The more suitable European short-sea routes for passenger/car HSC services, (South Europe)

CONCLUSION

The above review of the car-ferry routes suitable for introducing HSC demonstrates the very large potential offered to this revolutionary mean of sea transport. Indeed, it appears larger in the north of Europe than in its South, a

quite obvious consequence of the relative density of population and degree of economic development. However, the routes in the South are longer as an average than in the North and the rough sea conditions are less frequent in the Mediterranean Basin than round Scandinavia and the British Isles. More and more northern tourists are attracted by the Spanish, French, Italian and Greek beaches and many of them can only be reached by private car or busses after one or more ferry crossing. Therefore the potential of the fast ferry looks good all over Europe.

FUTURA - A FAST RO-RO SHIP FOR MEDITERRANEAN COASTAL TRADE

By G. Trincas, C. Closca, R. Nabergoj, J.S. Popovici

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FUTURA - A FAST RO-RO SHIP FOR MEDITERRANEAN COASTAL TRADE

ABSTRACT

In order to make ro-ro ships competitive with respect to land-based transport system, it is vital to design them faster while assuring global safety and high performance as well as low manning and operating costs. For any progress at average speed of trailer transport it is needed not only to properly develop hull form and propulsors, but also to decrease ship weight and speed losses in waves. The last problem includes all characteristics of seakeeping development. The FUTURA monohull configuration is the first response to all these requirements as a result of an international cooperative research program between the University of Trieste and ICEPRONAV. It has been conceived to produce a prototype matching the north-south Italian route given the waterborne transport of trailers required. Economic studies indicate that a service speed of 24 knots in severe weather conditions is the goal to be pursued to candidate ro-ro ships as a real alternative to road transport mode before the latter reaches saturation. Combination of theoretical calculations and experimental analyses reveals capability of the prototype concept to accomodate driver-accompanied freight market, improving economic efficiency as well as superior levels of safety.
A sensitivity study making use of TOPSIS procedure for preference order among a set of design alternatives allows evaluation of techno-economic efficiency with respect to different requirements and constraints posed by driver-accompanied freight market

INTRODUCTION

The importance of shipping as a primary method of trading and communicating has never been recognised completely by Italian politicians, although necessity to develop a rational and efficient coastal trade system has been recognised by the General Transport Plan since 1986. But the shipping industry has never been known for its high profitability. Consequently, the low return on capital invested and the continual rise in the operating costs are more and more stimulating the development of innovative ships. In Italy the way forward is seen as moving into highly specialised vessels, also as a measure to avoid transfer of older tonnage from northern Europe.

Although significance of cabotage activities is continuously growing, at EU level coastal trade still remains the less agreed shipping policy, maybe because Mediterranean countries still apply commercial restrictions to foreign flags.

Nevertheless, here it is assumed that a liberalised market as well as modern and highly efficient maritime services are provided. Duty of naval architects is then to conceive and design the most efficient ships possible in terms of performance and cost with very low environmental impact.

As regards ro-ro vessels they have grown only slightly in size, limited by the amount of cargo available and the port dimensions. In spite of improving the efficiency and economics of shipping, ro-ro's have never been really competitive with land-based transport mainly because of inadequate minimisation of round-trip times. Commitment of innovative ro-ro vessels urges to develop more specialised vessels within a fully integrated intermodal transport system.

The objective of this study is to develop a commercially viable ro-ro/trailer ship capable of matching the market requirements in terms of safety and port-to-port schedule. Fast speed, reliability in time schedule, major safety with respect to environmental risks, comfortable accommodation, frequent and safe service with reduced operating costs, are targets to be simultaneously achieved in order to persuade drivers and trailer companies to prefer coastal transport. First a market survey was performed to determine proper goals in terms of size and speed. A set of alternative designs has been developed, derived from a concept design of a fast monohull concept vessel with high ratio of slenderness, deemed as optimal from a previous study [1]. Notwithstanding a number of limitations, the analysis of economies of size and speed are to be evaluated at the earliest stages of design together with estimate of unit costs, mainly because they provide an internally consistent set of comparisons to work from. On this basis, evaluation of the competitive vessels by means of a techno-economic mathematical model has given information to rank them according to different goals and preference importance given to main selected attributes.

SHORTSEA SHIPPING INTO MEDITERRANEAN AND BLACK SEA BASINS

Growth in the number of movements of vehicles and pollution as well as increasing congestion of long-distance heavy traffic compels European shipping industry to introduce and apply new strategies for developing intermodal and combined transport using techniques integrating road, rail, inland, and maritime transport. Recent statistics show an unacceptable number of road traffic accidents and the growing negative effects of pollution and energy wasting of land-based transport in the environment.

To lead to a better division and integration of traffic flows among the various modes, while minimising at the same time social diseconomies and in view of the potential it affords to relieve the congestion which threatens the crowded motorways, the Prague declaration on pan-European transport policy (1991) emphasises the necessity of structural support for less environmentally detrimental transport modes, like inland waterways and coastal shipping, also because speed restrictions at European level for cars, coaches, trailers and

lorries are expected. Reduction of the circulation of vehicles and of the air and noise pollution from too congested traffic veins through a suitable development policy of intermodal traffic is deemed fundamental to develop a transport system efficient in economic, environmental and social terms. The huge maintenance costs of heavily loaded road systems and the relatively small investment planned in the future for cargo-rail transport system indicate that coastal services will become vital to our countries.

Compared with other modes of transport, the waterborne transport presents a number of advantages. The cabotage has minimal impact on the environment, requires a relatively low level of infrastructural facilities required, and consequently needs much less financial support than that required by roads and rails. In spite of recent release of new ships, Italian coastal trade is still marginal with respect to land-based transport although shipping is a topic definitely of major significance to all the countries in the Mediterranean and Black Sea basins. It is of utmost importance to create and provide for an efficient and technically advanced short-sea shipping which has to be encouraged as a particular mode of transport in view of the potential it affords to relieve the congestion which threatens the crowded motorways and to ensure a favourable environmental impact. In this respect goods moved by trailers are of main concerning, thus compelling a re-analysis of ro-ro ships as an alternative means of transport.

Particular attention is here paid to Italian and Romanian situation. Goods are moved in Italy mainly on road base, up to 90 percent of cargo transport from and to Sardinia and transfer of goods towards first processing plants sited in coastal centres are neglected. Their increase is forecast to double at the end of this century with a saturation till paralysis of motorway network. Italy's geography gives a further clue as to why powering the waterborne transport is the faster, more viable solution. Analyses show that goods are mainly moved in the north-south direction along coastal infrastructures. The demand for high-value products (electronics, cars, etc.) to be delivered on a just-on-time basis, together with fresh fruits, vegetables and flowers because of their perishable nature, plus other sectors, requires fast shipment.

As regards Black Sea coastal trade some information have been collected from shipping company ROMLINE and from a land transport corporation. Because of the war in former Yugoslavia and insecurity of cargo through Bulgaria, the traffic of trailers from northern and western Europe to Turkey is mainly preferred via coastal trade. A ro-ro shipping line is open between a and Istanbul (192nm) sustained by 3500 dwt ro-ro ships flying Turkish flag with a capacity of 35 trailers. Fare is about 350–400 $/trailer. Two or three runs are performed weekly from each side. Another ro-ro line has been recently activated between Turkey and Russia, namely, Samsung/Soci (270 nm) and Samsung-Odessa (300 nm). Also these ships fly Turkish flag with a capacity of 60 trailers/ship. Fare is about 800–1000 $/trailer. All these ships run at a mean speed of 12 kn and have no accommodation for the drivers. Fares per trailer are higher than in Italian coastal trade. However, they can be justified by the fact that the road-transport costs for a trailer from Constanta to Istanbul is about 1550-

1750$ including all particular costs and taxes through Bulgaria and Turkey. So the road transport seems to be at least three times more expensive than the waterborne transport in the Black Sea area.

The ro-ro trailer traffic across the Black Sea is not covered by Romanian ships. The present imbalance in the use of the different transport modes can be demonstrated by the following figures: almost 50% of the Romanian domestic traffic is carried by road and 50% by rail, with a very low contribution by waterborne transport. The Romanian ro-ro fleet currently consists of the following ship types (**Table I**), operating in time charter or bareboat charter contracts. But since ship speeds are too low and comfort on board is totally unsatisfactory, a large margin exists for easy improvements. Consequently, here discussion on innovative ro-ro ships will be mainly devoted to Italian situation, assuming that results could be interesting also for Romanian shipping's needs.

Ship		A	B	C	D
DWT	(t)	4100	4700	6700	12000
Speed	(kn)	14	15	17	14
Trailers	(no)	41	80	77	117

Table I: The Romanian ro-ro fleet

THE FUTURE OF FAST TRAILER WATERBORNE TRANSPORT

The future development of trailer waterborne transport system will be dramatically affected by the evolution of the national and international economy. But an ever-increasing traffic demand can be foreseen. Estimation of traffic quota for potentially acquisition by waterborne transport shows that in Italy 750,000 trailers and lorries might leave the road in favour of cabotage [2]. Since traffic flow along the Adriatic roads is quantitatively similar to the one in the Tyrrhenian basin, in the next future the possible goal is to move 1000 trailers per day by Adriatic waterborne transport.

Taking advantage of Italian government subsidies, development has continued in the numbers, size and sophistication of ro-ro ships built in Italy. Main characteristics of some vessels are illustrated in **Table II**.

The competitive nature of the transport industry compels to new faster ships which must carry payload more efficiently, also in severe environment. World-wide experience indicates that a successful high-tech design presupposes significant upgrades in design strategy [1]. Our basic assumption is that speed

Ship		Palladio	Fenicia	Romea	Fides	Majestic	Viamare	C164
Year		1988	1989	1990	1991	1993	1993	1994
L$_{OA}$	(m)	122.00	121.00	138.00	178.10	188.40	150.40	178.00
L$_{BP}$	(m)	110.50	110.00	124.50	164.00	163.00	137.30	160.50
B	(m)	19.40	19.80	21.60	26.80	26.80	23.40	24.40
T	(m)	5.30	5.30	5.90	8.76	6.70	5.75	6.50
DWT	(t)	5000	5000	7600	16800	71.50	5600	10000
V$_{MAX}$	(kn)	18.50	25.30	16.00	19.00	23.00	19.10	20.00
Output (kW)		6150	19400	4900	11520	23060	11520	8145

Table II: Some Italian ro-ro ships since 1988

attracts cargo in the waterborne transport domain. Service quality is mainly related to a fast transit time. High installed engine shaft horsepower is again possible because of stagnation of oil prices.

Positive aspects of coastal trading are comfort, periodicity, major safety, avoiding the second driver, possibility to travel also on Sundays and holidays, plan the trip, and perform custom duties on board. Several sensitivity studies may point the way toward improving the economic benefits of waterborne transport. The idea about trailer transport network presupposes a complex network of multiple itineraries providing wide distribution between the trading hinterlands served.

Harbours deemed as attractive for a fast ro-ro service are those well linked with surrounding areas, namely, Trieste, Venice, Ravenna, Ancona, Bari/Brindisi in the Adriatic sea, Genova, Livorno, Civitavecchia, Napoli, Gioia Tauro, Palermo in the Thyrrenean sea (**Figure 1**). A detailed parametric analysis of the options on these routes has been carried out.

The slow service speed of ro-ro ships would demand more than one day for a one-way trip on the longest routes. The technique of round trip modelling has been used, incorporating the need to operate within a daily rhythm as a basic condition. The idea about trailer transport network presupposes a complex network of multiple itineraries providing wide distribution between the trading hinterlands served. The shipping lines can release the strict confines of the daily rhythm by precise choice of route using intermodal transport to adjust the number of ports in the itinerary and route length. Given the premises, and some assumptions about handling rates, port access time, etc., freedom of choice about speed/size configuration becomes constrained. Comparative studies show that with costs based on services offered by currently available services, only increased distances between ports convey towards seaborne transport. Therefore, the ship is conceived for relatively long voyages parallel to land routes, thus excluding very short shipping, such as Salerno-Palermo. Service frequency has to be daily with departure time selected to guarantee that most part of voyage is undertaken by night.
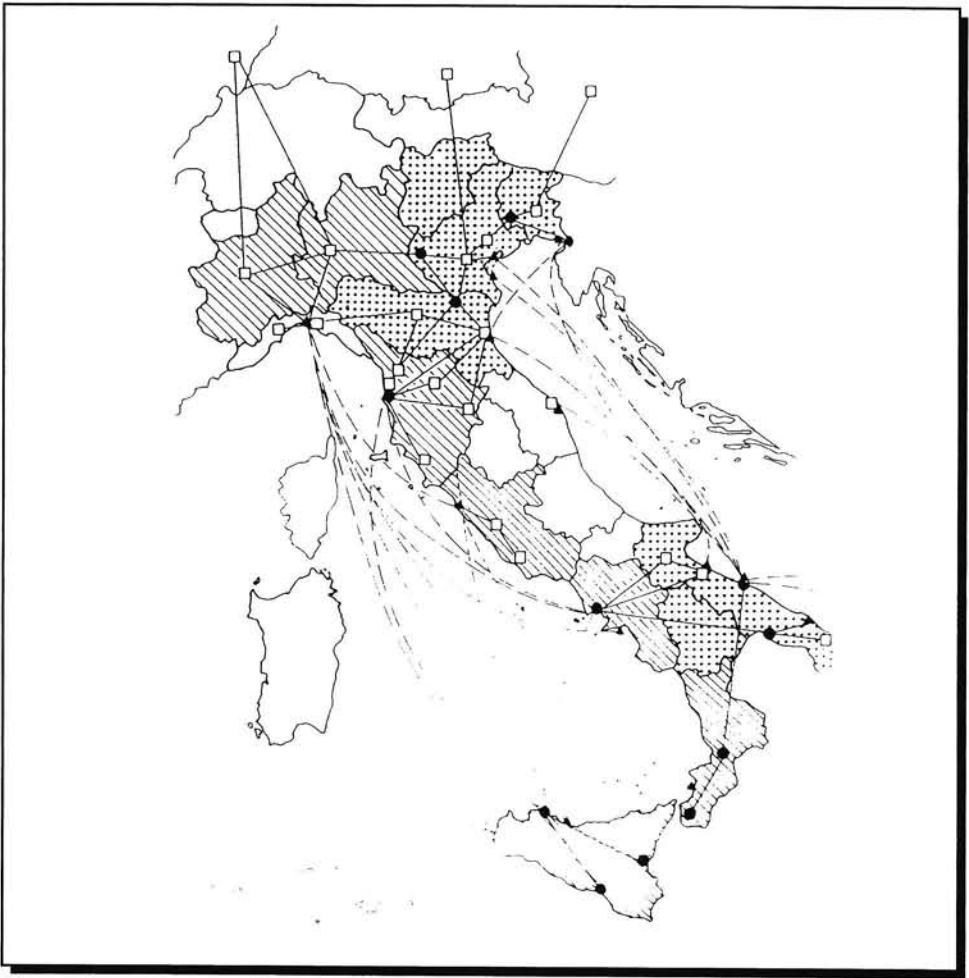
Figure 1: Italian coastal routes

Since the percentage growth rate of trailer traffic is uncertain, the realisation of size economies for individual ships is preferred instead of conceiving a fleet immediately. The preferred policy is envisaged in gradual introduction of modest size increases and increased frequency of sailing obtained by higher sustained speed. Some preliminary economic studies show that it is necessary to reach a sustained speed of 24 knots if times of road- and waterborne transports are wanted to match, for instance in the route Trieste-Bari (**Table III**). Alternative proposals have been designed specifically for the carriage of wheeled trailers between the north and south of Italy. Investigation of transport demand calls for a flexible and fast ro-ro trailer carrier, improved version of ro-ro ships built in Italy during last years.

Trieste Bari	Present ro-ro (calm weather)	Land-based transport	Fast ro-ro (Beaufort 4-5)	Fast ro-ro (calm weather)
Distance	336 nm	965 km	336 nm	336 nm
Route time	19 h	15 h	14 h	12 h
Manoeuvres in ports	1 h	-	1 h	1 h
Loading/unloading time	5 h	-	5 h	5 h
Fixed stops	-	3 h	-	-
Total time	25 h	18 h	20 h	18 h

Table III: Time comparison among different transport modes

Since on long coastal routes no existing ro-ro ship is able to guarantee departures every 24 hours, speed at sea has to assure that the fast vessel can handle the same value as two traditional ro-ro vessels. The concept has been conceived to emerge as a standard design of fast trailer carrier along Italy's west and east coasts for the mid-1990s. It strictly complies with the rules laid down in international agreements. It does not represent the perfect ship for every owner. As such, it can be modified as needed by a specific operator purchasing the concept design.

Risk associated with fast ro-ro ships may be high because of their departure from proven designs. Experimental campaigns are necessary also to validate theoretical calculations which basically constitute a means of achieving innovation and controlling risk in ro-ro design. Design of innovative ro-ro ships implies coupled analysis and experiments since very early design stages, since only limited information is available on the resistance properties of fast displacement ships.

NAVAL ARCHITECTURE MODEL

The general approach for the project was first to identify the trade route and market requirements, and then to develop the best design possible to meet these specifications. Preliminary analysis of commercial requirements call for a trailer capacity of between 100 to 200 trailers A service speed of approximately 24 knots in sea state 5 is established, specifying the Adriatic sea as basic area of operation for investigated ships. Further restrictions imposed by the selected service are a maximum overall length of 210 metres and a maximum draft of 6 metres [3].

The global design goal was to produce ship designs technically feasible, with as low an initial cost as practical while maintaining overall commercial viability. To the purpose, it has been absolutely necessary to yield reasonable estimates of speed loss in weather routing as well as power and fuel consumption cor-

responding to those speeds on the one hand, and probabilistic estimates of operating time in bad weather conditions, on the other hand. To this purpose the hydrodynamic items of the design model have been tuned up for a new type of fast ro-ro vessel, based on the results of an experimental campaign carried out at ICEPRONAV.

The present model is structured around several basic assumptions:

* Propulsion arrangement is predefined outside the model itself (main engine output 2,490 kW, two shaft axes with controllable-pitch propellers);
* Features of the hull form are transom stern, high slenderness and low block coefficient;
* Hull structure material is partly higher tensile steel.

Principal components of the model comprise ship parameters, attributes, objectives, and constraints, which uniquely define the model itself and whose numerical values are controlled by the designer. Most part of the design model hereinafter outlined concerns the phase of estimating main hydrodynamic characteristics subject to given constraints (longitudinal strength, intact and damage stability, vibrations, manoeuvrability) and reaching prescribed objectives for selected attributes, e.g. trial speed, service speed, operating time in winter under established criteria of pitch, vertical accelerations, slamming and deck wetness, damage stability, first cost, required freight rate.

Development of alternative ships

The first step in developing the naval architecture model concerned the phase of generating a set of design alternatives built up from a mini-series, which can potentially meet the objectives. These alternatives should be developed freely with respect to the anticipated acceptability. Starting from FUTURA protoype baseline hull form developed according pure heuristic decision-making, two parent forms have been derived in the light of realistic design criteria [1] capable to be transformable to two large families of realistic hull forms suitable to foreseen traffic requirements in the Mediterranean and Black Sea basins. Main characteristics of the parent hull forms indicated as ECONOMY and ECOFAST as well as of FUTURA prototype are reported in **Table IV**, where PL/W is the payload-to-weight ratio.. ECONOMY vessel was obtained by putting emphasis on economy while ECOFAST vessel was the result of giving approximately equal preference importance to economy and trial speed. Each design was developed to the concept level. Some technical areas (particularly hydrodynamics) were analysed more deeply.

It is important during the development of a research project that alternative proposals can be generated and assessed rapidly. They have to be conceived to satisfy all technical requirements, but not to provide more capability or performance than specified. All design alternatives developed must provide data in

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Ship (m)	L_{OA} (m)	L_{BP} (m)	B (m)	T	C_P	C_X	C_{WP}	C_{VP}	Trailer (no.)	PL/W
FUTURA(proto)	206.80	188.00	22.00	6.00	0.587	0.878	0.812	0.675	157	0.363
ECONOMY	198.90	180.80	23.87	5.74	0.584	0.859	0.784	0.649	157	0.429
ECOFAST	204.70	186.10	22.88	5.91	0.581	0.850	0.770	0.642	152	0.415

Table IV: Main characteristics of the parent ships

sufficient detail to permit a comparative assessment of performance and costs required to make sensitivity studies and thorough decisions. To this purpose, a systematic mathematical series has been set up around the 'ECOFAST' parent form in order to quickly estimate main characteristics of realistic variations of the novel hull concept. A trade-off has been made among different features discussed in the sequel. Based on current knowledge, it was considered that the parameters which have not so high effect in resistance and seakeeping are CX and XB. Thus, while maintaining the midship section coefficient constant (CX = 0.85) the following prime parameters have been varied giving way to practical hull forms:

* L/B   from 7.5 to 8.5 in steps of 0.5;
* B/T   from 3.25 to 4.25 in steps of 0.5;
* CB   from 0.46 to 0.52 in steps of 0.03.

The families of hull forms were obtained very fast by deforming the parent hull forms with their local details through BLINES code [4], while maintaining fixed all other parameters established for the parent hull. The main characteristics of the alternative designs are reported in **Table V**. The last three digits of the alphanumeric code name designating each ship refer to fixed values of L/B ratio, B/T ratio and CB, respectively.

In the meantime, an experimental hydrodynamic programme on parent hull has been carried out at ICEPRONAV to tune up theoretical computations for resistance, wake field, cavitation, seakeeping and manoeuvring. Speed, range, seakeeping, deck areas, weight, stability, etc., of each ship design are all interrelated and are functions of ship dimensions and configuration. Care has been taken to ensure that the level of confidence associated with each procedure incorporated within a module is acceptable.

The economic importance of the relationship between fuel cost and ship hydrodynamics compels to new research in this field. Criteria for economical ship propulsion are directly coupled to factors such as hull form, machinery and fuel costs. Other criteria to be considered are the quality of propulsion and the

	$C_B = 0.460$			$C_X = 0.850$			$C_{WP} = 0.740$		$C_{VP} = 0.618$
	EF111	EF211	EF311	EF121	EF221	EF321	EF131	EF231	EF331
L_{PP} (m)	145.50	155.20	164.90	168.00	179.20	190.40	190.50	203.20	215.90
L_{WL} (m)	151.71	161.82	171.93	175.17	187.08	198.63	198.52	211.87	225.11
B (m)	19.40	19.40	19.40	22.40	22.40	22.40	25.40	25.40	25.40
WS (m²)	2936	3130	3329	3681	2925	4170	4544	4846	5150
∇ (m³)	7750	8263	8780	10339	11028	11717	13305	14192	15084
Trailers	100	110	120	142	152	162	186	197	208
PL/W	0.338	0.326	0.421	0.341	0.323	0.299	0.333	0.304	0.274

Table A

	$C_B = 0.490$			$C_X = 0.850$			$C_{WP} = 0.768$		$C_{VP} = 0.636$
	EF112	EF212	EF312	EF122	EF222	EF322	EF132	EF232	EF332
L_{PP} (m)	145.50	155.20	164.90	168.00	179.20	190.40	190.50	203.20	215.90
L_{WL} (m)	151.71	161.82	171.93	175.17	187.08	198.63	198.52	211.87	225.11
B (m)	19.40	19.40	19.40	22.40	22.40	22.40	25.40	25.40	25.40
WS (m²)	2989	3188	3397	3784	4063	4287	4675	4986	5297
∇ (m³)	8256	8807	9357	11011	11745	12479	14169	15113	16058
Trailers	100	110	120	142	152	162	186	197	208
PL/W	0.368	0.357	0.350	0.369	0.347	0.328	0.356	0.328	0.300

Table B

	$C_B = 0.420$			$C_X = 0.850$			$C_{WP} = 0.794$		$C_{VP} = 0.642$
	EF111	EF211	EF311	EF121	EF221	EF321	EF131	EF231	EF331
L_{PP} (m)	145.50	155.20	164.90	168.00	179.20	190.40	190.50	203.20	215.90
L_{WL} (m)	152.77	162.71	171.93	175.17	187.08	198.63	199.71	213.03	226.35
B (m)	19.40	19.40	19.40	22.40	22.40	22.40	25.40	25.40	25.40
WS (m²)	3098	3303	3509	3897	4157	4416	4820	5141	5461
∇ (m³)	8780	9366	9951	11718	12501	13280	15078	16084	17089
Trailers	100	110	120	142	152	162	186	197	208
PL/W	0.400	0.393	0.381	0.487	0.463	0.438	0.451	0.442	0.391

Table C

Table V

presence or absence of propeller cavitation, noise and vibration. Slender medium-sized ro-ro ships can require dramatic design changes for optimum fuel efficiency.

Hull form

In determining the principal dimensions and appropriate form parameters, a number of restrictions have been imposed, mainly on length and draught because of shipyard and port limitations. Improvement of hull selection has to explore the disposition of cargo space concurrently with form selection.

Since high cruising speed in a seaway is the main technical objective, a form with high slenderness ratio has been selected, meant to significantly reduce the primary resistance hump, although it yields slight increases in structural weight fraction. The design water line with fine entrance runs at full beam almost all the way to the transom, resulting in a buttock flow astern. 'V' shaped sections are fitted together with increased freeboard and flare, in order to reduce the negative effects due to more motions exhibited by slender ships with respect to usual hulls, although these features probably induce some extra cost and loss of deadweight.

Since many recent accidents depended on bad turning behaviour, the following design features have been avoided: small GM, high windage, XB near to amidships, aft-body lines with flat sections on the at-rest waterline. Trim by the stern is advised. For a ro-ro ship, the hull depth is a function of clear deck heights and double bottom height.

An early lines plan has been developed in order to derive hull scientific information and to obtain deck cuts and sections used for arrangements. Modifications of initial forms have been performed after analysis of streamflow tests and axial wake surveys performed in the wind tunnel of ICEPRONAV [5]. A soft semitunnel has been sized to accommodate two controllable-pitch propellers. **Figure 2** shows an isometric view and the body plan of EF322 hull form.

Internal arrangement

Provision of space and its efficient utilisation for ro-ro trailer vessels has a great importance on the general ship effectiveness so that it is necessary to consider alternative layouts which satisfy goals and constraints set by designer since concept design stage. Exploration is focused here on the main areas of the ship. The use of space for stowage of trailers and for efficient and speedy loading/unloading have been optimised. The arrangement devised for subdivision of vehicle decks has fully taken into account safety considerations.

The analysis of a number of layout designs has produced a detailed breakdown of the location of each trailer on the vessel both in terms of its geometric centre and its assumed centre of gravity. Thus it has been possible to assess the effect of various loading arrangement on the overall displacement and minimum acceptable stability of the vessel. General arrangement plan of 'FUTURA' vessel is shown in **Figure 3**.

With a double bottom height of B/10 and imposing a nominal trailer height of 4.5 metres, the resulting depth for the ro-ro ships of the series range between 12.9 and 13.3 metres. Salt water ballast tankage is arranged in such a way to

provide operational flexibility and to minimise any negative effects on the ship's economic viability resulting from damage stability requirements.
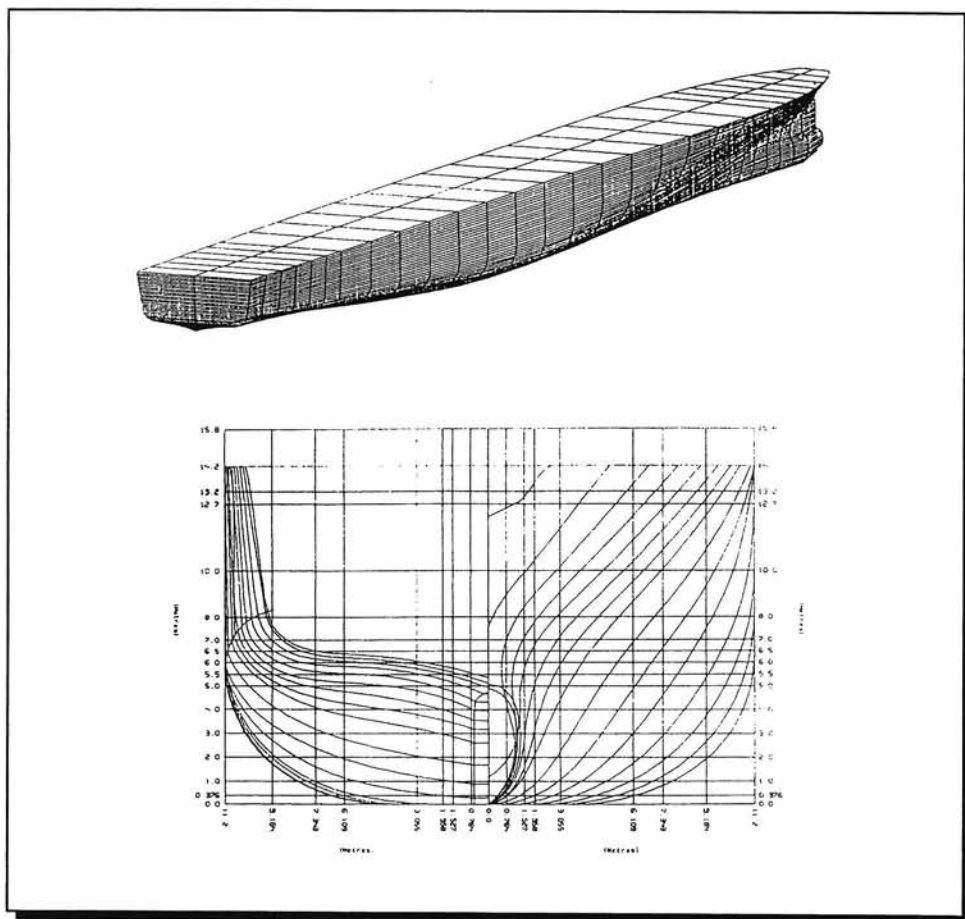
Figure 2: EF322 Vessel

The double bottom under the machinery space, although limited in volume, is available for distilled water, sewage, dirty bilge, and other miscellaneous small tanks. Fore and aft peak tanks are available for salt water ballast to control trim. Potable water tanks are located in a cofferdam aft of the machinery space. Fuel tanks and fuel oil tanks are located in deep tanks situated away from the side shell, so reducing the risk of fuel and fuel oil spill in the event of side damage. High standard accommodation, amenities, and a pilothouse are located forward also to facilitate trim by the stern imposed to increase propeller diameter, to avoid propeller ventilation, and to provide effective protection for the trailers stowed on deck. This avoids a forecastle, offers advantages for the new IMO

visibility requirements, and isolates crew's living quarters and cabins from the noise and vibration associated with the propulsion machinery. The lower headroom of the medium speed diesel plant will significantly improve access in way of the two fixed internal stern ramps giving access to the tanktop and the upper deck with a maximum allowable 12 percent slope.

The midship section consists of a double bottom, a main deck and an upper deck, and alternatively of two longitudinal bulkheads positioned at B/5 with cross floodings or of a so called "C-format configuration". The latter solution improves ro-ro survivability and safety but with a certain loss of payload, which is however less than the loss due to adoption of transverse bulkheads or transverse doors [6].
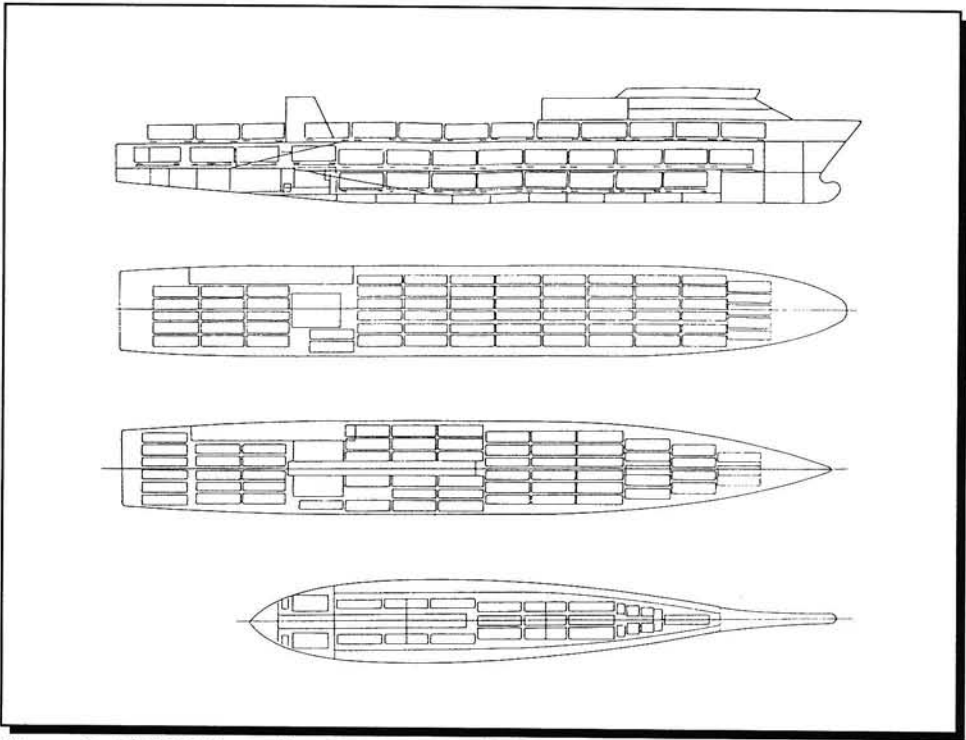
Figure 3: EF322 Vessel's arrangement plant

Structures

Ro-ro vessels often have complex structural configurations which are dictated by standard dimensions of trailers, limitations on clear heights, etc. The distribution of hull scantlings for the majority of the stiffening and plating has been

established from the one visible in some Italian ro-ro ships built in recent years. In terms of hull girder bending moment and hence required girder strength, the finer block coefficient results in a very slight decrease in the required strength. Therefore, the usual scantlings can be used safely for this project, providing a hull girder strength in accordance with the requirements of international classification societies.

Higher tensile steel is used for the twin-deck girder. In selecting components of a ship decisions can be taken on the basis of selecting the material and its distribution, that do the most to enhance the ship's overall measure of merit. Longitudinal strength is decisive for these long and slender forms. The maximum stillwater bending moments occur in the hogging conditions because of the low block coefficients associated with high vessel speed.

Lightship weight and centres

Weight reduction is necessary to facilitate high speed for a ship intermediate in performance and cost between contemporary ro-ro ships and advanced concepts such as multihulls. Ro-ro trailer vessels exhibit the characteristic of high lightship to deadweight ratio. A strict control of the steelmass becomes necessary through the combined use of mild and higher tensile steels in hull structure, aluminium in superstructure and lightweight outfit materials. Different standards of weight reduction have to be economically justifiable, and multicriterial design approach can assess the trade-off reliably. Weight reduction will improve stability because of reduced top weight, eventually inducing a reduced breadth to achieve the same stability standards.

Estimate of steelmass, outfit, and machinery weights together with estimate of corresponding centres of gravity are derived from expressions given by Watson and Gillfillan [7], which have been revised according to confidential information received by the authors. Different weight subgroups have been studied and different variants within weight subgroups have been examined to determine the influence that changes in the design features might have on the lightship weight. The estimate of lightship weight has been completed through its breakdown into three categories, i.e., ship structure, outfit and machinery. Weight of ship structure includes hull structure, superstructure, foundations for machinery and other equipment. In the case of the "C-format" configuration the calculated light ship weight has increased in the order of magnitude of 5%. Outfit weight is based on a square number method. The machinery weights are obtained from information supplied by the engine manufacturer.

Stability

Comprehensive stability assessment is a major factor in hull form selection to make a design viable. Intact stability is considered in terms of maximum permissible KG values measured against IMO intact criterion, for a range of draughts

using two extreme loading conditions. Some limitations on wind area of super-structure arrangements have resulted by imposing IMO weather criterion.

Flooding

Recent introduction of more stringent damage stability requirements clearly indicates that contemporary ro-ro ships are vulnerable to flooding. In fact, they are more susceptible to capsize than other ship types. It is thus important to introduce flooding since concept design stage.

Instead of applying the prescriptive rules (the IMO 1990 stability regulations) governing passenger-carrying vessels, an alternative approach based on setting targets is applied. Some systematic evaluation seems to indicate that freeboard associated with B/T ratio are main parameters to be included in damage stability assessment. For the time being, the mean line capsize results plot devised by Dand [8] is used as a qualitative target which relates the wave-height non-dimensionalised with respect to flooded freeboard Hf/F with the non-dimensional parameter $GMf \cdot CB \cdot T/B2$. All ro-ro vessels considered are two-compartment ships.

Seakeeping performance

The propulsion performance in waves is perhaps the key topic in the overall economy of the design project. The seakeeping ability determines the vessel's operability as well as ride comfort and habitability on board. Since two active folding type fin stabilisers and anti-rolling system are fitted to avoid high roll motions, the analysis is bound to vertical plane responses.

Added resistance calculations have been performed in long-crested head seas only, since the most critical motions affecting involuntary speed reduction usually occur in that case. As one of the main goals of the project is to assure time schedule during the whole year, added resistance in waves were calculated for sea-state 5 in Mediterranean seas, area 27 [9].

The merit characteristics of the series of alternative vessels are investigated based on evaluation of seakeeping capabilities in severe operating conditions [10]. The merit rating analysis covers the use of seakeeping computations to give a reliable prediction about the basic seaworthiness which the vessel should possess, thus enabling the designer to perform a thorough evaluation of the design alternatives. The following strategy has been designed when performing this evaluation [11]:

* Main factors affecting the operational performance are utilised for a reliable assessment of the vessel's seaworthiness;
* This assessment considers the long-term forecast in the seaway where the vessel will operate;

* At an early stage in the design process the vessel's merit is determined by the occurrences limiting the vessel's operability.

Here, the merit rating has been examined by means of an analytical procedure which yields the percentage of vessel's operating time by applying different seakeeping design criteria. The long-term probability distribution of the seaway conditions has been introduced analytically by an explicit expression and the maximum wave heights have been determined by considering when the operability is unsatisfied at the minimum economical service speed.
The operability limits have been established by assuming criteria of ship behaviour in severe seas [12] as follows:

* Pitch: the probability of exceeding a r.m.s. double amplitude of 2.0 degrees is less than 2.5%;
* Absolute vertical acceleration: the probability of exceeding 0.4g at bridge is less than 5%;
* Slamming: the probability of occurrences is less than 2% at station 0.15L aft FP;
* Deck wetness: the probability has not to exceed 2% at FP.

The first two attributes can be referred to a stable platform requirement, whereas the minimisation of the two latter assures high mobility in a seaway. Propeller emergence is not included as the vessel is designed to run at a constant stern draught, corresponding to the full load stern draught.
The mathematical representation of the probabilities for different events at given limits can be stated in terms of Weibull distribution, except for the vertical acceleration to which Rayleigh distribution has been applied. For each event the minimum significant height h among the N heights represents the operability limit for the vessel in a given sea state having a certain mean period T and a significant unit height H1/3. This can be stated as:

$$h_v(T_v) = \min\{H_{1/3}(T)\}_i, \ i=1, \ N$$

Thus, for every vessel at each speed and heading, the significant limits for each of the N operative limits can be obtained. Minimum limit height in previous equation divides the plane height-period into two regions, where the lower region represents the aggregate sea states where the vessel at given speed and heading will operate within assumed limits. The percentage of operability is given by the probability to encounter such sea states $P\{h_v(T_v)\}$. The percentage of the vessel's operational effectiveness at different speeds and headings has been obtained for all period groups weighted with the marginal probability of occurrence M_j related to each period range, found by summing up the elements of each column in the statistical sea table. Then, the vessel's operating time as a percentage is expressed by integrating previous equation, i.e.:

$$h = 100 \Sigma P\{h_v(T_v)\} Mj$$

The operating time resulting when assigning equal weights to times corresponding to pitch, vertical acceleration, slamming and deck wetness, constitute the score to be included into the rank procedure.

Powering

An estimate of the power and propeller revolutions per minute has been made both in trial and service conditions at full load displacement. Resistance evaluation has been based on the statistics provided by Fung [13], corrected according to the measurements carried out for FUTURA prototype at ICEPRONAV. Propulsive coefficients are based on Holtrop's regression formulae [14] tuned up according to authors' data base of self-propulsion tests. The propeller design had to meet the 0.75 maximal A_E/A_0 requirement for a five-bladed controllable-pitch propeller with a hull/tip clearance equal to 26 percent of the diameter. Propeller performance characteristics have been based upon the Wageningen B-screw series introducing CPP correction on the efficiency according to Koning, as referenced in [15]. In addition a mechanical efficiency of 0.97 has been used in determining brake power required. A machinery maintenance margin of 10 percent is used to calculate trial and cruising speed.

Then, the engine power required has been converted, via specific fuel consumption assumed equivalent to 140g/kWh, to the amount of fuel needed to complete the loaded leg of the voyage for a week, plus 20 percent margin for emergencies. Fuel required for electrical generation and hotel services is fairly independent of ship speed. It has thus been straightforward to determine the total fuel consumption per year.

Power plant

The selection of main power plant to be installed is primarily governed by the need to achieve high power to weight ratio and fuel economy. The main propulsion apparatus is based on four medium-speed diesel engines coupled to two gear boxes fitted to controllable-pitch propellers through two shaft lines. The ship has three shaft alternator sets rated at 1000kW for electric load. They are normally operated with two on line and one on stand by. Manoeuvring is enhanced by three electrical driven bow thrusters, each rated at 800 kW. Air conditioning is supplied by two air conditioning units (2 x 800 kW). Ventilation to the ro-ro decks will be provided by ten axial flow reversible fans.

Thus, it has been possible to determine which of the engines stored in a database of engine particulars are suitable, giving information on output, fuel consumption, revolutions, weight and main dimensions.

For the time being, the use of the gas turbine in Mediterranean (and Black sea) basin should be avoided because of the non-availability of good-quality fuel at a relatively cheap price at all the possible scheduled ports. In any case, for this ro-ro ship concept of conventional layout, the gas turbine electric propulsion system will always be more expensive when compared with diesel engines of equivalent power. Consequently any proposal to use such a system must be justified by other than initial investment, for example, increased space for trailers and reduced maintenance.

Hull vibration

The fast ro-ro ship will operate at high powers in relation to size and weight, thus causing vibrations to feature significantly. At concept design stage frequency coincidences have to be avoided in the vicinity of blade frequency and double blade frequency.
First approximation to the four modes of natural vertical frequencies have been estimated through the virtual masses and inertia, using empirical formulae derived from vibration data collected by Brodarski Institut [16].

Manoeuvrability

Certain rules concerning ship manoeuvrability are to be satisfied since concept design, at least in calm conditions. Manoeuvrability in port must be easy and possible with a minimum of turnings. Use has been made of the turning ability index expressed in terms of Nomoto indices and of the dynamic stability condition suggested by Abkowitz, through evaluation of acceleration and velocity derivatives according to regression analysis equations provided by Clarke et al. [17]. The new shup concept's high degree of manoeuvrability is promised by the CP propellers and the twin active spade type rudders. The controllable-pitch propellers have been assumed to turn inwards in order to improve manoeuvrability, particularly astern. Since a fast ro-ro vessel has to operate on tight schedules, generally berthing without tug assistance, the fitting of two bow-thrusters and a stern thruster is recommended.

ECONOMIC MODEL

Engineering economics form an essential portion of the project analysis as an advisor for putting orders and a necessary guide for obtaining the optimal free variables of a ship. It is a necessary tool to rank ships according to their techno-economic qualities, preliminary to decision-making procedures directed to the achievement of maximum economic effectiveness of the ship's exploitation.

Thus, decisions on geometric design parameters affecting technical factors are based on search for maximum economic benefit.

The developed model uses an additive cost approach where relationship between economic factors are very simple also for naval architects and single costs are simply summed up. In optimising economy of a fast ro-ro ship operation incomes as well as costs must be considered. For freight-earning vessels, annual income can be regarded as a function of trailer fare x average payload units per voyage x number of voyages per annum, finally producing cash flow and rate of return on investment.

Among the most commonly used economic cost functions here the required freight rate (RFR), i.e., that rate per trailer at which the present worth of incomes and costs are equal, giving zero net present value (NPV), is assumed as measure of merit.

$$RFR=[(CRF)P+Y_o+Y_v]/C$$

where: CRF = a capital recovery factor large enough to return the investment plus a reasonable level of profit after tax; it is assumed to have a mean yearly rate equivalent to 13 percent of acquisition price;

P   = capital investment;

C   = average annual quantity of trailers;

Y_o = annual operating costs;

Y_v = annual voyage costs.

Capital charges have been evaluated for uniform cash flows and single payment acquisition; they are affected by a straight-line depreciation. Since at early design stages the designer is primarily concerned with differences among alternatives, it is not so important to search for precise and absolute values of costs but to obtain the correct relative costs. Nevertheless, a breakdown of cost information analysis is summarised here.

Construction cost

The total construction cost can be split into material costs, labour costs, and overheads. The approximate method for early total construction cost estimation follows the scheme suggested by Carreyette [18].

The cost of steel construction utilises the prismatic coefficient instead of block coefficient as a 'shape factor', because the former gives a better indication of curvature distribution along the hull and therefore of work content. It decreases linearly with a gradient of $1.3 \cdot 10^{-3}$ per ton of steel weight increment. The cost per ton of outfit is assumed independent of ship size. The cost of machinery has been obtained from information supplied by a manufacturer of large medium-speed diesels. From 'The Motor Ship' surveys it has been determined that for ro-ro ships employing medium-speed diesel engines for main propulsion,

the total cost of machinery, including hull engineering, is 2.1 times the cost of the main engine.

The model of labour cost makes use of man-hour coefficients proposed by Winkle [19] and tailored according to records obtained by an Italian shipyard. To convert steelwork man-hours to total steelwork labour costs, an Italian average wage rate, overheads 100%, and profit 10% have been applied.

Finally, the cost equation comprehensive of profit for the shipbuilder is used as:

$$Total\ Construction\ Cost = Total\ Material\ Cost + Total\ Labour\ Cost + Profit$$

Then, this first cost has been updated because of special equipment incorporated in the ship, such as twin-screw installation, controllable pitch propellers, thrusters, stabilisers, etc. Previous equation allows to immediately evaluate the revised cost of alternative ships around the parent vessel, by running new estimates of steelweight, outfit weight and engine(s) power.

The shipbuilder cost includes also cost for design and supervision, plus any immediate financial charges.

Operating costs

The annual operating costs are estimated according to Benford formulations [20], revised on the basis of confidential information received by the authors. These costs are independent of the trade routes in which the ship will be engaged. They include maintenance (manpower, material, overhead) costs, crew wages and benefits, insurance and port costs, ship and management costs, and loan repayment.

Voyage costs

They cover fuel and oil costs, port and light fees, and miscellaneous port expenses. The fuel cost is based on fuel annual requirements. The voyage costs are a function of the number of voyages per year.

PREFERENCE ORDER FOR EVALUATION

The need for rational decision making is especially significant during early stage design, provided that the designer has the ability and the synthesis tools to rationally evaluate the design alternatives he can produce. Here the design problem is to optimise the dimensions of a fast ro-ro trailer ship for a coastal trade in the Mediterranean basin. In order to come closer to the 'real world' of the ship design process, all single criterion or single objective procedures have been avoided. Thus selection of the best possible ship among a discrete number

of alternatives which results to be the best achievable compromise when technical and economic requirements are simultaneously considered, calls for a multi-faceted decision-making procedure (MADM). Without the mathematical complexities of other non-linear optimisation methods such as multiple objective decision-making techniques, the MADM procedure is safe of failure in the process of design selection. Use is here made of the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) developed by Hwang and Yoon [21], fully illustrated by Trincas [22] for optimising propulsive performance of fishing vessels in a seaway. In the present paper it is sufficient to summarise the main successive steps of the procedure.

The attribute values (scores) reached by each alternative ship form the following design matrix D including designs which are technically feasible.

$$
D = \begin{array}{c|cccc}
 & X_1 & X_2 & X_j & X_N \\
\hline
A_1 & x_{11} & x_{12} & x_{1j} & x_{1n} \\
A_2 & x_{21} & x_{22} & x_{2j} & x_{2n} \\
A_i & x_{i1} & x_{i2} & x_{ij} & x_{in} \\
A_m & x_{m1} & x_{m2} & x_{mj} & x_{mn}
\end{array}
$$

where: A = the ith design

x_{ij} = the numerical score of the ith alternative with respect to the jth attribute X_j.

The scores are assumed to be known with certainty. Since the various attributes, measured in different scales, must be compared, the design matrix is then normalized by eventual accomodation of a set of weights $w = (w_1, w_2, .., w_j..., w_n)$ from inter-attribute preference matrix via hierarchical structures [23], to introduce heuristic judgements of the decision maker (the designer, the owner, etc.). After determination of ideal (A^+) and negative-ideal (A^-) solutions, calculated by introduction of Euclidean distances in the n-dimensional attribute space, the separation measures S_{i+} and S_{i-} of each alternative from A^+ and A^- are evaluated. Finally the preferred solutions are extracted through ranking among the set of alternative ships by calculating the relative closeness to the ideal solution, defined as

$$C_{i+} = S_{i-}/(S_{i+} + S_{i-}) \quad 0 < C_{i+} < 1, \quad i = 1, 2, ..., m$$

The process of design selection is basically interactive since the designer might like to vary and refine his preference through sensitivity study. The set of alternative designs can now be ranked according to the descending order.

STRUCTURING THE DESIGN PROBLEM

The relative merit of shorter and longer ships is not so straightforward to be determined. Large ships are cheaper per unit of trailer at sea in terms of construction cost, as well as in terms of fuel and crew costs. Limits are set by various operating diseconomies, including higher costs in port and difficulties in maintaining service quality and efficient operating patterns as ship size increases in relation to the amount of traffic flow. The main diseconomies of large ship operation are encountered in the port sector where at any given handling rate ship costs relatively increase with both size and speed. It is therefore necessary to control the overall balance between economies at sea and diseconomies in port. There are also diseconomies of speed which are a reflection of the fact that the daily costs of a fast ship are greater than those of a slow ship even when it is at berth. An important measure of merit is the payload/weight ratio, which not only depends on the type of the vessel or its speed but also on the length of the route. On long routes, such as Trieste/Ancona/Split/Patras, Civitavecchia/ Tunis, Barcelona/Civitavecchia, fast vessels should carry substantial bunkers which reduce the trailer capacity.

A total of 30 design alternatives, i.e., the parent hulls and the series set up from ECOFAST vessel has been investigated. After preliminary technical design of the considered set of alternatives, estimate of their first cost, and of operating and voyage costs have been carried out, thus performing a global economic evaluation. The trade route chosen is meant to represent the trailer traffic from Trieste to Bari. The worth of competitive designs have been analysed under application of different preference requirements. The design requirements and criteria to establish goals for the fast ro-ro ship's performance and capability are the following:

* Ship is to be Italy-built and operated;
* Propulsion is to be by conventional geared medium speed diesels, twin-screw;
* Design draught is limited to 6 metres;
* Range has to assure transit for seven days, plus a 20 percent margin;
* Cost levels are to be taken as appropriate to 1994, with bunker oil at 110$ per ton;
* The income tax rate is 48 percent;
* The economic life and tax life are taken at 15 years, with zero-salvage value and straight-line depreciation;
* The after-tax yield (for RFR) is to be 10 percent;
* Average deployment is 340 days per year.

The MADM model evaluation combines naval architecture and economic targets, consisting of the following seven attributes: calm weather speed (A_1), service speed in a given seaway (A_2), operating time in winter (A_3), safety against

capsize in damage conditions (A_4), payload-to-weight ratio (A_5), acquisition cost (A6), and RFR giving zero NPV (A_7). The first five attributes are benefit criteria, the others are cost criteria. Other naval architecture features, i.e., longitudinal strength, intact stability, hull vibration, and manoeuvrability, are used as first level constraints to produce feasible designs. Alternatives which do not meet these constraints are dropped.

Given all the above, the task is to find the best possible vessel among the competitive ships. Preliminary calculations of each attribute have been performed off-line. The attributes have been assumed independent, which allowed to break down the evaluation of multi-facted alternatives into single evaluations.

Results of powering calculations are given in **Table VI**, where P_B(trial) and P_B(tserv) are referred to main engine power required to reach 28 knots and 24 knots in trial and service condition (sea state 4-5), respectively. As the installed power is varied by changing the number of cylinders in discrete steps, fuel consumption per year has been evaluated by modifying obtained power values on a per-cylinder basis. Both the main engine and the generators use the same heavy grade fuel. The propellers have the same diameter for all the ships (D = 4.7 m). The payload has been considered independent of the variation of speed in the sense that the bunkered fuel remains the same for all the alternative designs.

For every alternative design the absorbed brake power required to run at 24 knots in sea state 5 is always less than the power necessary to reach 28 knots in trial condition. This allows some margin if one considers uncertainty in predicting added resistance when using linear seakeeping theories. The last two rows in **Tables VI** indicate the trial and service speed attainable by each candidate vessel with the same propulsion system fitted, running at 90 percent MCR. The obtained values can be considered as merit indexes for ship speed requirements, being aware that for the smaller ships installation of such engines would imply modifications in internal arrangement and subdivision.

As far as seakeeping is concerned, factors affecting operational effectiveness are reported in **Table VII** in terms of percentage of operating time when winter sea state environment in East Mediterranean area is specified, and maximum permissible values are introduced according to previous discussion. The proportion of time entering in the preference merit procedure is obtained from the equiweighted sum of the scores reached by the four seakeeping attributes.

All the ships of the series are assumed to run at almost the same draught (T = 5.97 m). Piecemeal deformations of hull shape, such as minor variation of block coefficient, have very little effect on the operating time as a result of little variation of ship motions in the vertical plane. Analysis of results show the major importance of changing the length-to-beam and beam-to-draught ratios, and consequently the waterplane area coeffient and the vertical prismatic coefficient. Larger L/B and B/T ratios are seen to increase all the seakeeping features and then the operating time, as a consequence of the lower excitations from the waves and of the larger added mass and damping coefficients as-

	FUTURA	ECONOMY	ECOFAST
Pitch	98.06	96.93	93.93
Acceleration	96.49	94.76	95.18
Slamming	94.34	92.98	93.65
Deck wetness	90.16	90.18	89.62

Table A

	EF111	EF211	EF311	EF121	EF221	EF321	EF131	EF231	EF331
Pitch	90.35	91.56	93.31	94.67	96.46	97.16	97.56	98.37	99.69
Acceleration	84.76	86.65	88.82	91.38	93.53	94.77	95.85	97.02	95.04
Slamming	90.04	90.75	91.72	92.32	93.51	94.14	94.33	95.17	97.26
Deck wetness	83.77	84.14	86.58	86.82	88.18	89.33	89.82	90.73	94.36

Table B

	EF112	EF212	EF312	EF122	EF222	EF322	EF132	EF232	EF332
Pitch	90.61	92.56	94.21	95.42	96.84	97.66	97.99	98.69	99.18
Acceleration	85.64	88.05	90.19	92.56	94.22	95.73	96.65	97.67	98.41
Slamming	89.88	90.96	91.91	92.50	93.51	94.26	94.45	95.26	96.28
Deck wetness	84.05	85.04	85.99	88.04	89.09	89.51	90.63	91.51	92.31

Table C

	EF113	EF213	EF313	EF123	EF223	EF323	EF133	EF233	EF333
Pitch	91.26	93.13	94.71	95.86	97.04	97.93	98.24	98.87	99.23
Acceleration	86.65	89.03	91.13	93.96	95.01	96.33	97.15	98.06	97.14
Slamming	89.88	90.95	91.91	92.49	93.42	94.23	94.42	95.21	94.76
Deck wetness	84.57	85.58	86.54	87.51	89.50	90.07	89.91	92.23	91.11

Table D

Table VI

sociated with increased displacement. Wider beams give lower levels of pitch motion and vertical acceleration. Slamming is poorly penalised because of sufficient draught established. A large forward waterplane gives favourable changes in both absolute and relative motions and in the probability of slamming.

Damage stability is accounted for by transforming position of each candidate vessel with respect to Dand's capsize mean line into safe and unsafe target. Unsafe ships are cut off, while increasing numerical values are assigned to growing qualitative attribute (safety against capsizing in damage condition) by using the 'bipolar scale' introduced by Mac Crimmon [24] for benefit attributes as illustrated in **Table VIII**.

		FUTURA	ECONOMY	ECOFAST
$P_{B(trial)}$	(kW)	33215	32007	28816
$P_{B(serv.)}$	(kW)	28376	26633	26175
Fuel	(t)	17678	17500	16990
$V_{(trial)}$	(Kn)	26.90	26.90	27.90
$V_{(serv)}$	(Kn)	24.00	23.65	23.65

Table A

		EF111	EF211	EF311	EF121	EF221	EF321	EF131	EF231	EF331
$P_{B(trial)}$	(kW)	27999	25626	23873	26958	25483	24573	23905	23399	23375
$P_{B(serv.)}$	(kW)	24809	23415	21507	25109	23606	22161	23508	21974	20994
Fuel	(t)	16760	16203	15991	16652	16342	16126	16167	15964	15870
$V_{(trial)}$	(Kn)	28.10	28.90	29.50	28.50	29.00	29..30	29.50	29.70	29.70
$V_{(serv)}$	(Kn)	25.10	25.60	26.30	25.00	25.50	26.00	25.50	26.00	26.10

Table B

		EF112	EF212	EF312	EF122	EF222	EF322	EF132	EF232	EF332
$P_{B(trial)}$	(kW)	30300	27697	26286	29611	28270	27695	32025	31797	31982
$P_{B(serv.)}$	(kW)	25686	24405	23327	28649	25679	24724	20765	29587	28817
Fuel	(t)	17125	16693	16423	17138	16868	16706	27678	17597	17583
$V_{(trial)}$	(Kn)	27.40	28.20	28.70	27.60	28.00	28.20	26.90	26.90	26.90
$V_{(serv)}$	(Kn)	24.75	25.25	25.60	24.40	24.75	25.20	23.40	23.70	23.80

Table C

		EF113	EF213	EF313	EF123	EF223	EF323	EF133	EF233	EF333
$P_{B(trial)}$	(kW)	32505	29904	28.39	32872	31848	31370	36886	36706	36968
$P_{B(serv.)}$	(kW)	26767	25599	24613	29733	28532	27924	34370	32412	31155
Fuel	(t)	17462	27071	16801	17759	17516	17408	18353	18263	18173
$V_{(trial)}$	(Kn)	26.75	27.50	28.00	26.60	28.95	27.10	25.75	25.80	25.75
$V_{(serv)}$	(Kn)	24.50	24.80	25.15	23.60	23.95	24.20	22.70	23.00	23.30

Table D

Table VII

Once the building cost and the annual operating costs have been determined, the economic model which takes also into account depreciation and taxes, is applied over the economic life of the ship. In this way, the required freight rate giving zero NPV is literally determined as an operation success indicator, assuming a load factor of 70 percent for all the alternative ships.

The total invested capital is assumed to be borrowed from a bank or as a subsidy from government at a specified rate of interest. The return after tax to the

1	2	3	4	5
Very low	Low	Average	High	Very high

Table VIII

owner is determined taking into consideration the loan period as well as the period and the amount of down payment. The repayments are paid in equal annual amounts, each consisting of the interest payment and the annual share of the loan quantity.

SENSITIVITY STUDY

Once the attributes have been described in numerical form, the designer has to rationally evaluate the design alternatives. His main duty is to assign weighting factors which reflect the relative contribution of each attribute to outranking relation. The weights serve as scaling factors which reduce all the score scales to a common scale of measurement. An over-all score defined by the relative closeness to the ideal solution C_{i+} may be assigned to each multi-faceted design. Its value represents the relative worth of each alternative ship in the outranking relation.

In our case study designs EF112, EF113, EF331, EF332, and EF333, have been dropped on the basis of basic requirements and first level constraints. Results from damage stability analysis have shown that ships EF111, EF211, EF212, and EF213 are unsafe. The design matrix have been thus reduced to 21 alternatives. The normalised design matrix reads:

		A_1	A_2	A_3	A_4	A_5	A_6	A_7
	EF311	0.2316	0.2330	0.2102	0.1893	0.2402	0.1654	0.1619
	EF121	0.2237	0.2215	0.2130	0.2132	0.1946	0.1915	0.2070
	EF221	0.2276	0.2259	0.2168	0.2132	0..1843	0.1987	0.2429
	EF321	0.2300	0.2304	0.2189	0.2132	0.1706	0.2085	0.2787
	EF131	0.2316	0.2259	0.2202	0.2365	0.1735	0.2377	0.3550
	EF231	0.2331	0.2304	0.2224	0.2365	0.1735	0.2377	0.2550
	EF312	0.2253	0.2268	0.2113	0.1901	0.1997	0.1724	0.1370
	EF122	0.2167	0.2197	0.2149	0.2140	0.2106	0.1996	0.1775
	EF222	0.2198	0.2193	0.2179	0.2140	0.1980	0.2083	0.1993
R =	EF322	0.2214	0.2233	0.2200	0.2140	0.1872	0.2183	0.2304
	EF132	0.2112	0.2073	0.2215	0.2366	0.2031	0.2463	0.2615
	EF313	0.2112	0.2100	0.2235	0.2366	0.1872	0.2603	0.2615
	EF232	0.2198	0.2228	0.2125	0.1895	0.2174	0.1775	0.1089
	EF123	0.2088	0.2091	0.2157	0.2133	0.2779	0.2057	0.1448
	EF223	0.2116	0.2122	0.2187	0.2133	0.2642	0.2147	0.1666
	EF323	0.2127	0.2144	0.2208	0.2133	0.2499	0.2256	0.1868
	EF133	0.2021	0.2011	0.2215	0.2371	0.2574	0.2573	0.2195
	EF233	0.2025	0.2038	0.2242	0.2371	0.2408	0.2732	0.1946
	FUTURA	0.2088	0.2126	0.2211	0.2218	0.2071	0.2290	0.1666
	ECONOMY	0.2088	0.2095	0.2186	0.2210	0.2448	0.3211	0.1806
	ECOFAST	0.2190	0.2184	0.2172	0.2168	0.2368	0.2200	0.1666

The TOPSIS algorithm can assign the inter-attribute numerical weights (cardinal) allowing the designer to reach synthesis, that is, the capability to rank the alternative ships according to the descending order of closeness to the ideal solution. Different weights have been applied to the seven attributes in the normalised matrix simulating eventual preferences of the decision-maker (see Table IX). Case (a) equivalent weights between naval architecture and economic attributes; case (b) accommodates weak importance to economics over technical qualities; case (c) accommodates dominance of economic attributes.

Case	W_1	W_2	W_3	W_4	W_5	W_6	W_7
(a)	0.150	0.050	0.200	0.100	0.100	0.300	0.100
(b)	0.225	0.075	0.200	0.200	0.075	0.150	0.075
(c)	0.125	0.025	0.075	0.075	0.200	0.300	0.200

Table IX: Vectors of weighting factors

Consequently, the following preference orders have been yielded:

Case (a):   EF311, EF131, EF221, EF321, EF121, EF312, EF231, EF313,....
Case (b):   EF131, EF231, EF321, EF221, EF121, EF311, EF132, EF322,....
Case (c):   EF131, EF231, EF321, EF221, EF132, EF331, EF322, EF232,....

It seems that vessels EF131, EF321, and EF231 are the best solutions according to the rank. They present lower power absorption also in waves, high operability effectiveness, and low required freight rate. The main drawback seems to be the relatively low payload-to-weight ratio thus calling for lighter trailers. It results that the longer ships are to be generally preferred although they are more expensive if the same propulsion system is fitted. Then the question is whether there are sufficient advantages associated with the bigger ships to justify their selection. A preliminary answer can be given by examining the scores reached by the best candidate designs for the attributes considered. The figures from the naval architecture model show that the long hull forms have lower fuel consumption and a higher service speed in a seaway than the short ships. Moreover, for target speeds the longer ships present lower motions and dynamic effects, giving higher effectiveness in severe weather conditions. Among the others, the latter induces substantial advantages in operating costs, on the basis of days lost at sea, and lower involuntary speed reduction.

CONCLUDING REMARKS

The basic aim of this paper is to propose to some prospective shipping company of shipowner a fast ro-ro ship design for maximising the profitability of trailer traffic flow along Mediterranean routes. The ro-ro ship concept suitable to the fulfilment of potential for seaborne trailer transport has been developed after application of a MADM procedure. It has been reviewed and optimised through systematic calculation on a 'ad-hoc' set-up series, making it faster while guaranteeing global safety, high performance, and low manning and operating costs.

Further improvements from the economic, technical, and commercial viewpoint, depend on a technological jump based on sound research. In the meantime, a prototype of FUTURA concept has been submitted to systematic experimental studies (performance prediction, powering in waves, seakeeping, manoeuvrability) at ICEPRONAV, in order to validate analytical and numerical computation tools as well as check the range of applicability for future ships of this type. It is difficult to forecast the long term development of the ro-ro trailer vessels, because this depends mostly on development of ro-ro traffic, transport policy in EU, competition with road-based transport. The harbour system remains the key flowing junction in the intermodal transport system. Maritime services have to offer frequencies and capacity adequate to traffic flows, i.e., carriers should group into intermodal companies to provide efficient waterborne conveyance.

Nevertheless, a number of elements which form the basis for the design of the 'ro-ro trailer vessel of the future' have been nucleated. The size of the vessel selected should be later subject to closer scrutiny, but it will be usually not changed to a great extent. The fact that such ships do not currently exist does not mean that they can be discarded 'a priori'. In fact, the analysis has pointed out that slight increases in acquisition cost are more than balanced by superior performance and effectiveness as well as by lower life-cycle costs.

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ARE RORO FERRIES SUBSIDIZING LOLOS?

By E. Heirung

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ARE RORO FERRIES SUBSIDIZING LOLOS?

In the last century ship measurement and port tariffs possibly had some kind of logic when Admiral Moorsom introduced his rules. Ever since, rules have become increasingly illogical and even controversial. However, since stevedoring and terminal handling costs were many times higher than the ship and cargo dues levied by the port authorities, the latter costs were paid little attention.

When the seafaring nations agreed upon the 1969 convention on new rules for ship measurement, the convention itself was not especially aimed at port tariffs - it proposed a fair change eliminating practised abuse, especially by open shelter-deckers which also had an influence on manning rules.

Today stevedoring costs have been relatively reduced and for selfdrive ro-ro ferries the stevedoring costs are practically nil. For these operations the ship and cargo dues are relatively important.

WHY PORT DUES?

It is quite natural that ports should invoice vessels for the use of port facilities such as capital cost, wear and tear and administration. Up until now this has usually been linked up with the ship volume - Gross Register Ton (GRT) or Net Register Ton (NRT) - and charged per 24 hours. In some countries the port dues are viewed as a source for financial income for the governments (Africa, the Philippines), some ports are run on a commercial basis by private companies charging as much as the market can bear, and some countries subsidise their ports generously in the belief that this will promote trade, industry and welfare.

However, many ports balance their dues to cover their expenses, and this is the case in Norway. We even have a law based on the cost centre principle, stating that port services should not subsidise each other.

The new rules, which will be effective July 18 1994, are also based on ship measurement/volume and are more logical than the previous ones as an expression for the volume of the vessel. The superstructure, the funnel and even masts, are measured and included in the new gross tonnage. Another question might be, What relevance has this to port dues (and manning)?

Ship dues and cargo dues are levied separately and with little reference to the use of port facilities. Ship dues are paid per 24 hours, even for ferries staying only one hour in port. Cargo dues are the same for cargo staying 2-7 days in port, discharged/loaded from/to lo-lo vessels, and for cargo from a ro-ro vessel leaving the port after half an hour.

If a 1599 GRT general cargo vessel, ro-ro or lo-lo, brings in 1500 tons import cargo, loads 1500 tons export cargo and stays less than 24 hours in port, the ship dues in the port of Oslo will be about NOK 2700, and the cargo dues will be about NOK 40,000. Under the new measurement rules the GRT will increase in average for lo-los with 130% and for ro-ros with 160% for vessels calling Oslo, but this will have only a marginal effect on the ratio between the ship and cargo dues.

Shipowners are protesting vociferous against the increase in ship dues, but there are not so many protests against the cargo dues - perhaps because these are very often paid by forwarders and covered in the total door/door freight. Further, the forwarders make a profit on adding a percentage to the cargo dues which are equal for all user of the port.

It is strange that port authorities continue to practice such an illogical and counterproductive tariff system, but it is even stranger that ro-ro and ferry operators do not scream louder. The same applies to users of ro-ro services.

The natural thing would be for vessel and cargo jointly to pay for the use of the port facilities - quay front plus sq.m port area - and for the time occupied. This is quite easy to introduce for operators with their own terminals, these could pay a monthly rent irrespective of the tonnage and passengers handled. For common user berths a fair solution might be more difficult to establish, but the existing system is wrong and counterproductive - it even promotes inefficient modes of transportation. An example from Oslo will exemplify this:

One section in Oslo handling lo-lo traffic - Ormsund - has about 40,000 sq.m port area. Yearly traffic is about 60,000 TEUs corresponding to about 40,000 lifts and 400,000 weight tons (1992 figures).

Gross ton per year is about 900,000.

Yearly ship dues	*about*	*NOK*	*800,000*
Cargo dues paid by the customers	*about*	*NOK 5,600,000*	
Total income to the port authority	*about*	*NOK 6,400,000*	

The two container cranes charge NOK 135 per lift. It is calculated that the container cranes show an annual deficit between NOK 3 and 4 million based on normal depreciation, reducing the contribution from this section of the port to about NOK 3 million. Adding some storage rent, the yearly income is NOK 4 million or about NOK 100,000 per day.

An other section of the port - Hjortnes - handles ferry traffic to Germany and Denmark - about 30,000 sq.m port area.

The yearly traffic is about:

- *600,000 tonnes, all ro-ro, selfdrive and articulated;*
- *800,000 passengers;*
- *180,000 passenger cars;*
- *3000 buses;*
- *15 million gross tonnes.*

The income picture is:

Ship dues	*NOK*	*7.8 million*
Customer dues	*NOK*	*14.8 million*
Total	*NOK*	*22.6 million*

There are no costly container cranes, and if we assume that the wear and tear is about the same, this gives a gross revenue to the port authority of about NOK 700,000 per day .

If Norwegian law was followed - applying the cost centre principle - and no cross subsidising was allowed - the port and cargo charges per TEU should be increased by about NOK 200 and the crane charge by about NOK 80 at Ormsund.

The charges on TEU basis should be reduced by about NOK 200 at Hjortnes, giving a difference in port charges including crane use of about NOK 480 between the two sections of the port.

Compared to freight rates Norway-Germany and Norway-Denmark, which are about NOK 2000 per TEU in round figures, this would definitely have a marked influence on the customers' choice of transport mode.

As the port of Oslo is short of space, a switch from lo-lo to ro-ro would also benefit the port and the city.

Comparing a 300 TEU lo-lo vessel with a 150 40' trailer ro-ro vessel (equivalent to 300 TEUs) the price per slot on the ro-ro vessel is more than three times that for one on a lo-lo vessel - roughly USD 100,000 compared to USD 30,000. In addition comes the need for trailers: road trailers or slave trailers. The capital cost of a ro-ro vessel is much higher than for a lo-lo vessel. On the other hand, time in port and port installations needed are simpler and cheaper, but most port authorities try to deprive the ro-ro owners and users of their rightful bonus for efficient port handling.

I would also make reference to the Philippines. The archipelago should be ideal for ro-ro operations, but with a few exceptions, this technique has not yet been introduced. The reasons are mainly the following:

* Liner shipping has been strictly regulated. The franchising system has not permitted owners to utilise time saved in port (this has been changed recently);

* Vessels and cargo pay the same dues irrespective of handling method;

* The free storage time is long;

* *The stevedoring and terminal handling tariff (arrastre) for breakbulk, lo-los and even selfdrive ro-ros, are about the same.*

These rules and practices have constituted severe hindrances to technological progress in the inter-island shipping in the Philippines. Fortunately the new government is working hard to implement productive changes. A consequence of this is that the cargo freight level in the Philippines is about the same as on the North Sea for comparable routes, in spite of a ratio in wage level of about 1:30.

When coastal ro-ro is non-existent in India, it is not only because of trade union rules and practises, but also because of counterproductive port tariffs and custom routines. When the World Bank grants huge sums of money for *modernising* ports in the developing countries, these factors should be given much more attention than what has been done to date.

NEW MEASUREMENT RULES - THE 1969 CONVENTION

The new convention should establish fairer and more logical measurement rules, and at least it would stop the unfairness created by the open shelterdecker concept. In a hearing paper, the port of Oslo states:

> *Though the aim is to keep the sum of the harbour authority's income un-changed, a comprehensive redistribution of the shipping fees is expected caused by the composition of the fleet using Oslo harbour as to vessel types and ages. However, insofar as the 1969 convention supplies cor-rect directions for measuring vessels, and insofar as GRT is a relevant basis for calculations, the new distribution of the burdens between the shipping companies will be just.*

In the context of a port the new convention represents little new, only a change in irrationalities. When the basics are absurd, original results are incurred! There is no fairness.

As stated before, ship volume is the wrong basis for levying port dues, and it is strange that port authorities maintain this illogical tariff system and that

otherwise efficient ro-ro owners and users continue to accept it. Payment should be based on the use of the port facilities.

It should also be clearly stated that the value of the port area should be brought into the picture - I concede that this is a very difficult question, as it has to be fair compared to how rail and road pay for their use of land.

In the case of Oslo there is one section of the port with a market value of about NOK 5 million per day. The interest on this could pay for the difference in trucking of the cargo to/from nearby ports if the other sections of the port of Oslo cannot cope with the potentially added traffic demands - this problem could most probably be solved by a change in the tariff with the consequential move from lo-lo to ro-ro.

Although the new measurement rules are more "fair", they also favour the lo-lo vessels as the deck cargo is not measured. Short sea lo-lo vessels might have three tiers of containers on the weather deck while ro-ros can only carry one tier. For lo-lo and ro-ro vessels with equal cargo capacity (short sea), the ro-ro vessels might easily *measure* 100% more than the lo-lo vessels. No credit is given for the faster turnaround in port and less use of port area for the ro-ro vessels.

Norwegian ports are introducing the *G factor* equivalent to (length + breadth)x draught, masterminded by the Norwegian Ministry of Fishing. This factor is not more fair than the previous ones, and might turn out very different for the various types of vessel calling the port. One port has introduced a 75% reduction of the G factor for ro-ro vessels and 50% for lo-lo vessels.

Another port in the Oslofjord area, being desperate to attract cargo to their under-utilised port installations, has announced that they will only charge cargo dues, down to one container, and no ship dues!

Slow-working, conventional vessels are also subsidised by modern vessels as the following example will show:

LOADING NEWSPRINT IN OSLO

Some time ago a Chinese, multipurpose tweendecker with ordinary derricks loaded about 10,000 tons of newsprint in Oslo. Because of the inefficient gear and the general arrangement of the vessel, the loading lasted more than ten days.

From this loading the port authority had the following income:

* Berth charges: 10,000 grt à NOK 0.50 x 10 days   NOK   50,000
* Cargo dues: about NOK 8 per weight ton   NOK   80,000

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* Total dues to the port authority	NOK	130,000
* Income to the port authority per day	NOK	13,000

The Port of Oslo is regularly frequented by Star Shipping vessels - open bulkers with two gantry cranes, size approximately 30,000 grt. These vessels pick up part loads of about 10,000 tons of newsprint. Because of efficient loading gear they manage to complete the loading in one, maximum two days. One day - 24 hours - is always possible, but there are union and environmental restrictions on night work in Oslo. For this vessel the picture will be as follows:

* Berth charges: 30,000 grt à NOK 0.50 x 2 days	NOK	30,000
* Cargo dues: about NOK 8 per weight ton	NOK	80,000
* Total dues to the port authority	NOK	110,000
* Income to the port authority per day	NOK	55,000

The Star Shipping vessel was slightly bigger than the Chinese vessel, but used the same berthing facility. Why should the modern vessel, which by any comparison is a much safer vessel than the old Chinese multipurpose vessel, pay more than four times as much for the use of the port facility?

Not long ago a Norwegian shipping official said that he would suggest that ship measurement be ruled out as it is misleading. This is controversial as it will make a number of people redundant, but there is much sense in it. The ports should give data on the cargo handled and number of calls.

It is also worth noting that manning of ships has moved away from being based on gross tonnage and is now usually based on actual safety manning needs. In many ports even the tugs use deadweight instead of gross tonnage as a basis for their charges.

SAFETY

Mr. Ir. E. Vossnack of the Netherlands Foundation for the Co-ordination of Maritime Research states bluntly: *Gross-tonnage rules are frustrating the development of better, safer ships*. This because the use of gross-tonnage measurement have a negative effect on the reserve buoyancy of vessels, which means *safety*. Further, it is rather unfair that the new tonnage rules also give an incentive to reduce crew quarters.

CONCLUSION

By practising wrong tariff systems the ports not only favour lo-los at the expense of ro-ros, they also reduce the competitive edge of ro-ro traffic and thereby indirectly strengthen road and rail traffic in short sea operations, hurting their own interests.

Because of this, the ports should change their tariffs in co-operation with the ship owners. This can be done without damage to the profitability of the ports - it could even strengthen their economy.

Generally, the gross-tonnage measurement should be given up as it leads to wrong conclusions. The new convention is actually outdated before it is ratified.

SAFETY IN A MODERN PERSPECTIVE

By J.A. Stoop

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SAFETY IN A MODERN PERSPECTIVE

1   INTRODUCTION

Shortsea shipping is favoured not only for its economic benefits. On a European level it offers promising alternatives to congestion on highways and railways and has favourable characteristics. The advantages of shortsea shipping are described as; no necessity for very high additional infrastructural works, an almost unlimited capacity at sea and only limited strain on scarce space in and near ports, a high degree of safety and a relatively friendly impact on the environment (Jacobs 1992).

To maintain the advantages some effort must be put into the design and management of short-sea shipping lines. The method of achieving the advantages is not self-evident, therefore a safety management policy should be developed. Safety is at a premium, in addition to the demands of cost reduction developments in the sea going shipping industry. This contribution focuses on one of the critical situations of a vessels' voyage; sailing in dense traffic areas, in and close to ports. From the beginning, the policy of a safe and sound passage has been embraced by Pilotage and VTS. However, the situations in which and the way in which this task has been performed, have been changed continuously. Each change creates new and sometimes contradictory requirements, which have to be incorporated into operational practice. A number of developments have had their influence on the future of Pilotage and VTS and these will pose problems in the execution of a safe and sound passage in sight of port.
Short-sea shipping is included in mainport developments in order to provide feeder lines to hubs and inland waterways networks. These networks put logistic and managerial constraints on shortsea shipping with respect to capacity, punctuality and efficiency.
Strict time management, local and regional planning considerations, reduce the margins for those who have to warrant the safety in operational practice. Mainports, by their nature, are complex and large-scaled and may suffer from unforeseen interactions and tight couplings which may result in accidents (Perrow 1984). Moreover, mainports and networks must be integrated with regional developments, putting external constraints on their operational practice with respect to environment, safety and sustainability. Experience in aviation and railways, indicates that mainports and transportation corridors are vulnerable if safety is not taken into account in their design or guaranteed during operational practice.

Research findings indicate that smaller vessels may be exposed to an increased risk in dense traffic areas which are under pressure in order to maintain produc-

tion. This can result in them exceeding their capabilities, irrespective of weather and sea going conditions. Pilotage and VTS play a significant role in quality control over the traffic flow management and may also serve as a facilitator in order to maintain production under conditions of a congested traffic flow. Future requirements on the role and function of pilotage and VTS raise additional questions both about the role of fairway and harbour authorities and of the required levels of skills and responsibilities of Vessel Traffic Service operators, pilots and of crews on the bridge.

2   TRANSPORTATION IN PERSPECTIVE

The dominant question is not if safety can be ensured, because everybody will respond in a positive manner. More pertinent is the question: how is safety weighed against other factors? Who pays the costs, who reaps the benefits? Two developments which dominate the perspective of transportation in The Netherlands will be discussed: Rotterdam as a Mainport and the 'Nederland Distributieland' concept (The Netherlands Distributing Country).

Mainport Rotterdam

Rotterdam reveals itself as a Mainport, one of the most important entrances to Europe with a major transit function. Is the 'mainport' only a label, a selling argument or is it a new dimension in the development of ports, with inherent challenges? Rotterdam is not on its own, Schiphol airport also reveals itself as a mainport.
Is it possible to define any 'mainport' characteristics?

* Large-scaled: there is a considerable change in volume. Substantial growth is present, disproportional distributed between the various sectors of the ports activities, thus requiring new and substantial infrastructural developments;

* Tightly coupled logistic chains with a complex interaction, 'Just-in-Time' tuned to a quick throughput of goods, with as little trans-shipment as possible. There are strict managerial requirements on capacity, efficiency, punctuality and synchronism;

* Multimodal nature. the input and throughput are based on the availability of various transport modes: roads, railways, shipping or multi-modal systems which have yet to be developed;

* Support by high-tech applications such as information technology, automation, telematics, EDI, decision support systems and automated traffic control systems;

* Complex decision-making, characterised by numerous, autonomous interests such as shipowners, port authorities, forwarders, national and local authorities and trade and industrial organisations. Decision making has a long term emphasis and effects a balance between numerous aspects and often conflicting interests;

* Integration within regional development and planning schemes; economic development; social aspects such as environmental issues, external safety, sustainability and social climate.

In this mainport concept, a gradual shift occurs in the roles and positions of the shareholders. The manager of the infrastructure is no longer passive and facilitating, but active and therefore puts constraints on both customer and user. This is in order to optimise his returns on the huge investments, under conditions of environmental and qualitative demands.

At the same time, the governmental organisations step back from a number of administrative and enforcement responsibilities with respect to tasks such as Pilotage or Air Traffic Control and restrict themselves to a supervisory and conditioning role. The responsibility for Quality Assurance is put onto industry itself by the introduction of a system of certification.

In the mainport concept, three developments are becoming visible which have a bearing on safety aspects:

* The tight coupling between processes requires careful tuning. The assurance of interconnections becomes important; in addition to capacity, punctuality becomes a process parameter. The production pressure to deliver 'Just-in-Time', puts pressure on traffic flow management to make the harbour in time, irrespective of aggravating circumstances, such as sea swell, poor visibility or strong wind. It becomes increasingly important to maintain the traffic flow;

* Volume growth means more vessel movements: the traffic intensity in the approach area is increasing and will have to be managed with proper safety measures, also under aggravated circumstances. The probability of accidents shortly before a traffic flow becomes congested, is increasing. High traffic intensities put increasing pressure on the separation of traffic, the traffic control facilities, the capability and proficiency of crews and pilots, the equipment of vessels and on the support systems ashore;

* Tight coupling and the number of interests requires a stricter control of dispatching. New, supra-organisational co-ordination teams will have to be formed. In such teams safety must be an integral part of their deliberations and must be explicitly quantified in the decision-making process and in the weighing of aspects. In other words: safety must become a quantifiable aspect in the management and decision making of the mainport, up to the highest managerial levels. Therefore, the process must be made

transparent to all agencies by the registration and analysis of accidents and incidents as undesired disturbances of the regular performance of the system.

The Netherlands Distributing Country

The transportation industry in The Netherlands is undergoing major changes in the light of the development of The Netherlands as a distributing country in a Europe without borders. This process is being accelerated by the increasing access to East European markets. In addition congestion on the roads as well as stricter environmental requirements call for wide spread changes. The transportation industry is one of the economic growth sectors in our country. The development of this sector can be characterised by new infra-structural concepts such as transportation corridors, mainports, transferee and principal transportation arteries. These should be incorporated in regional developments with regard to their effects on environment, social life, local planning and sustainability.

In order to spare the environment, a tight coupling between transportation modes into corridors and hubs is frequently preferred. This tight coupling puts additional emphasis on the external safety of inhabitants and other activities. It also constrains the use of transportation arteries by formulating zoning requirements with regard to allowable noise levels, risk contours for harmful effects of dangerous substances and to allowable risk levels for disasters. In operational practice one is confronted with new categories of constraints, formulated on external safety and environmental grounds, which have their drawbacks on the internal operational practice and traffic management.

That this may lead to a complex stress situation between internal and external safety has already been demonstrated in the areas of shipping and aviation. Some examples are: the intended construction of buildings alongside the roads of Terneuzen, the re-routing of vessels transporting hazardous goods on the North Sea and the noise and environmental restrictions of flight procedures around Schiphol Airport, which may be at the expense of the margins for a safe flight execution.

Tight coupling has a second effect; the developments within the transportation artery may influence each other in such an unforeseen and unwanted manner, that safety is endangered. During the summer of 1992 the tight coupling between motorway and railroad became evident by the blocking of the railroad alongside the A 16 motorway, after two incidents with tank-lorries near Dordrecht and Prinsenbeek.

The design of a transportation hub may also be criticised. In the Integral Plan for the Northern Ledge of Rotterdam (Integraal Plan Noordrand Rotterdam) a motorway underneath the runway of the airport is planned. Just ahead of the thresholds of the runway the motorway bends away from the runway. Close to the eastside of the runway a High Speed Train and Metro station is planned. Statistics show that about 20% and 50% of aviation accidents occur at take-off and landing respectively. If we realise that most of the time due to the prevailing

Western winds, the hub is directly under the landing threshold it is not difficult to see that a high risk situation has been designed.

A tight coupling in the design of a transportation artery without a strategy which mitigates foreseeable residual risks, makes a hub or transportation artery vulnerable. If, in such a vulnerable design, an acceptable safety level is to be guaranteed during operational conditions, a considerable and costly effort is required. The control of intensive traffic is indispensable. High qualifications with respect to professional skills, local knowledge, and insight into the possible (safety-)consequences of their decisions are demanded of those who must guarantee operational safety. It may offer impossible options to captains, pilots or traffic controllers. For example, should a ship-to-ship collision be selected with possible fatalities, injuries and environmental damage or is a grounding or collision with a costly infrastructure preferred, with liability claims involved?

3   BALANCING SAFETY AGAINST COSTS

How are the development of Pilotage and VTS related to these developments? The control of the Pilotage has changed during its existence from private, through Naval and Ministry of Transportation and back again to privatised organisation. Consequently the involvement of government, industry and port authority with the tasks of the Pilotage and the safety management has been changed. In the former situation, the government was involved by the employment of fully qualified pilots and the port authority was involved by the employment of harbour pilots. Nowadays, the government is withdrawing due to the policy of cost reduction and the development of mainports and the port authority has no direct involvement with pilotage any longer. Unpiloted passages are possible by a Declaration of Exception and a compulsory piloting fee no longer exists.

Who takes care of safety in this field of forces?

Shipowners do not supply in-house training, in which region-specific problems are incorporated for pilots whose local expertise is limited. They supply the captains during their careers with a variety of vessels, with which they have to become familiar, without legally based radar or simulation training, no legal knowledge and no bridge resource management training. This picture fits in with the criticisms on current operational practice with respect to the safety of the international shipping trade.

Captains mostly qualify only once at the beginning of their career, obtain less local expertise by infrequent visits, do not attend refresher courses and have insufficient or no expertise of changes in the local infrastructure. Sister ships are not fully identical in equipment or characteristics, while the shore based support systems are under pressure, particularly where aggravated conditions obtain.

The Pilotage can supply helicopter support during heavy seas, but cannot service all ships. The smaller vessels especially, frequently apply the Declaration of Exception from compelled pilotage.

In a cost effective way this is not unprofitable for pilots: small vessels require a similar effort but offer less returns with comparable costs. The Pilotage therefore, has less costs if it does not have to pilot smaller vessels. There are major differences in regions, as Pilotage is cost-effective nationally. Therefore, there is a ratio of distribution to compensate cost-ineffective regions. To a privatised pilots organisation, it is profitable to dispose itself of market segments which are economically unattractive, to refuse smaller vessels and to optimise the staffing. Such a financial approach has its disadvantage: it will be at the expense of the business core of the pilotage: to guarantee a safe and sound passage in sight of the harbour for all segments of the sea going shipping trade.

In the trade-off between safety and economy, a number of conflicts are present due to direct cost-effectiveness considerations; government, port authority, ship-owners, captains and pilots. The aspirations towards mainports and Nederland Distributieland put an additional time and planning pressure on safety by additional requirements in operational practice and by the limitation of operational flexibility.

4   CURRENT OPERATIONAL PRACTICE

How does operational practice appear under the circumstances? Is there a causal relation between accidents which have been occurring in practice and the developments as previously described? Will future developments decrease the present safety levels and endanger the developments in short sea shipping if the safety policy is not adapted.

A picture of the current operational practice has been drawn up by analysing accidents, as described in the verdicts of the Dutch Maritime Court (Stoop 1993, Stoop 1994). There are few but mainly serious accidents on the open sea. The majority of accidents occur in the vicinity of harbours and in coastal waters but are of a less serious nature. The majority of the vessels involved in accidents belong to class 4 and 5, i.e. are smaller vessels (**Table I**). The vast majority of the accidents occur under (a combination of) aggravated conditions such as darkness, strong wind or fog. To leave smaller vessels unpiloted in waters relatively unknown to them, is not without consequence. Accident patterns are occurring, which can be allocated to accident scenarios, containing specific combinations of classes of vessels, sailing areas, types of accidents, external conditions and pilotage (**Table II**). These scenarios indicate that inaccurate position finding, inappropriate use of aids-to-navigation, inadequate preparation of a journey, limited communication between captain and helmsman, combined with relative unfamiliarity with the sailing area, may bring smaller vessels into difficulty. If pilot assistance is rejected on cost considerations, an increased risk bearing situation is present, especially under aggravated weather, visual and sea state conditions (**Table III**).

Class	BRT	1989	1990	1991	1992	Total
1	<100	-	-	3	4	7
2	100-499	2	2	2	4	10
3	500-999	5	1	7	3	16
4	1000-1599	5	5	4	9	23
5	1600-9999	4	3	8	6	21
6	10,000-29,900	4	5	1	5	15
7	30,000-59,999	3	-	2	2	7
8	60,000-99,999	-	-	1	-	1
9	>100,000	1	-	1	1	3
		24	16	29	34	103

Table I: Vessel class - accident number per year distribution 1989-1992

Selected cases		Collisions		Strandings	
No.	Area	p	u	p	u
9	WS	8	1	-	-
4	NM	4	-	-	-
3	Dutch h.	-	2	-	1
6	Forgn h.	-	-	2	4
4	NS	-	4	-	-
12	Scan	-	4	-	8
38		12	11	2	13

WS = Western Scheld area   NS = North Sea area
NM = Nieuwe Maas area   Scan = Scandinavian waters
Dutch h. = Dutch harbors   p = Piloted
Forgn h. = Foreign harbours   u = Unpiloted

Table II

Pilots, although rarely, may run into problems. On one hand, experienced pilots may be taken by surprise during a routine passage by aggravated weather conditions, reduced visibility or the strength of the current. On the other hand pilotage requires a considerable amount of professional skill, experience and carefulness. Pilots are not familiar in detail with the manoeuvring characteristics

Scenario	Darkness	Wind	Fog	Darkness + Fog	Darkness + Wind	Total
a = 19	5	1	3	1	4	14
b = 6	2	-	-	4	-	6
c = 19	8	2	2	1	3	16
d = 9	3	1	-	2	-	6
53	18	4	5	8	7	42

Total of 53 cases

Deleted:
- 5 extraordinary
- 6 daytime, good visibility

Remains:
- 33 darkness
- 42 (combination) of aggravating circumstances of which involved

Table III: Scenario - external conditions

and state of the vessels they sail and may run into difficulty by a poor bridge layout or by their unfamiliarity with the details of the equipment under critical conditions. Transfer of information and communication between captain, pilot and shore based support requires carefulness, in which the task-concept of the captain plays an important role (Stoop 1994).

Further analysis indicate areas of interest for vessels, fairways and ports with respect to vessel traffic management systems, pilotage, vessels bridge equipment and crew qualifications (Stoop 1994):

- a. Fulfilling horizontal and vertical navigation requirements: avoiding stranding and collision with the fairway boundaries;
- b. Participation in a simple or complex traffic situation: avoiding interference and incidents, especially collisions, with other traffic participants;
- c. Keeping the uncertainty of the navigation and traffic participation within acceptable limits.

a. horizontal and vertical navigation

In the execution of these tasks a 'manoeuvring envelope' could be defined, which contain the uncertainty to keep clear of fairway boundaries and other traffic participants. This 'envelope' is related to vessel length and a time constant characteristics defined by the manoeuvring capabilities of the vessel itself and deals with the normal ship-fairway and ship-ship interaction. There is a relation between the size of the vessel and the dimensions of the fairway and

surrounding infrastructure. Vessels, manoeuvring in marginal situations are restricted in their behaviour by their relative size to the fairway. Although such situations are encountered at the moment only for large vessels in harbours, in the near future it seems very well possible that shortsea shipping might encounter similar problems when entering rivers and inland sailing areas. The relative dimensions are important to deal with the vessel-fairway interaction in marginal conditions (Visser 1990).

A certain time-period is necessary for decision making of the man on the bridge. Scaling up the decision making, to a higher level of attention and from a skill to a knowledge based mode, requires a certain response tolerance to the situation during which the man on the bridge should be able to perform a recovery action (Hale et.al. 1988).

b. simple and complex traffic situations

Simple and complex traffic situations are essentially different. In a complex traffic situation the participants do not only have to find their own way through the fairway by preparing a voyage plan, but also have to deal with other participants. Therefore they have to create an image of the traffic flow and situation in order to plan and execute their participation in the traffic flow. Such a strategic and tactical image is necessary in order to obtain an accurate indication of their own position in the traffic flow, to generate expectations about the behaviour of other vessels and enables them to 'negotiate' their way through the traffic flow. Active and passive participation in the verbal communication becomes essential in order to have an up-dated image for their short term strategic and tactical task performance. The building of such a mental image of the traffic situation bears similarities with aviation, where the verbal interaction between air traffic controllers and pilots is known as the 'partyline effect'.

c. limiting uncertainty

In all situations the man on the bridge wants to control the rate of uncertainty in the execution of the navigation task. There are three main areas which may reduce the uncertainty for the man on the bridge:

* Accuracy in position finding. The accuracy may be significantly improved by the introduction of very accurate position finding equipment -such as GPS- and the representation of this information in an unambiguous way to the man on the bridge -such as ECDIS and integrated VDU-;

* Knowledge about the traffic situation. Such knowledge can be derived from the information provided by a VTS system and can be applied on board as well as on shore. The recommendations of the Maritime Court indicates possibilities for improvements in procedures, regulations and legislation in a national and international context;

* Communication on board as well as between ship and shore based stations about the state of the fairway and the traffic. Information about the traffic situation should be communicated between the members of the crew on the bridge, between the captain and the pilot on board and between the captain or pilot and the shore based stations. In order to improve expectations on the behaviour of other vessels a fed-forward supply of information becomes necessary. Improvement of the communication could be achieved by bridge crew resource management or bridge crew co-ordination courses. The individual capabilities both on board and ashore could be improved by proficiency checks, certification and recurrent and emergency training as already applied in other branches such as the aviation, process and nuclear industries (Helmreich 1987, Schimmel and Shelton 1987, Kanki and Foushee 1989).

Conclusions on the role of VTS and Pilotage

In establishing the precise role of VTS and Pilotage, a variety of factors play a role, such as strategic versus tactical advice, future developments with respect to increased density of traffic, the complexity of the fairways, logistic and production pressures on the bridge crew performance.

Elaborating the notion of complexity in safe task performance a distinction should be made between complexity of the sailing area and that emerging from the traffic situation. To deal with the complexity of a sailing area, the man on the bridge should be able to identify very accurately his position, his course and speed. He should inform the fairway authority of both his voyage plan and tactical intentions in order to enable this fairway authority to compose a traffic image of the sailing area and the traffic flow.
To deal with the complexity of the traffic situation, the man on the bridge should develop a strategy in order to manage the conflicts in the interaction with the other traffic participants in the sailing area.

The role of VTS and pilotage could be beneficial, especially if the man on the bridge fails to detail his voyage planning adequately. If the first, globally performed preparation before the start of his voyage is not followed by a detailed plan, he might run into problems during the execution of the planning. Also he might run into problems when he does not adjust his planning due to aggravated circumstances. If his primary aid-to-navigation, his external visual cues, are reduced or deleted, he has to compensate for this loss by changing to an internal visual aid such as radar, or to aids-to-navigation of another nature such as pilots, radio communication or VTS/shore based advice.
The installation of VTS and pilotage have positive effects on the traffic flow safety. They may eliminate certain types of accidents, increase vigilance and situation awareness, improve position finding and may more clearly define traffic flow expectations by accurate position finding and communication with other vessels and shore based stations.

5 PROBLEMS AND SOLUTIONS

In aviation, it is not uncommon to clear bottlenecks in safe and sound traffic flow management by means of technological improvements to infrastructure and equipment. Mainport Schiphol allocates large investments for the improvement of air traffic control and for the coupling of automated flight handling in aircraft and on the ground. A fifth runway is planned. Is such an approach also possible for the pilotage of vessels, for instance by the introduction of remote pilotage or the expansion of VTS facilities?
For four reasons such a development is not obvious:

* Comprehensive automation of control processes has negative side-effects. Increased automation may lead to accidents, as demonstrated by the well known 'ARPA assisted collision, in the maritime sector or the 'Controlled Flight into Terrain' in aviation. Man is very well equipped to recover from mistakes and errors and to regain control over the situation, based on his experiences and on his professional skills, which cannot be formalised in control algorithms. In aviation 'situation awareness' is known, a phenomenon by which the human operator is no longer capable of understanding the system configuration under critical conditions due to his limited monitoring tasks and thereby not capable of taking over the control tasks in the system. Finally, automation necessitates further support by additional equipment in order to detect or to correct undesirable deviations.

* The Bijlmermeer air disaster has underlined the importance of proper organisation and quality control. The safety audit by EAC/RAND has demonstrated that the best gain in safety improvements of a mainport like Schiphol, is rather in the improvement of organisation and quality control of the various processes related to traffic control, than in increased automation. A close co-operation between the various interests is mandatory. The most relevant recommendations for the safety of Schiphol were the introduction of an Integrated Safety Management System, including the registration and analysis of accidents and incidents, the maintaining and enforcement of quality standards and the introduction of an independent, qualified and impartial organisation to guarantee the weighing of safety in the decision making process (ref RAND).

* Technological solutions, appropriate for one mode of transportation are not necessarily transferable to another, adjacent mode. In analogy with Air Traffic Control in aviation, Remote Pilotage seems to be promising for shipping in the future, but the conditions for a social acceptance are not yet present;

* Sustainable and efficient solutions demand a thorough expertise in the examination of problems and their causes, indicating balanced packages of measures and multiple-solution strategies. Complex organisations and structures are in contradiction with a monodisciplinary or mono-aspectal approach. The nature of the process control and decision-making requires co-operation between a variety of mostly autonomous interests and also requires a weighing of interests and aspects beyond the level of individual organisations and decision makers. The obtaining of a transparency of the processes, structures and the tasks involved is the basis for such a co-operation and decision making. One of these tasks is to guarantee a safe and sound passage in the vicinity of the port.

6   RECOMMENDATIONS

As stated in the beginning of this paper, the advantages of short-sea shipping are described as; no need for very high additional infrastructural works, an almost unlimited capacity at sea and only limited historian on scarce space in and near ports, a high degree of safety and relatively friendly impact on the environment. To achieve these advantages of short-sea shipping to congested roads, a number of conditions have to be fulfilled:

The slogan is no longer 'Safety First' but; 'Safety Too'. This looks like too modest an approach in view of the pressure which is put on the safety of all transportation modes at the moment. Rather than a pendulum swinging in time causing a temporarily ad-hoc overexposure on safety due to serious accidents and incidents, a plea is made for a pro-active and continuous, balanced attention.

Risk taking behaviour of captains may be induced by logistic and economic motives, reducing safety limits. Therefore, operational cost-benefit considerations should carefully be made, avoiding a 'pennywise-poundfoolish' attitude in the weighing of safety aspects against costs.

Policy decision-making for traffic flow management in ports and in busy shipping areas, should carefully address the issue of investing in pilotage and VTS because of their evidential benefits to a safe, efficient and smooth traffic flow.

Although technology may add to the safety of maritime traffic by the introduction of dedicated navigation and communication systems, the most promising gain in safety lies in the design, management and organisation of mainports and transportation corridor concepts, including high quality standards and qualified crews.

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THE SINGLE MARKET AND THE REMOVAL OF OBSTACLES TO THE GREATER USE OF SHORTSEA SHIPPING

By F.M. Everard and C.P. Boyle

Choose shipping first! Wherever sending goods by sea - either directly or as part of the intermodal chain - is feasible, our aim as shipowners is for shippers and forwarders to choose shipping first.

Over the past forty years shipping's market share in the UK has declined dramatically in comparison with road (**Table I**).

	Road	Rail	Water	Pipeline
1952	31	37	20	0.2
1962	55	26	24	0.7
1972	88	21	29	3.5
1982	95	16	59	9.5
1992	127	15	55	11.2

(Source: Transport Statistics Great Britain 1993)

Table I: Freight Transport, 1952-92 (billion tonne kms)

Our goal is to increase this market share. There are various recipes around favouring differing degrees of intervention as to what must be done by industry and legislators if this goal is to be achieved. We shall consider the effects on the competitive position of short sea shipping of current Community initiatives designed to promote greater integration, such as the Trans-European Networks, as well as industry efforts towards greater efficiency. The purpose of this paper is to assess whether our chances of success in competing against other modes are better now in the era of the Single Market, or whether the Single Market ethos will need to be balanced by wider policy considerations such as environmental imperatives.

We start by accepting the philosophy underlying the Single Market: that the removal of barriers to trade generates greater competition, enhanced choice and level of service for consumers releasing formerly unproductive labour and capital for other purposes so making best use of resources. In tandem, the philosophy

must demonstrate a willingness and flexibility to look at best practice in terms of efficiency and innovation and adopt and adapt as appropriate. Properly and fully implemented, it should work as well for shipping as any other sector of European industry.

"1992" has come and gone leaving us with what should be a liberalised shipping market with a streamlined system of controls and procedures at frontiers. Reality in 1994 looks different but experience is teaching us it takes time to create an integrated market - 2004, for example, is the date finally agreed for the implementation of the last tranche of liberalisation in the European cabotage markets - and even then liberalisation will only extend to vessels under EC flags.

What is beginning to happen albeit slowly is that the removal of national barriers and general liberalisation within the Community is producing a different sort of transport market to meet changing patterns of trade and customer requirements. Research shows many businesses are marketing Europe-wide.

As a progression from the 1992 programme, the Commission and Member States are taking steps to facilitate the free movement of goods, people and services throughout Europe. Transport is one of three elements (together with energy and telecommunications) which is the new spearhead of European integration: the Trans-European Networks programme. Some ECU 220 bn has been put aside for transport infrastructure projects over the next few years.

The purpose of these networks is to provide the interconnection and inter-operability of national networks and access to them - taking account of the need to link island, land-locked and peripheral regions with the more central areas of the Community. They must both ensure the efficient flow of goods and people and provide a lifeline for the periphery. Existing networks have developed on national lines "designed to satisfy the European nation states of the 19th Century," in the words of Commissioner Christophersen and this fragmentation is perceived to be frustrating the Single Market concept and damaging to Europe's competitiveness: Italian lorries, for example, must thunder through the Rhine Valley on their way to Rotterdam at least in part because of lack of efficiency in Italy's ports.

There is little point in creating a system which serves only to funnel traffic into limited corridors exacerbating existing congestion and pollution. The new networks have therefore to be balanced, efficient and environmentally friendlier than at present. Greater use of maritime transport around the coasts of Europe serving the vast range of Community ports is seen as one way of achieving the stated aims of the programme. But as they are shaping up, the networks are in danger of developing only the most obvious cross-border links with exactly the sort of funnelling to main arteries which the programme was conceived to avoid. Could it be otherwise? The major European centres of population and industry lie largely in the so-called "golden banana" which stretches from S.E. United

Kingdom to Northern Italy. The Single Market with its emphasis on rationalisation and economies of scale is to date encouraging centralisation. Conversely, can the building of infrastructure to peripheral regions on its own prevent this centralising trend?

The question of congestion has been under examination for several years by the Commission and various Member State governments with a view to ways of shifting freight from road to rail or sea. However, in the era of the Single Market new forms of discrimination which favour one sector over another have not been acceptable. The preferred policy is the removal of unfair advantages (in the form of subsidies or monopoly) and the creation of open access - letting modes compete on an equal footing. Active intervention by Member States/Commission to require a modal shift has been unacceptable because of possible distortions to competition. The shipping industry itself is as wary of such intervention as governments. Even if governments can be persuaded that environmental concerns merit positive action for shipping, the problem lies in devising a mechanism to promote shipping which does not favour one operator over another.

If little can be expected from Trans-European Networks or the likelihood of fair and balanced intervention - what can the industry do itself to compete with other modes and boost its market share.

Costs at the port interface are estimated at between 30-80% of the waterborne freight and usually above 50%. Port efficiency has been identified as a key area for improvement if shipping is to be able to compete more successfully with other modes. To keep costs to a minimum and reduce transit time, the Short Sea Panel of the Maritime Industries Forum identified the following pre-requisites for an efficient port based on users' experience and needs. It should be stressed that Government help is required to set the right legislative framework in which ports can provide:

* Easy and safe access, including availability of navigational aids;
* Round the clock availability of services;
* Design/adaptation of port infra and superstructure with specific short sea needs in mind;
* Smooth interface with road/rail/inland waterway connections;
* Competition in ports' services - abolition of monopolistic and restrictive practices;
* Greater use of EDI;
* (MARPOL) reception facilities;
* Transparency of tariffs.

Coupled with improved documentary procedures, action to ensure such pre-requisites are met should boost shipping's appeal to the user. The ownership/operating structure of a port is also a vital element to its efficiency.

Whilst there are clearly various successful models, the experience of recent port privatisation in the UK has produced greater flexibility and a stimulus to use commercial freedom and imagination to seek new trade and pursue new methods.

The discipline of having to examine and eliminate obstacles to growth if they are to survive and prosper in what is undoubtedly becoming a less protected, more competitive climate is stimulating short sea operators, ports and customers alike. At present this is truer for those parts of the Single Market which have gone further in liberalising and deregulating but what is seen to be done successfully in one part of the Single Market may now be more readily copied or adapted for use in another. We may well be on our way to achieving some degree of cohesion/integration through market forces.

But is greater efficiency and a willingness to be dynamic enough to make shipping the first choice for shippers/ forwarders? Other modes have been undergoing the same processes of liberalisation, modernisation, privatisation and have taken advantage of greater efficiency to cut costs and streamline. Research into the de-regulation of road haulage in Europe suggests an overall drop of 15-20% in road haulage rates is likely once the full benefits of new legislation come into play. International road haulage services from UK to the Continent via ferry have achieved significantly improved transit times as a result of the removal of border restrictions - over longer routes, such as Birmingham to Barcelona or Manchester to Milan, by as much as 24 hours. From the fact of being an island, the UK has through necessity built up a large network of more than 100 regular shipping services, giving access to all parts of mainland Europe and Ireland, which collectively make up Britain's largest trading area. Many of these services are roll-on/roll-off, allowing the direct transfer of trailers, accompanied or unaccompanied to many European markets. However, from March 1994, competition with the Channel Tunnel is anticipated to see the estimated journey times in **Table II.**

Route	By Rail (hrs)	By Road (hrs)
Glasgow-Brussels	20	36
Manchester-Milan	32	60
Birmingham-Vienna	31	66
Liverpool-Stuttgart	28	48
Wakefield-Bordeaux	32	60
London-Munich	24	42
Cardiff-Paris	15	18
Middlesbrough-Perpignan	33	60

Table II: Channel Tunnel estimated journey times

Despite our best efforts might we not be in the same relative position of disadvantage vis-à-vis road and even rail (whose own market share in the UK has fallen more dramatically than that of shipping over the last forty years)? This is not an argument for complacency or against becoming more efficient - it is possible to lose out yet further to road, whilst for ports the neighbouring port is always a competitor.

There are other factors necessary to creating an open and fair Single Market. Governments are beginning to address questions of unfair pricing structures between modes. The privatisation and demonopolisation of railways is on the agenda together with an examination of ways of making the polluter pay for transport-generated pollution through such mechanisms as the carbon tax. Such programmes are likely to take years to agree and implement. In the meantime - the removal of the type of obstacles outlined above are alone not enough to achieve our goal.

The other major action the industry can take for itself is marketing. The current invisibility of short sea shipping suggests that the marketing of this sector is poor and this is indeed confirmed by shippers. This need not be the case and a recent example will show that the UK industry has been able, through marketing, to capitalise on the confused state of the British Rail freight industry. Within the past eighteen months rail freight users were informed that there would be a 150-200% price rise for the carriage of traditional bulk cargoes of grain, china clay or oil. The reasons are complex but in an environment of artificially created rail freight pricing structures, with little commercial understanding about what the customer wanted and was prepared to pay for, there was an overnight modal shift away from rail. Unfortunately the vast majority of such traffic flows were naturally suited to road transport - a mode with vast over-capacity and resultant low rates.

However, seeing an opportunity, the short sea shipping industry honed its marketing skills and for the first time ever was able to make some headway against the still subsidised railways. On its current performance, short sea shipping appears to be able to compete very favourably in terms of price and quality to win specific types of traffic such as grain flows from the East of England to the North East coast of Scotland.

Within the last year rail in the UK has also lost a traditional flow of deep sea container feedering to Comar's visionary coastal service between Thamesport and Grangemouth.

Are these just isolated examples or are they the tip of an iceberg as far as short sea shipping potential is concerned? UK short sea owners are now actively marketing in areas which were unknown to them five years ago.

For many shippers facing the demands of an increasingly congested European motorway network, the availability of short sea shipping, hopefully from their local port, often comes as a complete surprise. The current invisibility of operation is a problem which must be overcome.

Potential winnable markets must be identified if promotion is to have any chance of success.

Selling short sea shipping services must be able to capitalise on its manifest merits:

Availability of services - short sea shipping offers attractive transport choices to destinations all over Europe.

Reliability and punctuality - enabled by set timetables and operating efficiency.

Programmed delivery - regularity of service enables deliveries to be planned according to a set schedule and provides a floating warehouse.

Price competitiveness - highly favourable in comparison to other transport modes.

Customer responsiveness - point to point solutions to meet the specific needs of the customer.

One transport contractor - enabling the customer to resolve specific problems.

Environment friendly - relieves traffic on land routes and offers energy efficiency.

High safety standards - compliance with strict safety regulations established internationally.

CONCLUSIONS

The issues covered and the views expressed here will not be new to you but by seeing them within the framework of an integrating European market what often appear as piecemeal actions show some underlying coherence.

However, caveats must be entered as to whether Cinderella will actually go to the ball as short sea shipping's supporters suggest.

First - for the benefits of the Single Market to flow, everyone involved must play their role effectively:

- Governments must ensure they meet fully their commitments to the legislation they have agreed. This is not currently the case in shipping as we see from the notable intransigence of Spain in the current Cenargo case which is denying a British company access to a Spanish/Moroccan ferry route for wholly political reasons.

- The shipping industry - operators, ports and customers must act as if the Single Market exists and exploit it. Where it finds hindrances and problems to its efficient operation complaints must be made and action demanded at local, national or European-level to remedy them. Recourse to law may be necessary to change entrenched positions.

Secondly - although the environmental benefits of shipping make it an attractive option - is the way the transport system of Europe is being developed via the Network Programme likely to make use of these advantages if it follows the centralising trends of the Single Market? The siting of industry away from already dense centres of population and consequent congestion is one of the much wider political questions which governments will have to address if they are serious about environmental concerns and European gridlock.

Governments must also seize the nettle of unfair transport pricing and look seriously at actions to address pollution and congestion costs, and existing subsidies.

Thirdly - the industry must be prepared to make more strenuous efforts in marketing itself and in co-operating with ports and local Chambers of Commerce in the search for new business.

Finally - to return to our initial questions - the underlying philosophy used in the nineteen-eighties to hasten the integration of the European County: removal of barriers to trade and full play of market forces is beneficial to short sea shipping in the same way it benefits all other industries - by forcing it to be more competitive. However, the centralising tendency which integration produces does not favour the use of direct shipping services.

The Single Market is encouraging European countries to trade more and more with each other. The nature of what we mean by short sea shipping is broad - the solutions for winning greater share of Europe's growing trade will vary accordingly. With the right marketing short sea bulk should benefit most from a modal shift from rail to sea. Whereas for liner services - the flexibility of the container must encourage greater use of intermodal transport providing there are adequate hinterland connections for road, rail and inland waterway interchange.

CONTAINER TRAFFICS IN EUROPE - CHANGING PATTERNS AND POLICY OPTIONS

By P. Sutcliffe and M. Garratt

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CONTAINER TRAFFICS IN EUROPE - CHANGING PATTERNS AND POLICY OPTIONS

1   INTRODUCTION

MDS Transmodal has recently completed the third edition of its publication 'The European Freight Market - Containers by Sea', to be followed shortly by the complementary study 'The European Freight Market - Containers Inland'. The first edition covered the statistical year 1982, the second was based on 1986 and the current edition is based on the year 1992.

It is largely from the research undertaken for these studies, now reflecting a decade's experience of the subject, that this paper is derived.

Containers by Sea covers all aspects of European container shipping. It estimates the volumes of ISO containers moving between eight port regions. Flows between port regions distinguish between:

*   Pure inter-European trade;

*   Trade transhipped in Europe to and from extra-European destinations and origins (feeder traffic).

The figures are compared with the equivalent values in previous editions and changes in route size, feeder (transhipment) volumes and the main players noted. The modal share of non-bulk cargoes, especially between trailer and container, is estimated and significant trends noted.

A full description of each route is provided and the leading ports and container carriers identified, as are the principal factors determining mode and route.

The purpose of the research has been to provide an aid to the marketing and planning strategies of the various participants involved in container shipping, both in Europe and world wide where an European element is included. These interested parties include:

*   Shipowners and operators;
*   Port authorities;
*   Terminal operators;
*   Combined transport operators
*   Freight forwarders;

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* Road hauliers;
* Rail freight operators.

In addition to those listed, the studies are also designed to be of assistance to research organisations, financial institutions and Government departments involved in European trade and transport. We shall describe such a case study in the second half of the paper.

Over the period of the studies, there have been many political and economic changes in Europe affecting the levels of trade, and now physical developments such as the Channel Tunnel and the Scandinavian fixed links are also factors. These changes have in turn influenced the nature and pattern of container movements in Europe in various ways.

The major influences since 1986 have been:

* the GATT negotiations;
* German unification;
* political liberalisation of the former East Bloc countries;
* the Maastricht Treaty;
* EU legislation;
* the abolition of dock labour schemes in France and the UK.

The GATT should help to prevent separatism and promote inter world areas trade, important in view of the creation of large trading blocks such as the North American Free Trade Area, the European Union and the ASEAN countries.

The unification of Germany, and the political shift from command to market economies amongst the former Combloc countries offers a huge new trade potential which must be realised over the next few years.

The Maastricht Treaty will intensify the economic union of the current member countries and those applying for membership. Monetary union, a fundamental aim of the treaty, will facilitate intra European trade, encourage growth and give stability to the EU's trade with extra European countries.

EU legislation in relation to transport covers liberalisation, harmonisation (particularly in the tax fields), the investment in a European transport structure, the promotion of maritime links and the opening of national railways to private operators. All these have and will impact the pattern of European container activity.

The abolition of dock labour schemes in Great Britain and France has encouraged an improvement in the performance of the ports in those countries although at the time of writing there continue to be labour relation problems in France. Labour difficulties still linger on in certain countries and until these are

resolved, the deepsea container lines' port choice in Europe will continue to be influenced by labour inhibitions.

With the Channel Tunnel due to open in the Spring of 1994 and the development of the fixed links in the Scandinavia region, there will be effects on the modal patterns of container movements. This is particularly so in the latter case where the competitive position of road and rail will be enhanced at the expense of shortsea shipping.

European container trade in 1992, both intra and extra amounted to 22 million TEU. This represents a 38% increase over the previous study year of 1986 despite a background of a cycle of economic growth then recession in Europe. As the recession bottoms out (depending on the country), container trade should increase proportionately. Trade with the Americas is more or less steady and the main growth area is trade with the Far East, particularly westbound.

The five leading container ports in Continental Europe are Rotterdam, Hamburg, Antwerp, Bremerhaven and Le Havre, in order of container volumes. Rotterdam is by far the largest handling over four million TEU in 1992 and only Le Havre handled less than one million. The other major port in Europe is Felixstowe in Great Britain, which handled one and a half million TEU in the same year. **Table I** illustrates the comparative position of the five main European container ports and the rate of container handling growth they have enjoyed.

	'000 TEUs
Rotterdam	177
Hamburg	977
Antwerp	796
Felixtowe	678
Bremen/Bremerhaven	563

Table I: Estimated European container throughput for leading ports, 1992

For the sake of good order, the rest of the paper will be confined to the 1992 edition and experience.

2   METHODOLOGY

Definitions had to be established to make the studies manageable. Containers are defined as solely for maritime use and of ISO specification, i.e. 20' and 40' in length. For statistical convenience, container units are generally expressed as TEU.

The studies measured container movements between port areas between and within port areas. The ports involved include those in Scandinavia, the Baltic, North Continent, British Isles, Iberia and the northern coastline of the Mediterranean as far east as Greece.

European container flows are derived from two separate patterns of international trade, ie intra European trade, and trade between Europe and non European countries. Clearly the latter is mainly deepsea but is relevant to the subject of shortsea shipping because it generates substantial interport container feeder traffic between European countries. This latter type of flow is a fundamental concern of the study.

Together, the eight areas defined, generate a total of 36 possible routes of which 34 have positive flows. The key flows, ranked by route are shown in **Table II**.

Channel-GB	1040	Nordic-E Baltic	60
Intra N Med	885	E Baltic-GB	50
Nordic-Denmark/Germany	485	Atlantic-Denmark/Germany	41
Atlantic/Channel	312	Channel-E Baltic	40
Channel-Ireland	309	Intra Nordic	38

Table II: Total European container traffic, rnaked by route (000 TEU)

As shown in the earlier surveys, the Channel - Great Britain route dominates European container traffic with some 20% of the total in 1992, but that percentage is decreasing having been 28% in 1982 and 25% in 1986. In all, 15 routes now exceed 100,000 TEU (in 1986 the equivalent was 11 routes). Those 15 routes together generate 89% of the total traffic.

2.1 PORT DATA

To create the necessary database, questionnaires were sent to all the ports concerned with the exception of the ports in the UK, for which HM Customs

and Excise and UK Department of Transport figures were used.

Responses were generally good, particularly from the major container ports. Channel, Denmark/Germany and Nordic areas responded well but were less comprehensive from the North Mediterranean and East Baltic areas. The data so assembled formed the basis on which container flows were estimated and corresponding areas generally correlated well.

In addition to this, personal visits were made to most of the high volume European container ports during which discussions concerning local container traffic were held with port authorities and some terminal operators. These visits included Hamburg, Bremen, Rotterdam and Antwerp.

2.2 SHIPPING COMPANY INFORMATION

It is estimated that some 80 shipping companies carry containers on European routes and if roll on-roll off (ro-ro) ferries and deep sea wayporting is added, the actual total must exceed 100.

To obtain detailed information on the European container shipping trades, a sample of 23 European and deep sea lines were interviewed personally, the sample including most of the major operators. The interviews also provided details in relation to the mechanics of European container traffic. Statistics of route flows obtained from these interviews permitted a cross check with the port data and correlation was in most cases acceptable.

2.3 TRADE DATA

A variety of public sources were used to establish the estimates of European non-bulk trade used in the study, and these are expressed in terms of tonnes weight. Non-bulk trade has been defined as total trade less that which is shipped as bulk cargoes eg fuels, minerals and ores.

2.4 DATA CORRELATION

For each route there are three possible sources from which to derive an estimate of the route flow, ie the ports at each end and shipping companies trading on it.

All route figures are estimates because on certain routes, especially those involving southern Europe, there were gaps in the data. To overcome this, other sources had to be used such as previously published data or figures related to previous years. Despite this the general magnitude and relative route and area

sizes are consistent. General confidence limits for all quoted route flows are plus or minus 15%. Desk research supplemented the information.

The estimates of container flows made in the studies are the sum of container movements between European ports areas imports and exports, full and empty. Empties are not freight earning but are a significant element in the flows largely reflecting non-bulk trade imbalances, both intra and extra Europe.

3   THE STRUCTURE OF EUROPEAN FREIGHT TRANSPORT

European ports handled a total of just under 22 million TEU in 1992, some 21% of the estimated world total of 103 million. This is a lower share than in the previous edition reflecting the faster growth of traffic elsewhere, mainly in the Far East. To highlight this, the top three container ports in the world are Hong Kong, Singapore and Kaohsiung. Together, those three ports account for almost 19 million TEU of the world total, more than 18%.

Of the European total, container traffic between and within European areas amounted to 5.2 million TEU (9.2 million handlings), of which approximately 3 million TEU (57%) were inter-European and the balance the feeder trades. These latter have increased share since 1982 from 30% to 43% reflecting the fact that deep sea vessels have become larger and make fewer port calls in Europe.

Containers were conceived as an intermodal form of freight carriage, and generally with a maritime element, which is where their origins lie. On routes in Europe as elsewhere, containers compete for non-bulk cargoes with road, rail and inland waterway. Even where sea passage is unavoidable, the growth of ro-ro ferries carrying accompanied and unaccompanied trailers, and even rail wagons is also a threat to the container's market share. Thus, for example, trailers travelling overland now account for up to 40% of unit load traffic between Portugal and the UK, using the short ferry crossings over the English Channel.

Sea carriers in Europe also compete modally for container traffic on many routes. Examples of this include the heavy flow of containers between Rotterdam and Antwerp, a route dominated by road, rail and inland waterway. Another clear case is between Hamburg and Jutland in Denmark, a route that has excellent road and rail links giving those modes a high market share.

The majority of containers move to and from inland destinations rather than solely between ports. It follows that the inland modes are an essential element in the overall movements. For deep sea itineraries this is without conflict but for intra-European container shipments, it is less clearly defined as in many cases

the inland mode can undertake the entire door to door movement if geography and cost is appropriate.

Despite this, there are significant port to port flows in Europe, mainly the re-positioning of deep sea containers which for environmental reasons should ideally move by sea. However, economic market forces prevail and road and rail present formidable competition for the sea carriers on these routes in many cases.

4   INTER-EUROPEAN NON-BULK TRADE

Total inter-European non-bulk trade stands at 320 million tonnes and containers have a very modest share estimated at about 6 - 7%. Containers by sea do not compete at all on many European routes, for instance where land frontiers are involved and/or movements are intra country. To highlight this, Germany and France both have major container ports but containers make little penetration into the non-bulk trade between them.

The container does compete more strongly in inter-European trade where geography favours its original concept ie intermodal maritime use. Examples of such routes include Great Britain - Continent, Great Britain - Ireland and in the Scandinavia and Baltic regions.

Port statistics themselves often make it difficult to relate the identity of inter-European container traffic to inter-country trade. This arises from the fact that a high percentage of containers are in transit through ports in one country, but destined or originating in another. For instance, a container from Italy may cross three or four land frontiers before being shipped out of a Benelux or French port to Great Britain. Port returns would simply record the movement between the latter two countries.

5   EXTRA-EUROPEAN TRAFFIC

It is possible to estimate the relative importance of different port areas in extra-European traffic. This category is mostly deep sea traffic but does include short sea trade with North Africa, the Mediterranean and other near islands. It also includes the feeder trades between Europe and these places.

As in 1986, the data shows the same high concentration of deep sea traffic in four European port areas. Of the total of 14.935 million extra-European TEU handled by European ports in 1992, 97% is accounted for by North Mediterranean, Channel, Denmark/Germany and Great Britain together.

Feeder traffic, estimated at 2.234 million TEU, constitutes 15% of extra-European moves and as such, shows the proportion of the latter transhipped. Mediterranean figures are less reliable than others and its feeder volume could be understated.

Generally speaking, a strong deep sea presence is reflected in a low feeder share of total moves generated by extra-European trade despite the extra transhipment moves gained. Conversely, a weak deep sea presence reflects a high feeder proportion.

6   INTER-EUROPEAN TRAFFIC

Inter-European traffic amounted to 2.955 million TEU in 1992, representing 57% of the European total, slightly lower than in 1986. Table III shows the distribution of the traffic on the main routes, including intra-area traffic.

The Channel-Great Britain route continues to be the largest accounting for 23% of the total, down from the 27% of 1986. Eleven other routes exceed 100,000 TEU. Intra-area traffic exists on North Mediterranean, Denmark/Germany, Nordic and Atlantic routes amounting to 300,000 TEU in total.

Channel-GB	690		
GB-Ireland	281	Channel-E Baltic	40
ChannelOIreland	240	Atlantic-Nordic	30
Intra-N Med	200		
Nordic-GB	196	Denmark/Germany-E Baltic	27

Table III: Inter-European container traffic by route 1992 (000 TEU)

Inter-European non-bulk trade has grown more slowly over the last decade than the previous ten years but still over 50% in the period. Growth from 1986 to 1992 has been at about 2% per annum. Table IV illustrates this growth.

Overall, containers appear to have a market share of around 7% of European non-bulk trades, a similar figure to those in 1982 and 1986.

	1977	1979	1981	1986	1992
Million tonnes	188	217	218	299	337

(Source: Eurostat)

Table IV: Inter-European non-bulk trade

7   TRANSHIPMENT (FEEDER) TRAFFIC

European feeder traffic amounts to 2.2 million TEU, representing 43% of the European total, slightly more than in 1986 when the equivalent figure stood at 39%. Overall, feeder traffic has increased by 66% between 1986 and 1992.

Table V shows the main routes, including intra-area traffic.

	1992	1986
Intr N Mediterranean	685	466
channel-Great Britain	350	290
Denmark/Germany-Nordic	350	147
Channel-Atlantic	200	40
Atlantic-N Mediterranean	160	20
Channel-Denmark/Germany	90	130
Intra Channel	85	54
Intra Denmark/Germany	80	50
Denmark/Germany-E Baltic	70	10
Channel-Ireland	69	40
Channel-Nordic	58	60
Great Britain	15	10
Intra Nordic	12	10
Intra Great Britain	10	-
Denmark/Germany-Great Britain	5	10
Channel-N Mediterranean	5	6
N Mediterranean-Great Britain	-	2
Nordic-E Baltic	-	2
All other flows zero		
Total	2244	1347

Table V: European feeder traffic by route (000 TEU)

Intra-North Mediterranean continues to be the largest market followed by Channel-Great Britain and Denmark/Germany-Nordic. There have been major changes between 1986 and 1992 but in view of the volatility of feeder flows, it is to be expected.

The Mediterranean continues to generate feeder traffic and the various ports in the region compete strongly for it. Location on deep sea shipping routes is more important than hinterland to the success of a port in the North Mediterranean area. The growth of ports such as Algeciras illustrates this. At that port, 72% of container handlings in 1992 were transhipment with Maersk and Sea-Land controlling 95% of the port's 780,000 TEU throughput. Other ports in the region dedicated to transhipment include Marsaxlokk in Malta, and more recently, Giao Tauro in the south of Italy, is being developed for this purpose.

The Channel-Great Britain route, another busy feeder flow, could be affected in the future by two factors. Firstly, the Channel Tunnel will offer road and rail operators, particularly the latter, the opportunity to compete with sea feeders more strongly than on the present ro-ro links, although rail rates quoted to date have not proved competitive. Secondly, the abolition of the UK Dock Labour Scheme has allowed an improvement in performance of the deep sea ports which has led to more deep sea vessels calling direct to the UK, with the concomitant reduction in feeder flows, a trend that may well continue.

With deep sea calls being negligible in the Nordic area, German ports dominate the resulting feeder flows. Again, the fixed links being developed may affect the market balance, as the effect may not simply be to transfer containers to other the modes, but to re-route them by road and rail, direct from deep sea port to destination or vice versa, cutting out the Nordic ports from the itinerary.

The other major factor in the European feeder patterns has been the re-unification of Germany and the switch from command to market economies amongst the former Comecon countries. Deep sea vessels previously required to call at Baltic ports because of political factors can now respond to the natural market forces and use North Sea ports as hubs and tranship by all modes. The decline of Rostock as a container port bears witness to this trend.

These physical and political impacts on the European container feeder patterns are dealt with in more detail in the complementary study, Containers Inland.

Lastly in this section, it is significant that the size of deep sea container vessels utilised by the major inter-continental carriers has steadily grown, with 4800 TEU vessels being the present generation's point of reference and 6000 TEU now a serious proposition in the near future. Clearly, operators of container vessels of that capacity and physical size will, for cost and port accessibility reasons, further limit port calls and the growth of hub ports and feeding by all modes will increase further.

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8   FACTORS DETERMINING CONTAINER THROUGHPUT

When considering the factors determining the level of European container port throughput, the feeder and inter-European trades have to be examined separately although there are certain common factors.

Feeder flows are dictated by the deep sea lines' European transhipment patterns. As previously discussed, the major deep sea lines are using vessels of increasing size. This is by no means universal as for many lines there are physical and commercial restraints that limit vessel sizes on certain trade routes. However, on the growing Far East trades with Europe, and the North Atlantic services amongst others, vessel sizes are increasing.

The general result is less port calls in Europe. Many lines now call at either Hamburg or Bremerhaven, Rotterdam or Antwerp but in each case, not both. This generates high volumes of feeder traffic between the two ports in each area, and arises because the lines are obliged to offer Bills of Lading to and from each port. This is generally a requirement of their customers, the shippers and receivers.

Whilst much of the inter-port feeder traffic moves by land modes and is lost to the sea carriers, the one port-one area practice of the deep sea lines also generates additional sea feeding to more distant ports. Clearly, for the ports that receive the main line vessels, throughput is enhanced, not just by the deep sea vessels' calls themselves but by the additional handling to and from the feeder vessels.

For the adjacent ports, both handlings can be lost if land modes are used heavily, and the more remote ports receiving the sea feeder services only, have small throughputs and will only handle the containers once. Low through-puts tend to raise ports costs. In this latter case the development of more fixed links in Europe could further exacerbate the traffic loss in those ports as containers are transferred by road or rail, directly between customers premises or inland freight stations, and the deep sea port.

Overall feeder growth is dictated by the deep sea lines container volumes and the degree of their commitment to the hub port principle. Containerisation of further deep sea areas in the world, currently served by general cargo services is unlikely to generate significant additional container volumes in the foreseeable future.

Inter-European container traffic is led by the level of non-bulk trade between European countries and the container's market share of the total. Inter-European non-bulk trade grew between 1986 and 1992 but more slowly than the previous

five years, no doubt reflecting the recession that has variously affected Europe in recent years. It is true to say that non-bulk trade and containerisable trade are not wholly the same thing but the growth in inter-European container handlings over the decade is in fact a reflection of the increased inter-European non-bulk trade.

9 THE MAIN CARRIERS

There are over 100 lines carrying intra-European container traffic, including the ro-ro and ferry operators as well as the wayport calls by deep and short sea lines. Most lines are either feeder or inter-European carriers and many are a mix of the two in varying degrees. Feeders can be dedicated or partly dedicated to the schedules of their deep sea customers, others are wholly common carriers.

Some of the deep sea lines offer their own intra-European services, these including Maersk, Sea-Land, K Line and NYK, again a mix of feeder and inter-European. Also in this category is Portlink, a wholly owned subsidiary of CMB.

The twelve leading operators companies account for 34-50% of the total traffic of 5.2 million TEU, a very similar percentage to 1986, implying that the market dilution which occurred between 1982 and 1986 has been halted.

10 A SUMMARY OF THE SURVEY

The salient results emerging from the study and their relevance to the previous two editions are:

* In percentage terms, European container handlings are down in relation to the world total, compared to the previous study years, standing at 22% in 1992;

* In real terms, European container volumes are up, rising from 2.2 million TEU in 1982 to 5.2 million in 1992, in increase of 136%;

* The feeder share of European container flows has increased from 30% to 43% in ten years;

* The inter-European share of European container flows has fallen from 70% in 1982 to 57% in 1992;

* The container share of inter-European non-bulk trade has remained more or less constant at about 7%;

* One in six of all deep sea containers handled in Europe are transhipped at least once.

11 APPLICATION OF DATA TO POLICY OPTIONS

From a policy point of view one of the values of such a survey is that it establishes a broad database which allows for the discussion of various maritime options.

The survey illustrates some remarkable contrasts in the success of the container mode in capturing market share. Thus, for example, we find that there is a larger volume of containers moving between Ireland and the Continental mainland than with Great Britain, although the unit load market overall is larger with the UK.

	'000s TEU	million tonnes liner traffics (approximately)	Estimated container market share
Ireland - UK	240	10.5	17%
Ireland - Continent	309	3.0	75%

Table VI: Container market shares with Ireland

A different type of contrast prevails in trades between Great Britain and Denmark and Spain respectively.

The maritime distance in both cases is approximately 400 nautical miles. Despite the fact that the UK - Denmark market is only approximately half of the size of the UK - Spain market (ie so ships are more difficult to fill), over 90% of Danish traffic moves by direct shipping, while only 30% so moves from Spain. The remainder follows the 1000 kilometre road transit of France.

12 A CASE STUDY: THE ATLANTIC ARC

We have examined some of the factors which underlie this contrast in a study recently completed for the Atlantic Arc Commission. The study was designed to determine whether regional ports in the Atlantic Arc area had a substantial future in the liner trades. It became evident that the success of such regional ports would go hand in hand with the development of a maritime network cor-

responding to the principles described in EC directives concerning combined transport. That is, a network which would provide a unit load shipping service within 150 kilometres for most origins, and long distance maritime routes to provide for a variety of destinations on a regular basis.

The area of study covered potential maritime markets between the Iberian peninsula and Western France with the British Isles, and including potential routes between Ireland and the Bay of Biscay to the Continental Channel ports.

13 THE ATLANTIC ARC MARKET

In 1992, there was little no direct roro traffic in this market area. The sum total amounted to only some 12000 trailers, or the equivalent of only 1.5 weekly shiploads.

Our survey of the container industry indicates that there are approximately 3 million TEU of intra-European traffic moving by direct container shipping. Some 780,000 TEU moves within the Atlantic Arc area.

	'000s TEU
Ireland - Continent	309
Iberia - N Continent	312
Iberia - UK/Ireland	159
Total	**780**
(= 520,000 units at 1.5 TEU/unit)	

Table VII: Estimated direct intra-European container traffics, Atlantic Arc routes

Our analysis of relevant trade data suggests that there are approximately 17.4m tonnes (1992) of liner trades in these markets, equivalent to some 1.58m freight units.

It follows that only a third of potential shiploads of unitised cargo in the area actually use the longer maritime mode. The challenge is to identify a commercial, route and port structure which can satisfy the market in terms of tariff and service quality.

Our analysis of trade data (source Customs and Eurostat), and regional data from the key countries (the UK, Spain and France) enabled us to develop an origin - destination matrix for the area of opportunity. Freight was categorized by trade classification at the five digit SITC level to estimate potential liner tonnages. Where this could be compared against tonnage data by unitised modes, it was found each country to country flow so checked was within 4% of our estimates of 'liner tonnes'.

The next stage was to convert these tonnages into the number of units (containers or trailers), and then into potential 'shiploads'. We assumed a mean conversion rate of 11 Customs tonnes per unit, to take into account empty trailers and containers.

	m tonnes
Ireland - N Continent	2.4
Ireland - Spain	0.1
Ireland - Portugal	0 1
UK - Spain	2.7
UK - Portugal	0.7
N Continent* - Spain	8.5
N Continent - Portugal	2.9
Total	17.4
Equivalent to approx 1.58 m freight units	

* excluding France. All N Continent routes include Germany.

Table VIII: Potential shiploads available from each Atlantic Arc area

This can be converted to approximately 1.58m freight units per annum. Loaded onboard roro ships of about 1000 lane metre capacity, that would equate to about 220 shiploads in each 'direction' per week (60-65 units per ship).

The Atlantic Arc shipping analysis was restricted to coastal port hinterlands between Southern Spain and the Netherlands, so that German traffic was then excluded. That reduces the total market to the equivalent of 140 shiploads per week.

We tested the proposition that a half of this total volume could be attracted to longer distance maritime routes. That is, that the maritime share rises by 50% from a one third to a one half market share, by offering more frequent services and using roro container ships to accommodate trailers as well as containers. This is described in **Table IV**. The table lists each Atlantic Arc area by the

number of 'potential' shiploads per week (each direction) that might be available to a maritime network. Only traffics trading 'within' these areas are included.

Area	Total shiploads per week	Flows over Inter area	
		2/week	3/week
E Spain	18.2	6	2
Ireland	17.2	3	2
Netherlands	14.2	2	1
Portugal	12.1	3	0
SE England	11.2	2	1
SW England	9.3	2	1
NE France	8.9	2	1
NE Spain	8.5	0	0
N England	8.3	2	0
Berlgium	7.8	2	1
NW Spain	5.3	0	0
SE France	4.7	0	0
Scotland	3.8	0	0
SW Spain	3.7	0	0
NW France	2.8	0	0
SW France	2.7	0	0

Table IX: Potential shiploads available from each Atlantic Arc area

Only two maritime area (one of which is actually on the Mediterranean) generated two flows which could justify three sailings per week to another region. Some areas had no potential flows which could generate two shiploads per week (eg NW Spain or Scotland). Of approximately 60 long distance routes available, only 12 could generate two 'shiploads' per week.

The Study highlighted six main features:

* Overland routing was more expensive than direct shipping, but only if port charges were charged at North European levels;

* Port charges varied widely, and tended to discriminate against longer shipping routes;

* There was rarely sufficient traffic to justify high frequency services between individual regions;

* A substantial proportion of forwarders required service frequencies of three times weekly;

* A substantial proportion of hte market was now committed to trailers;

* Maritime systems could offer competitive transit times.

Providing that the problem of high port charges in some countries could be addressed, the crucial problem, therefore, is neither the cost or speed of the maritime mode, but one of identifying sufficient volume to justify a competitive frequency. Nevertheless, if (as above) we assume the maritime mode can capture half of the available market, each area is able to generate sufficient total volume to justify a competitive frequency: three sailings per week. Unfortunately, traffic actually 'spreads out' to several areas, and it is essential that some means be found of aggregating several are-to-area flows within the same vessel.

14 NETWORK OPTIONS

We examined four different approaches which could address these challenges. These were:

a. Small ships, so that a given volume would permit a competitive frequency to a wider number of destinations;

b. Multi-porting; to achieve the same objective by assembling several markets on the same ship;

c. 'Super-routes' over longer distances, with larger catchment areas;

d. Transhipment, to expand the number of destinations which could eventually be served from a given sailing departure.

A small ship approach could not succeed commercially. It is a feature of these markets that the existing 'base-load' traffic moving by sea is that which is prepared to accept a low frequency to achieve economies of scale through using larger ships. Such services would not bear the cost implications of operating smaller ships. The operators could not be persuaded to lose economies of scale, as they would be under immediate threat from competitors who did not so adapt.

A multi-port approach over the distances available with the Arc proved un-economic; the cost of diversion so raised shipping costs as to render the option expensive and slow, because of delays at intermediate ports.

The most likely opportunity lay in 'super-routes'; new routes between such ports as Bilbao and Southampton designed to capture roro traffic through offering several sailings per week. There can be no doubt that a substantial propor-

tion of the market prefers the use of trailers. Approximately 70% of the UK - Spanish market uses the roro mode despite the cost of haulage across France. However, the reason why longer distance roro services are still in their infancy can be largely attributed to the high charges levied in Iberian ports, and particularly the practice of charging goods by value bands and not weight. This obviously discourages maritime trailer traffic, as that traffic tends to be the most valuable.

15 COMBINED TRANSPORT PRINCIPLES

Unfortunately, such routes would still not conform to the principles of combined transport. Long road hauls (in Spain and Great Britain) would still be required. That lead the study to also consider transhipment, to provide the means whereby an individual region could support a local service two or three times per week, providing that it passed through a transhipment port where some cargo could be transferred to other services, to provide a comprehensive network.

There are two principle drawbacks to transhipment. Firstly, there may not be a suitable port infrastructure available to satisfy the geographical characteristics required of such a port, and secondly, the shipping industry is unused to the degree of inter-line co-operation that would be required. Furthermore, it could only achieve its potential if the cost of port cargo transfer was low. Its viability is the subject of further studies.

It would have been pointless to identify a maritime opportunity if rail could be shown to be capable of better fulfilling the objective. The study therefore compared the potential cost of maritime services with the charges which an efficient rail network could offer, working under the principles of EC directive 91/440 whereby infrastructure owners should not discriminate between train operators.

This comparison drew attention to the contrast between intermodal handling rates between rail and shipping, and the way in which the public sector railway industry is able to develop operating networks (such as Intercontainer and through the members of the Union Internationale Rail-Route) in a way the private sector shipping industry seems viable.

Intermodal rail-road handling costs are typically 30 Ecu per unit. Sea to road charges in the Iberian peninsula are typically 200 Ecu per unit. Insofar as network development is concerned, the railway system has developed techniques of train-sectioning at 'hubs' to provide the means of offering daily services between European regions. The maritime industry has no such equivalent flexibility.

16 SUMMARY

One of the effects of the Single European Market has been to reduce drastically the availability and reliability of intra-European freight transport data. It is, therefore, all the more important to be able to develop alternative methods of tracing the development of intermodal traffics if the success and potential for maritime combined transport is to be understood. We have illustrated in this short paper, how such data can be collected, collated and then applied to policy issues in the Community, and allied with market intelligence and transport cost information to debate and develop policy options. The preliminary conclusions from the Atlantic Arc Study were that existing ship technology is able to deliver a cost effective and rapid level of service, and that the challenges lie in minimising port charges and addressing the commercial structure within which the maritime industry functions.

17 THE EUROPEAN CONTAINER FREIGHT MARKET: CONTAINERS INLAND

This complementary study to Containers by Sea covers all aspects of the inland movements of containers in Europe. It analyses and quantifies the movements of maritime containers between European countries and regions, and places the analysis into the context of the many changes that have and are taking place in the European domestic freight transport. For each country covered, the competition between road, rail and inland waterway is evaluated and the resulting container carrying infrastructure compared. Containers Inland will be published in May 1994.

STRATEGIC PROFILES FOR TRANSPORT COMPANIES: THE CASE FOR DUTCH FOREST PRODUCT CARRIERS

By A.A.C.M. Wierikx and J. van Riet

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STRATEGIC PROFILES FOR TRANSPORT COMPANIES: THE CASE FOR DUTCH FOREST PRODUCT CARRIERS

1 INTRODUCTION

The Dutch shipping industry is in a crucial phase of its development. Increasingly Dutch shipowners choose to register their vessels under foreign flags. Last year the total number of ships under Dutch flag declined a further 10 percent, a development which worries national government, believing it to be important to maintain national shipping activities. It is held that a group of successful shipping companies would be beneficial to the further development of the Dutch transport and distribution industry and the improvement of The Netherlands as an entrance/mainport for global cargo flows into Europe.

The government is presently considering to change the focus from direct financial support for the industry to other types of transport policy. The future goal of government transport policy will be to stimulate Dutch shipping companies to maintain activities in The Netherlands and also to attract new shipping (related) activities in from abroad. One perceived way to help industry will be to provide information about strategic market opportunities in different market segments.

In 1993 a number of studies was carried out for the Dutch Ministry of Transport to investigate the current position of the Dutch shipping industry and gave recommendations for future development of the shipping industry and the potential role of the government therein. At the same time INRO-TNO carried out a study regarding the strategic development of transport companies in general, which resulted into a method determining strategic possibilities for these companies. So far, this method has been applied to a number of, mostly land-based, transport markets.

At the moment shortsea shipping seems to offer bigger opportunities for shipping companies than do deepsea trades. In this paper the results of the different studies mentioned will be combined to determine the strategic opportunities for Dutch shortsea shipping companies. The focus will mainly be on the shipment of forest products. In one of the studies for the Ministry, the logistic chain of forest products was analysed in order to learn about the position of shipping companies within this chain, compared to other participants involved.

The results of the studies have been discussed with government officials, industry representatives and managers of a number of shipping companies. Their

reactions, though critical, have so far been mainly positive. The authors believe that the results of the studies do not only apply to the Dutch situation, but can be relevant for other European shipping companies and governments as well. We are also convinced that the ideas are not limited to forest products and shortsea shipping alone, but can also be applied to other trades and commodities.

In this paper the general method to determine strategic opportunities for transport companies (called TOVER) will be discussed. The next step will be to analyse the current situation of the transport market for forest products. This analysis will result in a market segmentation, based on market and product characteristics. Subsequently, the current position of Dutch shipping companies within given market segments will be determined. These steps are necessary to be able to come up with the strategic opportunities that these companies have to improve and expand. Finally, some conclusions and recommendations for shipping companies involved in forest product markets will be given. Attention will also be given to the relevance of the ideas presented for other markets and commodities.

2 TOVER: METHOD TO DETERMINE THE STRATEGIC OPPOR-TUNITIES FOR TRANSPORT COMPANIES

Making choices is essential for the strategic management of all companies. Logistic service providers make no exception to this rule, especially because their environment changes rapidly. Without adaptation to new circumstances their existence might very well be endangered; furthermore, logistic develop-ments are quickly emerging, and are creating a need for improved logistic services.

All logistic service providers, including shipping companies, have to position themselves into the markets that they wish to operate in. Successful companies will develop from operational transport firms into fully equiped companies that deliver extensive logistic services. This requires a considerable metamorphosis. Large investments in people, equipment and systems are necessary if companies want to follow this path. In some cases the return on investment is not clear, so the playors have to select the timing and optimal design of these investments carefully. The market for logistic services certainly is not a homogenous one and what is a good strategy for one firm could very well mean a disaster for another. For some firms an ideal strategy would be to focus on a dedicated service for a small number of clients, whereas for others more generic services are ap-propriate.

In the TOVER study (van Riet et.al., 1993), regarding the future role of transport companies, strategies are determined that can be followed by logistic service providers in order to avoid the threats and make full advantage of the pos-

sibilities that apparently exist. A number of steps need to be followed for these strategies to come about:

I.   Definition of the relevant market;
II. Determination of the current position of a company (or a group of companies) in terms of activities and relationships;
III. Analysis of the external circumstances;
IV. Determination of strategic opportunities for improvement of the current position;
V.   Determination of strategic opportunities for expansion of the current position.

These steps will be briefly discussed. However, it is important to mention first that the TOVER method is based on earlier research into strategic management by, a.o., Porter (1980) and Ansoff (1984). Also the strategic development of transport companies has been the subject of a number of other research projects in The Netherlands. The method described hereafter is basically an integration of two different viewpoints:

*   The first approach to strategic development is related to the products and markets that companies are focusing their activities on. Ansoff is the principle prophet of this line of thinking;
*   The second approach looks at strategic behaviour of companies from a competitive perspective. According to Porter, companies react to the competitive forces they experience as a result of the actions of other parties.

The combination of both approaches leads to the following steps:

I. Definition of the market

Before the strategic options for a specific company (or a group of companies) can be found, it is essential to define the relevant market that needs to be studied. Transport markets can be defined by:

*   Market characteristics (such as geographic area, density of demand and supply points, type of regulation);
*   Product characteristics (such as volume/weight density, value density, necessity of conditioning);
*   Technological characteristics (such as transport mode, information technology used, handling equipment);
*   Logistic characteristics (such as shipment size, order time, reliability).

It is important to find the relevant and dominant characteristics of a particular market. These characteristics determine the possibilities for certain strategies.

For example, in an already very specific market, the chances for further specialisation are small.

II. Determination of the current position

Based on one of the viewpoints mentioned above, a company's strategic position can be described by the activities it carries out. For transport companies these activities can be displayed by the use of a three-dimensional diagram. This diagram (**figure 1**) shows on the axes respectively *geography, network activities* and *logistic activities*. The activities of a transport company will always be a combination of these three dimensions.
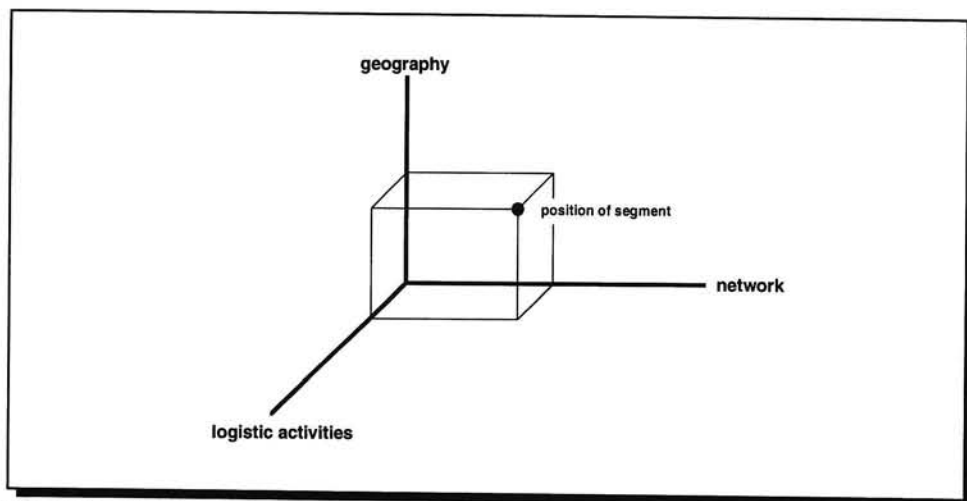

Figure 1: Strategic development axes

The *geography* axis represents the geographical area of operation of the transportation company. This area can be local, regional, national, continental and/or intercontinental.

The *network* axis represents on the one hand the complexity of the network and transportation activities and on the other hand the level of control the company has over the transportation activities within the network.

The *logistic activity* axis contains two aspects as well. On the one hand it represents the complexity of the storage related logistic activities offered. On the other hand this axis represents the level of control the transport company has over the activities that are carried out within the logistic chain.

III. Analysis of the external circumstances

An important step in the method is to analyse the external circumstances and developments the company faces. Aspects that need to be included are expected development of volumes, changing needs of customers, number of competitors, etc. Especially important is the position, the strategies and the power of other participants in the logistic chain(s) in which the transport company participates.

IV. Strategic possibilities to improve the (current) position

With the input of market definition, the current position and the external circumstances, now the strategic options can be determined. This can be done in two steps. The first step will focus on the possibilities for consolidation (improvement) of the current position. The next step describes the possibilities for changing (expanding) the position.

Given the current position in the diagram (geography, network activities and logistic activities), a company can try to find a more profitable position, where it has some level of protection against its competitors. By pursuing a certain competitive strategy a company can try to make the most of its current position. This can be done in the following ways (based on Porter, 1980):

Value adding: This means that the operator possesses or develops a number of unique characteristics for its organisation. These characteristics are only valuable when:

* the competitors do not have these characteristics;
* the customers recognise and appreciate these characteristics;
* the customers are prepared to pay higher rates.

Specialisation: The second possibility to improve the position is specialisation. This means a further concentration on certain market segments, based on one or more of the earlier mentioned characteristics: product, market, technology and logistics. Also specialisation is only possible if a company can get a higher price for its services.

Price/service ratio: The last possibility for transport companies is to improve the price/service ratio. When there are no more possibilities for value adding or specialisation, price competition is the only opportunity left. For Dutch transport companies with their high labour costs, this is most of the time not a very attractive option.

Figure 2 shows the combinations and priorities of the three possibilities in general.

value adding   price/service

generic

specialisation
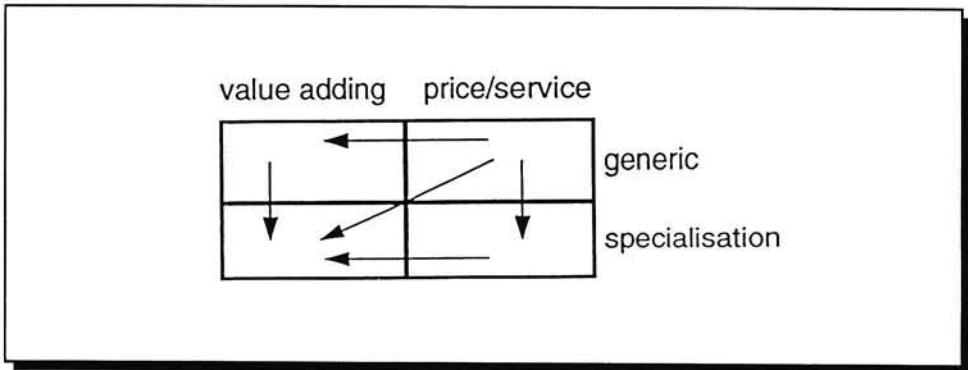
Figure 2: Possible strategic developments for transportation companies within their current position

In many transport markets it is difficult to find ways to escape price competition (Korver et.al., 1991). One could argue that in some markets there is a cyclical process going on. Strategic advantages, like unique characteristics and specialisations, can be, and increasingly are, copied by competitors. Therefore operators continuously need to take action to stay out of price competition. But as time goes by, they are running out of possibilities for value adding and/or specialisation. Finally, all possibilities are exhausted and no further improvement is possible within the current position. **Figure 3** gives an illustration of this process in which possibilities for improvement of the position are getting increasingly narrow.

## V. Strategic possibilities for changing the current position

Besides the possibilities for improving the current position, there are also strategic possibilities for changing or expanding the current position of a transport company (Vermunt & Ruijgrok, 1993). These changes in the position can be visualised as one or more moves within the three-dimensional diagram presented earlier.

Geographic axis: On this development axis, transport companies can expand their geographic service area (expansion strategy). For instance, new customers in other countries can be pursued.

Transport/network axis: The transport and network activities of a transport company can be developed by (diversification strategies):

* Moving the focus from carrying out transport activities to increased control of subcontracted transport activities within the network and/or:
* Developing the transport activities from a simple network to a more complex network.
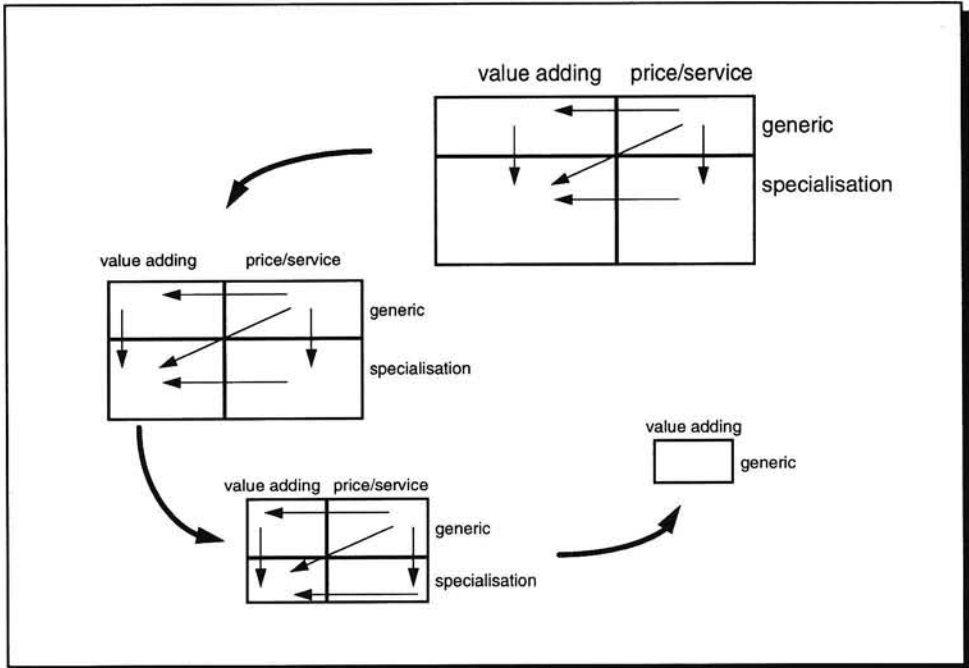
Figure 3: Cycle of declining possibilities for value adding or specialisation strategies

Logistic activities axis: The third direction may be to find a new position on the axis of logistic inventory related activities. This can be done by:

* Developing from simple to more complex logistic activities, and/or
* Changing the focus from carrying out inventory related activities to increased control of activities in the logistic chain.

It is obvious that most of the time there is little or no discussion. The possibilities for development along the axes have to be found within the limited means that a company has available. Often therefore expansion in one direction is accompanied by concentration in another. Expanding the network with pickup and delivery services for example could mean that further concentration on a limited geographic service area is necessary.

After a change of position, a company again needs to make a choice how to implement the chosen new position. This of course can be done by value adding, specialisation or price/service competition. Once again the transport company can use these tools until its possibilities for upgrading its competitive position are dried up. This will probably result in the need for a new change (expansion) of the position of the activities of the company. These continuing

changes are necessary for a company to escape the situation of price competition. In highly competitive markets this can eventually result in a (second) cyclical process that is visualised in **Figure 4**.
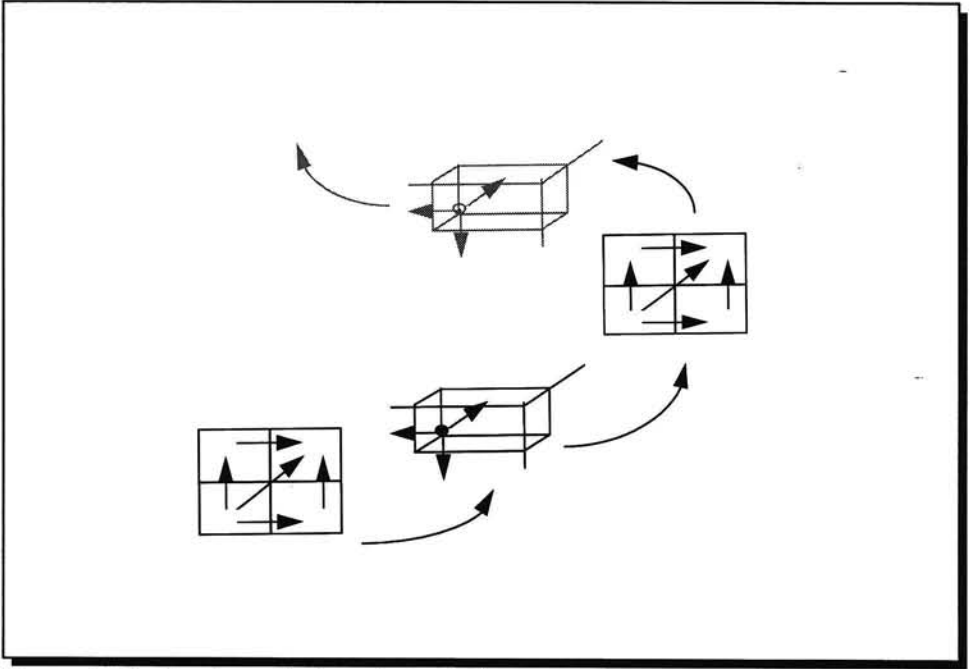

Figure 4: Cycle of continuing strategic improvement

3   MARKET   ANALYSIS   AND   DEFINITION   FOR   FOREST PRODUCTS

The TOVER-method was used to find possible corporate strategies for Dutch forest product carriers (Wierikx et.al., 1993). As mentioned in chapter two, the first three steps consist of a definition of the relevant market, a determination of the current position of the shipping companies and an analysis of the external circumstances. Although steps one and three were carried out separately in the study mentioned, in this paper they are discussed together.

3.1 MARKET ANALYSIS

The forest products industry can be divided into a number of application areas. The base material, wood, is used for: (percentages in 1991)

* Fuelwood (52%);
* Pulpwood/woodchips (13%);
* Industrial roundwood:
    - Sawn logs/veneer logs (28%);
    - Other industrial roundwood (7%).

Although it is the largest category, fuelwood is mostly consumed locally in the areas of origin and therefore not transported over long distances. Most important in value are the paper and paper product chains, which are part of the pulpwood application area, and the sawnwoods chain.

To gain knowledge of the market developments that are to be expected, it is important to look at the position and logistic requirements of the actors in these chains. In the forest product industry the following developments can be recognised.

* Production companies are merging their activities to avoid excess capacity and to take advantage of economies of scale. Cargo flows increasingly become intra-company flows;
* Production companies are building market positions in developing countries by increasing production capacity and buying forests.
* The increasing use of recycled paper in the production process causes transfers of areas of origin (from forest to cities);
* Paper supply nowadays is more diversified and of higher value. Transportation companies need to react to these developments;
* To reduce inventory costs, production companies are searching for new, efficient and controllable distribution systems;
* Given the customer driven markets, the power of the buyers is increasing. This results in a more customer driven production and smaller and more frequent shipments.

Within the scope of these developments, it is expected that relations between shippers and buyers will intensify to reduce costs and insure quality. Transportation companies and logistic service providers can play a very important role in these developments.

When comparing market demand, product characteristics, transport distance, logistic chain and other important elements in the transportation of forest products, a differentiation can be made into five segments, each describing unique combinations of the elements mentioned above:

* Main stream deepsea transport;
* Additional deepsea transport;
* Dedicated shortsea transport;
* System shortsea transport;
* Standard shortsea transport.

In the next paragraph, every segment will be described in more detail. Although the deepsea segments are less relevant here, they are discussed in short, to give a complete overview.

3.2 SHORTSEA AND DEEPSEA SHIPPING SEGMENTS

3.2.1 Main stream deepsea transport

For long distance transport of forest products, large multi-purpose carriers are used. The vessels are equipped with gantry cranes and open hatches. They basically carry primary bulk products (low value density). Mostly they only call at a few east- and a few westbound ports. They can operate their services either as a tramp or as a line carrier.
Within the forest products trade, this segment is dominated by Gearbulk (41 vessels, tramp service) and Star Shipping (26 vessels, line service). The rates on intercontinental trades are set by these carriers. Dutch shipping companies are not involved in main stream deepsea transport.

Market perspectives

Rates are expected to decrease with a further increase of the capacity of vessels. In the next decade capacity will probably grow beyond maximum demand. However, in the beginning of the 21-st century, new markets will probably open and GATT can bring some improvement of the market situation.

3.2.2 Additional deepsea transport

Characteristics

Additional deepsea vessels operate in the same trade as main stream deepsea carriers, but with a higher degree of flexibility. DWT of the vessels in this segment is much smaller than in the main stream segment, which makes these vessels also suitable to call on smaller ports. Besides the higher degree of penetration, the quantity per shipment is smaller and the value density is higher. Customer service plays an important role in this segment. The Dutch forest products operator Spliethoff is involved in this segment.

Market perspectives

Nowadays, the additional deepsea carriers are working in the shadow of the main stream deepsea traders. It is expected that, in the future, this market will grow. Customers are demanding smaller amounts, higher quality and more varieties to be delivered faster and more reliable.

3.2.3 Dedicated shortsea transport

Characteristics

In this segment, shipping is part of the logistic chain of a specific production company. Carriers (are forced to) operate in service to the benefit of the whole company (eg Finncarriers).
Therefore, the ships are equipped for transportation of a small number of commodities. Their cruise speed is high and their port-time is minimised. They operate in line-service with a minimum amount of calls. The combination of line-service and special equipment makes it difficult to acquire back-haul.
The "Reels-On-Wheels System", developed by the Delft University of Technology (Wijnolst, 1993), is classified as highly dedicated and will, whenever it will be implemented, belong in this category. It is equipped to handle and transport paper-reels in a very efficient way.

Developments

Because of the economic recession, the need for back-haul is growing. Very often the rates offered by operators in this segment for back-haul are low. This can be explained by the lump-sum prices calculated for the specialised commodities. However, the possibilities to transport other commodities are limited.

3.2.4 System shortsea transport

Characteristics

Characteristics

The main goal for the operators in this segment is maximisation of occupancy ratio. The vessels need to make as little miles in ballast as possible. To achieve a high level of paid miles, operators are setting up system-traffics. The system traffics are recognised by a few large contracts for shipping commodities. These contracts are mostly based on weekly shipments without further time restrictions. Additional cargo is acquired to make the round-trip payable. Commodities that are often transported in back-haul are china clay, waste paper and steel. Depending on the additional cargo, roundtrips are carried out in A-B-C-A-like

systems. Vessels in this segment are flexible within the system-traffic. The vessels do have a certain specialisation (box shaped holds and loading/unloading gear), but are able to transport other commodities.

Developments

The market perspectives for carriers in this segment are relatively good. An increasing number of shippers will be involved in fixed schedule product flows, that are very well suited for this type of transport service.

3.2.5 Standard shortsea transport

Characteristics

In the standard shortsea transport segment, the transported commodities can be characterised by low value-density. Logistic requirements are not very important. Low rates are most important for shippers. The average maintenance condition of these ships is worse than in the other segments. Operators in the system shortsea transport segment use the standard segment to escape. Whenever there is no shipment available in the system segment, they agree with shipping cargo against spot market prices. They then transfer temporarily to the standard segment.

Developments

Although most operators prefer to establish more long-lasting system-traffics, their will be always a need for additional standard shortsea shipments. It is expected that the market situation for this segment will not change dramatically in the future.

4 CURRENT POSITION OF SHIPPING COMPANIES IN FOREST PRODUCT TRADES

After discussing the shortsea shipping market for forest products, in this chapter the focus will be on the current positions of the Dutch forest products carriers in the three different shortsea segments. These positions will be determined by using the method described earlier.

In the Netherlands about 8 shipping companies are active in the forest product trade. They operate either world-wide in deepsea trades or continental in shortsea trades. Because competition and crew costs are increasing, they are looking for possibilities to specialise. One of them sets up special system traf-

fics, another specialises in great flexibility and another one focuses on port-port tramp-services.

The vessels used are from a diverse range, equipped to carry bulk, neobulk and/or customer products. The variety of products and changing sources and markets pose commercial and technical challenges to ship operators. Concepts like Sto/Ro, Ro/Ro, 'Reels-on-wheels', cassette, COB, etc. are a few examples of the level of innovation within the forest products trades.

In all shortsea segments the current position of Dutch shipping companies involved in forest products on the *geography* axis is limited to Northwest Europe. Concerning the *network* and *logistic activity* axes, there are several differences between the shortsea segments. Therefore, they are discussed separately.

network axis

In the standard shortsea shipping segment the network consists of relatively simple port to port transport activities. In the system-traffics segment, transport tends to be somewhat more complex. Some operators transport wood and paper products on a carrier-haulage basis (port to door). This means that the shipping company has a responsibility for and control over inland transport. In the dedicated shipping segment, the trades are part of a more complex network, that includes all land based movements for the shipper. So far these networks are not controlled by the operators but by the shippers or the consignees.

Conclusion: There is some difference in the complexity of networks between the three segments, but in the current situation this difference is relatively small.

logistic activity axis

Concerning additional logistic activities the approach is similar. Operators active in the standard segment only transport and do nothing more. Operators active in the systems traffic-segment only take responsibility for transhipment when the occupancy ratio of the vessels increases. Other logistic activities in this segment are very rare.

In the dedicated segment sea-borne traffic is part of the total logistic operation of a production company. Although vessel-operators are part of a complex network, they are not responsible for the operation of other logistic activities. These activities (like stevedoring, trucking, etc.) are carried out and controlled by the producer or third party companies hired by the producer. It might even be so that the vessel operating company itself is hired and controlled by the producer (eg. Transfennica). The position of the dedicated carrier on the logistic activity axis is then equal to the position of the standard carrier on the logistic activity axis.

Figure 5 shows the current position of the shortsea segments. Since there is no difference between the geographical service area of the shipping companies in all three segments, the geography axis is left out of the diagram.

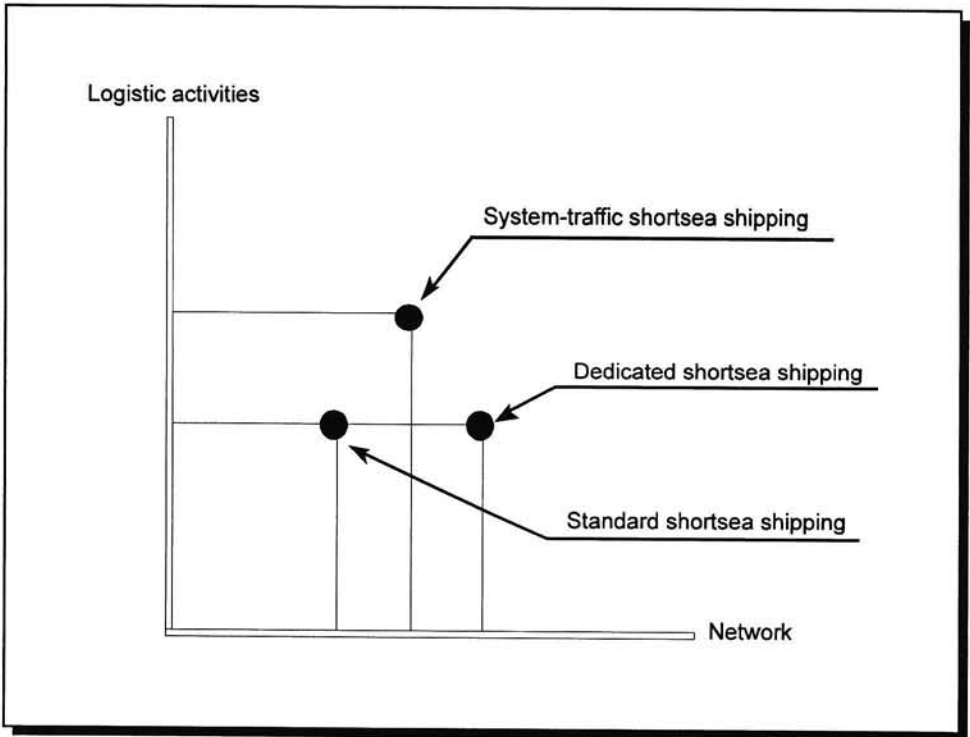Figure 5: Current position shortsea segments

5 STRATEGIC OPPORTUNITIES FOR DUTCH FOREST PRODUCTS CARRIERS

5.1 IMPROVEMENT OF THE CURRENT POSITION

Within the current position there are a number of possibilities to improve operations and profit. In this step we will talk about the possibilities for operators in general and the situation in the different shortsea segments.

Value adding

To distinguish oneself from the competitors, additional value can be added to the service of the operator by improving aspects as flexibility, quality of the crew, reliability and excellent maintenance.

Regarding Dutch forest products carriers, we doubt whether it is possible to extend or even consolidate the current position in this way. At present the Dutch flag already stands for high quality service. Shippers are always tempted to choose a cheaper operator from a low cost country. Besides, the competitive advantage of added value disappears when these competitors offer the same service.

Specialisation

A possibility to escape from price competition is to introduce further specialisation. Specialisation can be achieved on one or more of the following aspects:

* *Products*
  Operators could specialise their equipment on transportation of specific categories of commodities such as paper reels, or concentrate on conditioned transport (eg. kiln-dried timber),
  The risks for operating specialised ships are very high. These ships offer little flexibility and it is very difficult to find back-haul.
  Besides, many forest products-carriers are already equipped to transport certain commodities (COB vessels, Sto/Ro, Ro/Ro).

* *Market*
  Many operators in the European shortsea market already have a geographic specialisation. For example, in the Baltic specialised ice-class ships are active.

* *Technology*
  Similarly to product specialisation, further technology specialisation will lead to less flexibility and decreasing possibilities to find back-haul. There is a certain relationship between development of loading and discharging systems in the port and technological development of ships. Shipping companies therefore cannot introduce new technologies by themselves.

* *Logistics*
  Further specialisation within logistic characteristics like lead-time, accuracy, shipment size, etc., offers sea-borne traffic fewer possibilities than land-borne traffic. In the present situation shippers are not prepared to pay extra for high speed or high quality services.

When ships become more sophisticated and dedicated the possibilities for finding back-haul are decreasing. However, so far back-haul is essential to survive.

Price/service ratio

Small Dutch forest products-operators, operating on a high level of costs (linked to expensive crew and security regulations), will never be able to distinguish themselves with a good price/service ratio.

After the discussion of the possibilities for improving the current position in general, we will now switch to the situation for the three distinguished segments

A. Dedicated shortsea transport

Services offered by dedicated shortsea operators are relatively sophisticated. The probability of not finding back-haul and being exposed to high operating costs is therefore large. Operators are totally dependant on their customers. Trying to distinguish themselves with a better price/service ratio is not a feasible option for the shipping companies. Within the current position, offering extra value will probably not be a good choice. Since competition is heavy, shippers rather choose cheaper operators with a lower level of service. However, in the long term the option of improving service is the only way for high cost operators to be profitable. This can only be realised when the shippers are prepared to pay for it.

B. System shortsea transport

Operators within the systems segment have more freedom than dedicated shortsea operators. They can offer more flexibility to customers and they have more possibilities to specialise and find back-haul. The objective for forest products operators in this segment is to maximise the occupancy ratio. To escape from price competition, there are some possibilities to upgrade their current position.

Value adding: This can be done by offering:

* *More flexibility:*
  Within the existing system-traffics, available capacity can be increased. This means more flexibility for the shippers.
* *Offering onboard quality management:*
  The value density and complexity of products is increasing. The transportation of these products needs to be done more carefully then before. A competitive advantage can be reached by offering shippers capacity that meets quality standards (concerning crew and maintenance).

Specialisation: The shipping companies can specialise their services on:

* *Products*
  Within the possibilities of finding back-haul, ships can be specialised in carrying more specific products (under certain conditions).

* *Technology*
  From a technological point of view, current services can be upgraded by introducing information technology systems (eg. EDI).
* *Logistics*
  Improving logistics within the current situation can be done by introducing faster ships or quick loading gear.

Whenever introducing these aspects, operators must think of shipper's needs, their willingness to pay and the availability of similar services from other operators.

C. Standard shortsea transport

The standard transport segment offers minimum service for low prices. Operators in this segment are competing on price/service basis, so having the lowest costs in the business is the goal. Shipping companies carry out nothing more than port to port transportation and try to offer the lowest possible rate. As long as the occupancy rate and profits are sufficient, there is no need to upgrade the current position. Shippers generally will not be willing to pay extra for further improvement or specialisation of services.

5.2 CHANGING THE CURRENT POSITION

Besides upgrading the current position, shipping companies within the shortsea segments have the opportunity to expand along one or more of the three axes mentioned earlier.
The possibilities for expansion are based on the current position (possibilities of upgrading) and logistic, economic and other developments. Below the possibilities for changes of position along the axes are discussed.

Expansion of the geographic service area

For all segments there are possibilities to expand geographic services:

* *Southern Europe*
  With the establishment of the Common market trade between the Northern and Southern European countries is increasing. An important part of trade with the South European market is now being served by road-transport. In the future, further growth of road transport is less desirable because of environmental problems. This leads to opportunities for rail-transport as well as for shortsea transport to take over part of the position of road transport.
  The recent negotiations for membership of Austria of the European Community led to the decision to maintain environmental limitations for crossing the Alps at least until the year 2005. This offers an important chance

for setting up shortsea services between North Europe and Italy, Greece and, to a lesser extent, Spain and Portugal. Pilot projects should start as soon as possible and operators have about 10 years to take advantage of the circumstances.

* *Eastern Europe & former USSR*
A number of new countries have opened up to foreign trade. However, economic development in these former communist states stagnates. Opportunities are mostly open for carriers in the standard segment, since most of the trades are port to port. When these economies start to perform better there are chances for all segments. Co-operation between operators can lower the risks on services to East European countries.

Network development

On the network development axis there are some possibilities for operators as well:

* To gain better control over network operations, they could develop their services from port to port to door to door. This would mean involvement of shipping companies in other transport modes.
* A second possibility is linking shortsea activities with deepsea activities. Until now, deepsea and shortsea activities are performed independently by different operators.
* A third possibility is setting up system traffics in co-operation with the shippers.

The opportunities that the possibilities mentioned offer for the three segments are different. Shipping companies within the dedicated segment are already active in complex networks, which means that they have limited opportunity to further develop along this axis. It might even be a better choice to lower their dependency by offering their transport services to more than one shipper. Network development by standard operators will result in a move into the direction of the system segment. The most favourable opportunities are available for operators within the system shortsea transport segment.

Development of logistic activities

On this axis operators can aim to take over certain logistic activities from their customers. This will only be possible in co-operation with port-related activities. Extension of these activities should be combined with upgrading relationships with customers (shippers and consignees). This will result in a move in the direction of integrated chain management, which offers operators an opportunity to change from a shipping company into a logistic service provider.

In this role they can gain a strong position compared with other participants in the logistic chain.

At present, logistic service providers can be found mostly amongst (former) road transport companies.

An interesting example is the combination and integration of forest products-stevedoring in the port of Antwerp. Stevedoring company Varant is controlled by Finnpap which is the marketing group of a number of Finnish production companies. Besides stevedoring, Varant is also responsible for hinterland transport (shipping on a 'free delivered' basis). Shortsea vessels are operated by Transfennica and Finncarriers and can be classified as dedicated. The only critical remark that can be made is the difficulty to find back-haul. Because of the line service the flexibility is small. There is no time to wait for back-haul.

6   CONCLUSIONS AND RECOMMENDATIONS

In this last chapter some conclusions are drawn and recommendations are given. These are not only relevant for the forest product trades. Although the examples given are derived from the forest product chain analysis, we think that the market segmentation and the TOVER method can be used in other shipping markets as well. The way this can be done, will be discussed in **Paragraph 6.2.** **Paragraph 6.1** gives an overview of the conclusions from the forest products chain analysis study.

6.1 STRATEGIC PROFILES FOR SHORTSEA FOREST PRODUCTS OPERATORS

The application of the method for shortsea shipping of forest products results in strategic profiles regarding the future development of operators. Generally, in the present situation, carriers mainly focus on increasing specialisation of sea-borne transport activities, together with an increase of added value. The operations are optimised by improvement of quality and flexibility of crew and vessels. In the long run, this will not be sufficient to stay out of price competition.

Strengthening of the strategic position can either be done by improving within the current position or by expanding the current position in one or more of the three possible directions (geography, network and logistic activities). A description of the possibilities within the Dutch shortsea forest products market can best be done by dividing the market into three segments (standard, system and dedicated).

Standard shortsea shipping

Many older ships are active in this segment. The operators in this segment perform port-to-port services. The products they transport and the networks they are involved in, do not request high level logistic service. Their strength is low costs and therefore low rates. In general this segment is used as a shelter for operators from the system segment. Whenever there is lack of cargo in the system segment, the capacity can be temporarily transferred to the standard segment (with its spot markets).

An improvement within the current position for these operators is almost impossible. Customers will not be prepared to pay higher prices for added value to the service or for further specialisation.
Expanding the present position is possible along the geographic axis. Services to and from new countries like Croatia, Russia and the Baltic republics can at this moment best be done by low cost operating vessels. Shippers from these economies are only interested in low-profile port-to-port transport.

System shortsea shipping

Forest products carriers in this segment have a certain level of specialisation (box shaped holds and loading and unloading gear). Their service consists of transportation of one or two main commodities (in this case eg paper reels) and additional back-haul commodities in a A-B-C-A- like network.

Until now, vertical chain integration has not been one of the main operators' objectives. Optimisation of occupancy ratio so far was the main goal to achieve. However, given logistic strategies of production companies and limitation of road transport, there are opportunities for operators in this segment. One of the most important opportunities is the expansion of services to Southern Europe (growing markets and substitution of road transport). This geographic expansion can best be combined with a further vertical chain integration by taking over activities from other participants.

Forest products producers are increasingly orientating themselves towards global markets, global sourcing and decentralisation of production activities. On the other hand they want to control the whole network. With their worldwide contacts, operators are able to help shippers/consignees in setting up this network. But they need to focus on other than shipping activities only. Attention must therefore be paid to network integration. Such core-business must move from vessel operating company to logistic service provider.

The overall conclusion for the shortsea shipping segment is that it offers the best perspectives for the future. A move towards more dedicated services for a smaller number of customers seems to be the best strategy.

Dedicated shortsea shipping

This segment consist of vessels especially equipped for the transportation of a few commodities and operating in the shippers' network. Due to the line services the shipping companies are involved in, it is very difficult to acquire suitable "back-haul." In the current position, vessel operating companies are very much dependant on a few shippers. Their services (vessels, trades, etc.) are totally dedicated to these shippers. To lower the risks and increase the occupancy rate, operators should commit themselves to more shippers, take over the control of related logistic activities (such as stevedoring) and link their services to the objective of increasing the occupancy rate.

The overall conclusion for the dedicated shortsea shipping segment is that an increase of the number of customers and the formation of system-like networks is the most attractive strategy.

A new segment?

Based on the conclusions for the dedicated and the system shortsea segment, the best perspectives are offered by a (theoretical) segment that can be positioned between system and dedicated: a dedicated-system segment. In this segment vessel operating companies operate networks of shipping services with additional logistic activities. Their vessels are specialised to transport a certain range of commodities and can be managed in a flexible way. Their networks consist of a few large contracts with a limited number of shippers and a some additional back-haul commodities to maximise the occupancy ratio. The service the operators sell to the shippers is not based on a port to port vessel operating service but on a door to door logistic service.

An illustration of expanding logistic activities in another trade is given by the container shipping company Bell Lines. Bell recently established the new daughter company Bell Distribution and opened a distribution centre for consumer products in Ipswich.

6.2 APPLICABILITY OF THE METHOD

In this particular study the TOVER method was used to define opportunities for vessel operating companies in the forest product chains. Based on the analysis of the markets, vessels, trades and activities, three segments describing shortsea shipping were distinguished. These segments can be classified as clustered companies on a meso level of aggregation. The earlier conclusions and profiles are therefore formulated on this meso (forest product segment) level.

1. The authors believe that the TOVER method can also be used for definition of profiles on a micro or macro level:
   a. The latter means that TOVER can be used by governmental organisations to detect opportunities for their national shipping industry. Their

attention should not only be on sea-borne traffic, but also on other logistic activities (stevedoring, inventory management, etc.)
It will then be possible to support shipping industry in other ways then direct financial support or shipbuilding subsidies;

b. Using the method on an micro level, results in the formulation of specific strategies for individual companies, that can be followed to consolidate or expand the company's market position.

2. The segmentation used in this paper to describe developments in the forest products division can also be distinguished for other commodities such as containers, reefer products, ore and oil trades, etc. Within the framework of the study and this paper, it was not possible to discuss these applications in further detail.

7 ACKNOWLEDGMENTS

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INTEGRATED TUG-BARGE SYSTEMS FOR SHORT SEA SHIPPING IN EUROPE

By E.G. Frankel

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INTEGRATED TUG-BARGE SYSTEMS FOR SHORT SEA SHIPPING IN EUROPE

INTRODUCTION

Short sea shipping of bulk and break bulk commodities is distinguished by the comparatively short sea or ocean distances between ports and often large numbers of port calls. Another important distinction of this type of service is that port capabilities and handling rates vary widely as do shipment sizes at the different ports. In dry and liquid bulk short sea shipping, we meet complete ship loads on some routes. Yet port loads and multiple port calls on a route are quite common, particularly in break bulk trades.

Container traffic has become of increasing interest in short sea shipping as mainline, long distance containerships make fewer load center port calls and short sea carriers provide more and more feeder services.

European short sea shipping services traditionally have used self-propelled vessels, often of unique design, such as North Sea and Baltic Sea carriers. Although short sea shipping had declined in Europe for many years, the trend is now being reversed as a result of its cost advantage over road and rail transport, road and rail network congestion, and environmental considerations.

In most cases, this growth in demand for short sea shipping has not been paralleled by port investments and improvements. As a result, short sea shipping requires long port times and resulting long origin-to-destination or delivery times. Integrated tug-barge systems which permit the drop off and swap of cargo barges at ports may provide significant advantages to short sea shipping, as it has in American coastal shipping. The technology, operations, economics, and management of integrated tug-barge operations in coastal trades are discussed in this paper and methods for routing as well as scheduling of tug-barge systems are presented.

OCEAN-GOING INTEGRATED TUG-BARGE SYSTEMS (OITB)

Recent advances in push-tow linkage technology have resulted in ocean-going barges being developed capable of carrying large amounts of cargoes (more than 85,000 dwt) of various types (petroleum, oil, dry bulk, wheeled, and con-tainerised) at moderate speeds (up to 13 knots) in coastal trades, including open

ocean routes. Such services now operate along the U.S. East and West Coasts, in U.S.-South American trades, in the West Coast-Alaska trades, and more.

OITBs of today not only are as capable as ships of equivalent size and speed, but exhibit the added advantage of separable propulsion and cargo units. They also have lower capital costs than ships of equal capacity and performance. Similarly their lower loaded draft, which is usually only 65-75% of that of a ship with comparable capacity, offers the advantage of using larger unit vessels at a particular port subject to draft limitations in its approaches, or make more ports accessible than when ships of equal capacity are used.

Many modern OITBs have linkages that give them the same capability as ships of the same size and speed in transocean or coastal operations.

The primary advantage of propulsion and cargo unit separability is the ability of OITBs to operate in a drop-and-swap mode. In this method of operation, the tugboat drops off the barge at a port to be unloaded and then proceeds independently or with another (empty/loaded) barge to another port or operating area. This allows the costly tug and its crew to be utilised more efficiently since they will be spending more time transporting cargo rather than waiting for cargo operations. On the other hand, in many commercial operations, this also results in lower barge utilisation since it has to await the return of a tug before it can be moved. Dropped barges, on the other hand, serve as floating storage. This lower barge productivity may make drop-and-swap operation uneconomical in commercial trades where port times are short compared to sea times and/or where only a few large OITBs can handle all the cargo movement requirements.

Push-towed, ocean-going tug-barges have been in use for over 25 years now and vary in size from 5,000 dwt to 85,000 dwt. Their major attractions are:

1. Significantly lower investment and operating costs when compared with ocean-going or coastal vessels;

2. Greater operating flexibility by virtue of the ability to separate the manned propulsion from the unmanned cargo unit;

3. Lesser draft, usually only two-thirds of the draft, of a vessel with the same deadweight carrying capacity; and,

4. Ease of construction and repair.

Typical characteristics of integrated tug-barge vessels which can be designed as tanker, dry bulk, or container (or combined) carriers are as follows.

The underway or normal horsepower is 70-80% of the installed horsepower and similarly the underway speed of 10-12 knots is calculated at 70-80% of in-

Carrying Capacity	10,000		20,000		30,000	
Barge Length	108	m	142	m	169	m
Barge Draft	5	m	6.1	m	6.8	m
Barge Height (above water)	20	m	20	m	20	m
Barge Width (beam)	26	m	29	m	32	m
Tug Length	18	m	22	m	23	m
Tug Horsepower (HP)	4,200		6,000		7,200	
Tug Diesel Consumption at Full HP Ton/Day Underway	15	tons	21.4	tons	25.7	tons
Size of Crew	10		10		10	
Sailing Speed (Kts)	10-12		10-12		10-12	
Fuel Consumption at Sailing Speed/Ton/Day	10.3	tons	16	tons	18.2	tons
Total Integrated Length	121	m	158	m	186	m
Total Integrated Height(above water)	20	m	20	m	20	m
Total Integrated Beam	26	m	29	m	32	m
Total Integrated Draft	5	m	6.1	m	6.8	m

Table I

stalled horsepower. Various configurations of barges exist, yet most are designed as single purpose tank, bulk, or container barges.

COSTS

The construction cost of an ocean-going barge is usually about 35-40% that of an ocean-going ship of the same carrying capacity. The tug will usually cost about 22-28% of the cost of a ship for a total construction cost of a tug and barge of 57-68% of that of a similarly sized ship. The major difference though is speed, with tug-barge operating speed usually slower at 10-12 knots versus the 13-15 knots for a tanker or bulk carrier.

Crew and supply costs are only about 50% of those of a ship of equal carrying capacity and, as a result, total daily variable costs (excluding financial, insurance, management, etc. costs) is normally 55-60% of that of a ship with equal carrying capacity. If we account for a 20% shorter travel distance per day, ton-mile or ton-km costs of a tug-barge vessel, including all financial costs (20-year amortisation) and insurance costs (4% of value) is about 57-65% of that of a vessel of the same size. The lower draft though would allow significantly large tug-barge systems to serve in a depth limited trade.

Mechanically-linked OITBs are manned with crews of approximately 10 men. There are three reasons why these systems have substantially smaller crews than ships of equivalent deadweight, though inspected and licensed by the same regulatory agencies as ocean-going ships.

The first reason is that their enginer rooms are highly automated, typical of diesel tugs, so that they are classed for unattended engine room service. This means that only a Chief Engineer, an Assistant Engineer, and another qualified member of the Engine room Department are normally required.

Also since barges are classed as unmanned for the purpose of freeboard reduction, no crew is permitted on them for maintenance while underway. This allows the deck department of the OITB to be reduced to the Master plus seven officers and men who are used primarily for underway watch standing.

Loosely-linked 3rd generation OITBs and pull-towed OITBs have even smaller crews. Since their tugboats are not inspected and usually under 200 GRT, there are practically no regulations pertaining to their manning. Thus, they can operate with two watches, usually of three men each, on voyages of less than six hundred miles and three watches on longer voyages. Consequently, crews range from 7 to 11 men.

Ships must have officers licensed in accordance with regulations.

TECHNICAL DEVELOPMENTS IN OITB SYSTEMS

OITBs can conveniently be divided into:

1. Pull-toward, tug-barge systems which are designed for towline operation only;

2. 1st generation push-towed, tug-barge systems where the barge has a small stern notch which the tug uses for pushing in rivers, sounds, and during good weather. In the open sea, the barge would usually be towed;

3. 2nd generation push-towed, tug-barge systems which are designed with a deeper notch and coupling hardware to permit the tug to push much of the time while in the open sea; and

4. 3rd generation push-towed tug-barge systems which are designed to permit the tug to push all the time in any weather condition offshore.

These 3rd generation systems can be further sub-categorised with respect to their type of coupling. Specifically, they can be divided into rigid mechanically-linked (or integrated), semi-rigid mechanically-linked (or articulated), flexibly-linked, and loosely-linked systems.

Different notch configurations and coupling methods are used for various conditions. Their choice depends on:

* Weather and sea state conditions expected in the trade;
* Directional control requirements;
* Expected differences in barge operating drafts; and
* Frequency of coupling/uncoupling required and sea conditions under which such operations are to be performed.

Time required for engagement and de-coupling is usually a function of the degree of rigidity of the coupling.

Some rigidly coupled systems use catamaran-type tugs which straddle the stern of the barge hull. Similarly, some couplings are designed to be fitted to ordinary tugs and standard barges.

In recent years, 3rd generation, loosely-linked OITBs have become popular because they are inexpensive and can be operated with 100% push-tow operation in coastal trades at a lower cost, then mechanically linked systems, and very deep notch rigidly-coupled systems. They reduce tug motion in the notch so that separation of the tug from the barge will not be required in any sea state. Such systems use a restraining device at the bow of the tug, tension

cables to restrict surge motion, and lines to limit tug roll, sway, and yaw. The costs of linkages vary with type and size of tug and barge. Typical costs are $300-700,000.

TYPES AND USES OF INTEGRATED TUG-BARGE SYSTEMS

While most ocean-going integrated tug-barge systems are designed to carry dry or liquid bulk cargo, often as full vessel single customers load their use for the carriage of container and other cargo is increasingly attractive, particularly when bulk transport is one way, which is the dominant condition.

Most oil barges use deep well pumps for cargo handling, with one pump well serving 2 to 4 tanks on a barge with a centerline longitudinal bulkhead. This way each tank has a backup pump. Pumps are connected to centreline deck-mounted loading and discharge pipes which give such barges a fairly clear, uncluttered deck which can be used for container storage, with the exception of a narrow centreline area.

Recent designs of a 30,000 dwt oil barge permit the carriage of 960 TEUs on deck stacked 3-4 high, with ample stability margins. Similar designs have been developed for dual coal/iron ore and container carriage on dry bulk barges. These arrangements are of particular interest in trades where liquid or dry bulk trades move in the opposite direction from containerised cargo trades. The carriage of empty containers on the loaded oil or dry bulk barge usually reduces its carrying capacity by only about 10%. In the above case, for example, the 30,000 dwt oil barge will carry 27,800 dwt of oil with a full (960 TEU) load of empty containers.

Unlike a ship, a barge does not carry consumables such as bunkers and water, and is therefore able to always accommodate the maximum deadweight allowable by its design capacity. Dual use barges are also often served by novel container loading/unloading and transfer equipment. Scissor-lift platforms are used to lift or lower prestacked (3 or 4 high) containers in blocks of 6 or 8 containers (12 to 16 TEUs) and moved to or from their position on deck on a deck-mounted transverse rail system by use of horizontal hydraulic positioning jacks. Loading/unloading of containers can therefore be performed quickly and without the need for large container gantry cranes.

In some cases, such barges are loaded/unloaded by long outreach (post-Panamax) container cranes on the offshore side of a docked containership. Barges are usually dropped and swapped in effectively designed integrated tug-barge systems. This not only permits effective use of the tugs who spend most of their time underway, but also assures that they are not delayed by long and often uneven port times. On the other hand, barges stay alongside longer than

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the minimum time required for cargo transfer, and as a result offer convenient storage facilities and permit cargo to be unloaded/loaded more leisurely, saving double handling, shoreside storage, and overtime costs. In some services, a barge is in fact always alongside serving as a floating tankfarm and container stack which permits significant reduction in the need for shoreside container stacking and oil tank capacity.

ECONOMICS OF OCEAN-GOING INTEGRATED TUG-BARGE SYSTEMS

As noted OITBs have lower acquisition and operating costs, and also have a greatly lesser draft than equivalent capacity monohull ships. They also provide major advantages in scheduling and routing which is particularly important in short sea routes where inter-port distances are usually short and port calls are many.

Most of the current experience with OITBs is in the U.S. Northeast and the Gulf Coast. For example, oil is transported between Philadelphia refineries and Boston (268 miles) by OITBs exclusively now (about 22 million tons/year). One barge is at Philadelphia loading, one at Boston unloading, and one is being moved between Philadelphia and Boston at any one time. The tug takes about 24 hours for the transit. Therefore unloading barges are alongside 48 hours at each end and a loaded barge is delivered every 48 hours. Adding one tug and one barge can reduce alongside time and inter-delivery time to 24 hours. In this case, 4 barges and 2 tugs would perform the transport work of 3 equal capacity ships. The choice of system obviously depends on port turnaround time required. If it is 48 hours, then 3 barges and 1 tug will do the work of 3 ships. If 24 hours, then 2 tugs and 4 barges will be required.

The cost of transport of oil from Philadelphia to Boston by 25-30,000 dwt or 30-45,000 dwt OITB (assuming 20 years of capital cost amortisation and interest or opportunity cost of capital of 8%, a fuel cost of $130/ton for diesel and $96/ton for mixed bunker/diesel, and American crew costs - 18 men on tanker and 10 men on tug) were $2.28/ton of oil delivered by tanker and $1.39/ton for oil delivered by OITB. Today, as a result, all oil transport on this route is carried by OITBs which have replaced over 56% of coastal tanker tonnage in U.S. coastal waters since 1970 and 34% since 1980, a trend which is expected to continue. In addition to transport cost savings, there are significant savings in terminal operating and terminal investment costs, such as inventory holding and tank storage capacity costs which, in the above case, would add another $0.19 cost advantage to OITB transport.

Similarly, dual use OITBs are now under investigation for iron ore/coal transport from deep draft coastal ports in China (Ningbo) to different ports on the Yangtze

River, with return cargo of full containers. These services are now provided by coastal vessels who tranship at the shallow Port of Shanghai to or from river craft.

This service is designed to deliver and pick up barges at a multitude (6-8) inland ports using a very efficient drop and swap program which includes repositioning of partially unloaded or loaded barges to attain both effective capacity utilisation as well as an effective schedule and origin/destination delivery time.

Preliminary estimates are that transport costs of the dry bulk and container cargo between the coastal and inland ports can be reduced by more than 50% while providing more frequent service and on average significantly lower origin to destination times.

Another advantage again will be the availability of floating stockpiles and container stacks at each terminal, as in most casts barges will be alongside at all times, eliminating double handling of cargoes.

A formal economic analysis model of OITB operations has been developed which allows the evaluation of transport costs between any two points of an OITB itinerary, including delivery time as well as terminal, tug, and barge fleet utilisation. This simulation model, which is now being rewritten in SLAM II to permit conditional and statistical time and cost factors to be introduced, has been used to determine costs and time of transport for a particular set of swap, port sequence, schedule, barge size, and tug power decisions. It allows for sensitivity tests when each or pairs of these decision variables are changed to converge on an increasingly more effective strategy.

The condition is always that all the cargo must be accommodated. The deterministic simulation model now in use which consists of the basic transport network simulation, with investment cost, operating cost, and cargo demand sub-modules, has been found to be a very effective tool for the analysis of the effect of alternative system design and operating strategies.

EUROPEAN SHORTSEA USE FOR OITBS

There are numerous short sea trades in Europe which could benefit from the use of OITBs. Some are in the bulk trades such as petroleum transport between Norway and countries not tied into a pipeline delivery system or Algeria and Libya and southern European countries. Similarly coal, cement, and grain trades between northern/central/western European producers and southern European consumers may benefit. A brief study of Poland's coal exports to western and southern Europe also indicated the advantages of using OITBs.

Considering the congestion of European roads and the inability of greatly expanding road capacity general and even containerised cargo may be attracted to short sea transportation by OITBs. This is particularly the case for transport between the British Isles, Scandinavian and the major European gateway ports such as Rotterdam. The increased size of mainline containerships for example (4,600 TEU +) is already reducing the direct port calls of long distance (transatlantic, Far East, etc.) mainline containerships at UK ports.

In future an increasingly large percentage of UK, Baltic and Scandinavian containerised trade may have to be carried by feeder to/from the large continental load centre ports such as Rotterdam. Large OITB floating container stacks may provide a most efficient and economic way to provide for these links while reducing the cost of using both UK/Baltic/Scandanavian as well as continental load centre ports, by eliminating the double handling at these ports.

This would provide for example a UK container stack at a UK port and Rotterdam at all times with, for example, one tug and three barges providing a daily service, for which otherwise 3 feeder vessels would be required. These are just a few examples of potential uses of OITBs in Europe. Others abound.

CONCLUSIONS

There are many other examples of the economic advantages of OITBs. The St. Mary's Cement Corporation of Canada, for example, recently converted 18,000 dwt oil OITBs into self-unloading dry bulk carriers (equipped with cargo scoopers) with a discharge rate of 1,200 tons per hour to significantly reduce its transport costs.

Similarly, new applications in Japan, South East Asia, and the U.S. Gulf and West coasts are evidence of the increasing recognition of the operational and economic advantages offered by the use of OITBs. OITB technology is also advancing with many new vessels equipped with radio controlled bow and/or stern thrusters, windlasses, and mooring winches to reduce docking costs, and eliminate the need for docking assistance by tugs.

In some cases OITBs serve as floating moveable container stacks or terminals. The potentials for OITBs are still not fully explored or exploited and their use in European short sea shipping should really be investigated for operational and economic reasons as their introduction could not only help reduce road congestion, but also congestion in ports and seaways.

APPENDIX A: RESISTANCE CURVES FOR OCEAN-GOING BARGES

Resistance curves (**Figure 6**) were calculated for both the 30,000 dwt and 50,000 dwt barges. The basis of these curves was SNAME Technical and Research Bulletin No. 1-29, "Design Considerations and the Resistance of Large Towed Sea-going Barges". A correlation allowance of .0004 was used and the frictional resistance was obtained from the ATTC line.

An integrated pusher tug adds 12-18% to the resistance of the barge alone. Therefore a 50,000 dwt push-towed barge would have a resistance of 257,000 lbs. at 12 knots. This is about 10% higher than the resistance of a monohull ship with equal dwt at 12 knots.

The resistance of the integrated ocean-going tug and barge also depends on the relative drafts of the tug and barge. Similarly, the propulsive efficiency of the tug is affected by the relative draft.

Resistance Curves
30000, 40000 and 50000 Dwt barges
Full load condition
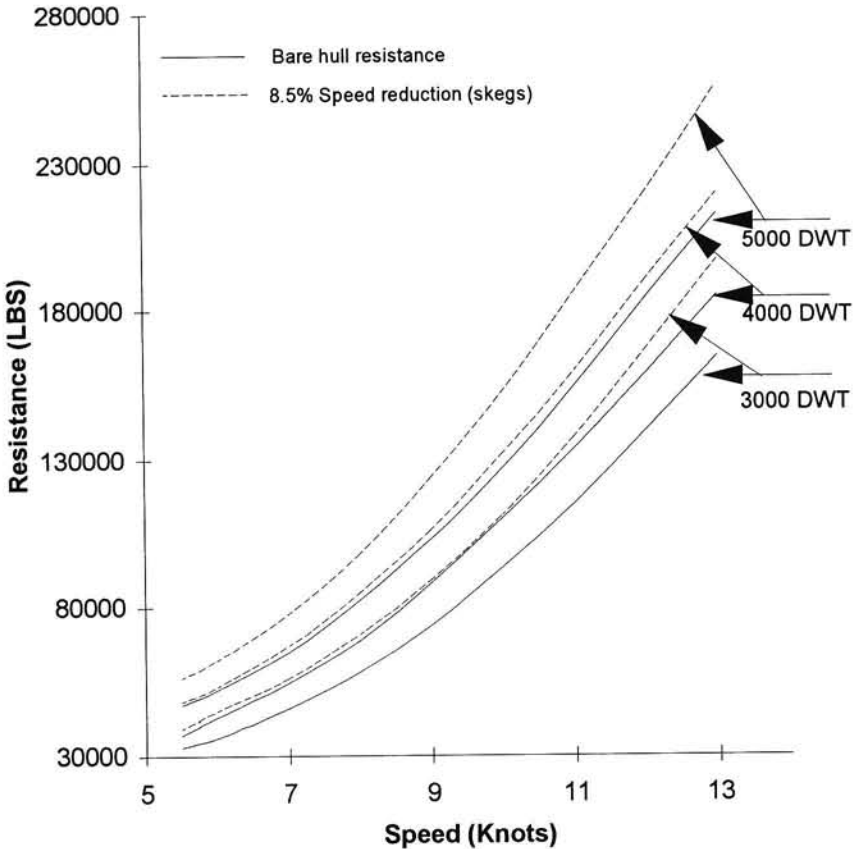
Bare hull resistance

8.5% Speed reduction (skegs)

5000 DWT

4000 DWT

3000 DWT

THE ECONOMIC AND SOCIAL IMPACT ON GREEK PASSENGER COASTAL SHIPPING OF THE FREE MOVEMENT OF MARINE LABOUR IN EUROPEAN UNION

By A.M. Goulielmos and M. Milliaraki

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"THE ECONOMIC AND SOCIAL IMPACT ON GREEK PASSENGER COASTAL SHIPPING OF THE FREE MOVEMENT OF MARINE LABOUR IN EUROPEAN UNION"

1   INTRODUCTION

Greece undertook an obligation to modify national legislation[1, 2], at the end of 1992 to allow European Union seamen to work freely on board vessels belonging to shipowners of European Union State, including Greece. The framework also applies to Greek seamen, allowing them to work on vessels of a member state of the European Union. Also, free marine labour movement must be established in the European Union, in general.

The above obligation was undertaken by Presidential decree mentioned in the footnote in which is written that Greece has to adapt its legislation, (and especially articles 56,57,87,88 of the Code of Public Shipping Law, Law 192/36 as well as RD 734/68), to the provisions of articles 7 and 48 of the EEC Convention and articles 1, 2, 3 & 4 of EEC Council Regulation No 1612/1968. The effect of these legislative modifications will be: (a) to lift the obstacles that exist in the accessibility of seamen nationals of Member State of the European Union to reach (and occupy) work positions on board Greek Commercial Vessels, (b) to allow employment of Greek seamen on commercial vessels with a flag of a Member State of the European Union, and (c) to establish the free movement right of working people within European Union for marine labour as well.

The Presidential Decree by its article two specifies that nationals of EU member states having the capacity of seamen (in accordance with the legislative provisions of a Member State) have the same possibility of access to work positions on board Greek Commercial Ships as specified for Greek Seamen bar the positions of Captain and a ship's official deputy. European Union seamen must be nationals of a member state, they must have acquired the capacity of a seaman in accordance with the legislation in force in a member state, which means that seamen should be born or come from a Member State of EU.

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[1]Presidential decree No 12/31.12.1992.

[2]Modifications are needed to: (a) Code of Public Maritime law (187/1973), (b) Law 192/1936 and (c) Royal Decree 734/1968.

2 THE PURPOSE OF THIS ARTICLE.

As this is shown above in the introduction, a trend is formulated in the European Union that all working people including marine labour (seamen) are entitled to work freely in any Member-State and on board all commercial vessels having a flag of a Member-State of EU.

As we can see, exceptions are established for Captain and its official deputy, for they must be nationals of the Member-State of the flag of the ship. Greek Coastal Passenger Shipping, however, has been excluded (cabotage) from the free movement of entrepreneurs, and our question is whether this sector is excluded also from the free movement of seamen coming from EC up to 1/1/2004? If this is not so, what will be the effects of such a free movement of EU nationals on board Greek Coastal Passenger Ships? Another important question is what will happen if Euros register is established for European (EU) vessels and what will be its relation to seamen belonging to European Union?

3 THE SOCIAL POLICY OF EU AND THE FREE LABOUR MOVEMENT.

Social policy of EU is based on the foundation Treaty (Treaty of Rome) forming EEC (preamble and articles) signed on 25th March 1957 in Rome[3].

From the beginning (1.1.1958) of the enforcement of the Treaty of Rome one of its main targets was to create an even treatment of the terms of living and working conditions of people of Member State. The articles of the Treaty of Rome fell into two broad categories: (1) the one connected with the free movement and settlement of working people (articles 48-58) and (2) the one concerned with the general provisions for the establishment of the Common Social Policy (articles 117-112).

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[3]Historically, the foundation Treaty of EEC put in force on 1st Jan. 1958, has laid down the bases of a Common Social Policy, which let limited space for differential actions in relation to social provisions. As a result a series of EEC actions were adopted, the majority of which related mainly to the free movement of working people, its social insurance, its equal treatment, its professional education and protection. The foundation treaty had its first review at the occasion when the single European Act started to be in force, i.e. on 1st July 1987. It has been adopted, too, the EEC charter of the fundamental social rights of working people by the Council at Strasbourg (9/12/1989), and this was an effort to show the social dimension of the Single Market through specific measures & specific implementation plan. The Convention for the European Union signed on 7/Febr/1992 in Maastricht (ratified by the Member State Parliaments at the end of 1992 beginning 1993) formed the second review of the Treaty of Rome.

The Treaty of Rome specifies that the progressive adoption in practice of the establishment of the free labour movement can be realised through the adoption of certain EEC actions (like Regulations, Decisions, Directives, Recommendations, Resolutions, Announcements, Conclusions and Statements). Within this framework, the Council of the EU. has so far adopted an adequate number of EU actions[4], especially in the form of Regulations and Directives of both general and special nature, which determine the measures needed for the implementation of the above. Also these complete the gaps existed in the Treaty of Rome in this subject. Member States have the obligation to incorporate EU actions in their legislation. This derives from a series of articles of the Treaty of Rome. So, according to article 5: "the member states take every general or specific measure suitable for securing fulfilment of the MS obligations that come from present Treaty or come from the actions of the EU organs". Article 189 specifies the forms, and the manner which binds MS as well as the time that EC actions begin to be in force[5].

Free labour movement in EEC

Greece had certain transitional periods for implementing some EEC actions. So, Greece according to its Assession Act put in force free labour movement on 1/1/1988. At this date the transitional period specified in articles 44 and 48 of the Assession Act has ended. Especially article 48 specified:

(1)   Free movement of working people within EEC is secured the latest at the time transitional period ends;

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[4]EEC has taken the following actions in connection with free labour movement:
   (a) Council regulation 1612/68/EEC of 15/10/68 for the free movement of working people with in EEC;
   (b) Council directive 360/68/EEC of 15/10/68 for the abolition of the restrictions to the movement and stay of working people of MS and their family members within EEC;
   (c) Council directive 1408/71/EEC 16/6/71 for the implementation of the systems of Social insurance for people employed and for their families moving within EEC;
   (d) Council directive 148/73/EEC 21/5/73 for the abolition of restrictions to the movement and stay of nationals of MS within EEC in relation to their supply of work services and their settlement in a MS;
   (e) Council directive 368/75 EEC 16/6/75 referring to the measures facilitating the actual exercise of the right of settlement and free supply of work services for certain professional activities, and also transitional measures for these activities;
   (f) Council decision 368/85/EEC 16/7/85 referring to the equivalence of professional titles between MS of EU.

[5]For Greece article 145 of the Assession Act requires that "Greek Democracy Puts in force the measures that are required for to comply with the provisions of the Directives and Decisions in accordance with article 189 of the Treaty of Rome". The manner that Greece can embody EU actions into Greek legislation can take the form of any legislative, regulative and administrative provisions.

(2)   The free movement of working people entails the abolition of any dis-
       crimination, due to nationality, to the working people of MS in relation
       to their employment, reward and other terms of employment;

(3)   Only certain restrictions to free labour movement are justified i.e. those
       related to Public Order, Public Security and Public Health[6]. Otherwise,
       the free movement of working people means that these are entitled to:

       (a)   Accept any real offer of employment;
       (b)   Move freely for the above reason within a MS of EU;
       (c)   Stay in one MS with a purpose of exercising there a certain
              profession in accordance with the legislative, regulative and ad-
              ministrative provisions that regulate the employment of the na-
              tionals of the MS;
       (d)   Stay in one MS and when employment in that MS terminates.
              This in accordance with the regulations for the implemention of
              this provision that will be issued by Commission.

The provisions of the above articles exclude employment in the Public Sector of
a MS[7], with the exception of Denmark (also few public positions can be filled in
by non-Member State nationals in France, UK, Ireland & the Netherlands). Such
provisions in effect try to establish an equal treatment between nationals of
Member State that wish to work in any Member State provided they can comply
with certain provisions of the Member State. This may equalise supply and
demand, and therefore stabilise wages in the EU. The effort would be to secure
the above-mentioned individuals more freedom in moving, to enable them to
remain "freely" in Member State, and be paid equally for equal work, irrespec-
tive of nationality.

In Greece the free movement of working persons is legislated by two Presiden-
tial Decrees[8]. According to the above P.D. no residence or work permit is
required for working nationals of Member State of EEC provided an employer
has been secured. EU nationals must, however, present himself to the ap-
propriate Police Station within eight days from his/her arrival in Greece.

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[6]These are related to personal behaviour. Previous penal convictions do not prevent a person
from work. Cases of illnesses are restrictive only if can endanger Public Health or Public Order.
Illnesses or injuries that follow the first work permit in a MS cannot justify work denial or deportation
of a person from a MS.

[7]The Treaty of Rome also distinguishes labour in two classes: those that are wage earners and
those that have an independent activity. The entry and stay in a MS of wage earners is regulated by
36 council directive 15/10/68 and the others by council directive 148 21/5/73.

[8]P.D. 525/1983 for the entry and stay of people nationals of MS of EEC that do not offer a paid
employment (non wage earners), but exercise an independent profession, and P.D. 499/1987 for the
movement and stay of working people nationals of MS of EEC and their families.

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4 THE ACCESSIBILITY OF EEC SEAMEN TO GREEK VESSELS

As mentioned in the introduction, Greece by Presidential decree 12/31.12.1992 adapted[9] its legislation[10] so as to remove any legislative obstacles that might have existed in the free movement of seamen, such as EU nationals to Greek flagged vessels. The reverse was the case also in the provisions of the Law i.e. Greek seamen to be able to gain employment positions on board vessels of a Member State of EEC.

The only provision that the Greek Law requires is that a "seaman" should have acquired the seaman capacity in accordance with a Member State[11] legislation. So, the term Greek Seamen or Greek Nationality seaman' covers from 1/1/1993 and any other seaman of an EU Member State.

For Greek seamen a sea service run in a Member State vessel counts as time for obtaining professional certificates on equal terms if such a service was done on a Greek vessel.

For foreign seamen i.e. non EU nationals, special provisions are laid down[12].

"Greek Seamen Pension Fund" and the "House of Seaman", which are public organisations providing pensions and hospital/medical services to Greek Seamen, have also adapted their legislation[13] to the EU Council regulation 1408/1971 for Social Security to be provided to all working people and their families moving for the purpose of work within EU.

5 THE SOCIAL SECURITY TREATMENT OF MARINE LABOUR IN GREECE

Social security is provided to seamen in Greece by the Greek Institution called "Greek Seamen Pension Fund (GSPF)", which provides the pensions, and the so

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[9] Articles 7 and 48 of the Treaty of Rome and articles 1,2,3,4 of EEC Council Reg. 1612/1968. Article 7 specifies that "no discrimination on grounds of nationality is allowed".

[10] Articles 56,57,87,88 of Code of Public Maritime Law 187/73 and Obl.Law 192/1936 and RD 734/1968.

[11] Seamen from a Member State should be born there or come from that MS.

[12] Ministerial decision 4803/13/10 a 29.6.1992 regulating entry-exit from Greece and signing on and off.

[13] Presidential degree 524/31.12.1983.

called "House of the Seaman", which provides hospital and medical services to marine labour. These two institutions in accordance with the laws that are in force at the time provide the above services to Greeks as well as to nationals of the Member State of EU. One interesting matter is in this case that the above services are extended as well to those without any specified nationality or to such refugees that stay in any Member State of EU. All the above, however, must work on board a ship under Greek flag holding the capacity of seaman. The above services cover also the families of the persons entitled and their heirs. It is clear that in relation to Social and Medical Security of Seamen, any national of a Member State of the EU is considered as a Greek Seaman in all terms. This provision extends also to people having no nationality and to refugees that stay in a Member State and they are seamen by profession in accordance with the laws of a Member State.

6 MS SEAMEN' FREE MOBILITY IN EUROPEAN UNION'S VESSELS.

We may now draw a main conclusion from the above, which is that Seamen nationals of a Member State of EU - European Union Seamen - are entitled to ask employment in Greek ships - or for that matter, on Greek Coastal Passenger Ships[14] without discrimination, and they will enjoy equal rights as well as equal obligations. Such seamen coming from a Member State other than Greece should be equally treated as Greeks (Greek passbook, application of Greek penal and disciplinary code etc).

The above can be accomplished as follows:

(1) First a shipowner (employer) must be found and secured, and thus a work and stay permit would not be required. Otherwise a Member State seaman must settle in Greece (i.e. have a domicile in Greece - a vessel not being considered as a domicile);

(2) A Member State seaman must accept the terms and conditions of the collective Agreement in force that specifies employment and wages of the Crew employed (signed on) on Greek Passenger Coastal Ships;

(3) Educational titles must be recognised/approved.

The above three conditions had, so far, no implementation according to our research, since so far no seaman of the European Union has decided to sign on a Greek Coastal Passenger Ship or other type of ship in this respect.

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[14]As this may be known Greek Coastal Passenger ships are obliged by Greek law to employ only Greek nationals.

Yet the average Greek Shipowner will most probably prefer a European Union seaman to a Greek, for all ranks of Crew, provided his wage is equal to that of a Greek seaman.

Is it possible that a European Union seaman accepts the terms and conditions of the Greek seamen collective Agreement as far wages and other benefits are concerned (insurance terms, leaves etc)? We will look next for a while into the above third condition of the title recognition.

Seamen's title recognition in EU

Greek legislation has not so far been harmonised with the EEC directive 89/48, neither with the complementary Council directive 92/51 (18/6/92), referring to a general process of recognising professional education.

A seaman's profession, both that of officers and of Ratings, can be classified to the professions for which European Union has not as yet specified the minimum required standard levels. As a result of the above, a Member State can specify the required minimum standards of its seaman with a view of securing a certain quality of professional services that are provided in that Member State Country.

Especially directive 92/51 of EEC Council refers in its inrtroduction to what we think applies directly to the maritime profession:

(a) There is a need to specify in legal form the recognition of the technical skills that are based on experience that has been obtained in another Member State;

(b) to introduce a simpler mechanism for such cases, where in one Member State of reception, for the exercise of one legally accepted profession, is required either education of a very short duration or certain personal qualifications or only a general education[15].

As has been said there is a need for the recognition of qualifications which have been obtained through only professional experience on a Member State. This experience has not so far legally be recognised for certain professions. There is also a need to acquire the opinion of certain professional unions and of certain educational institutions as well as of the institutions of professional education.

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[15]According to a work survey carried in Greek shipping in 1990 in a total of 26304 Greek seamen that have finished their general education, 52.6% were graduates of high school and 47.4% were fraduates of the primary education. Also, among the 10711 Greek seamen being officers, the 6950 were graduates of special cadets schools, of Public & Private nature as well as of private technical lyceums or schools. See *Marine Labour Survey*, 1990, Table 17, p. 26, Athens 1992, Greek Statistical Service.

There is also the need to secure the proper participation of the above institutions in the decision making process[16].

7   CONCLUSIONS FROM THE SOCIOLOGICAL POINT OF VIEW.

The concept of a Single European Market as a space without borders and where the abolition of any obstacles to the mobility and free movement of persons and services is removed, creates and will create a lot of problems - in our opinion - of special organisational and functional type in the Labour Sector of the Single Market. Beyond the matters of Supply and Demand (see next section), and factors and conditions that shape and influence the mobility of human capital, there is the sociological and psychological dimension which calls for working people to become part of the single European Market.

With special reference to marine labour profession, which has so many special characteristics, it is worth noting that the marine profession is widely considered to be more a way of life than conventional professions[17].

A crew member of a ship does not simply work on a vessel; he often lives on board vessel for the time he has signed on. The duration of work on a vessel is a determinant factor for the degree of adaptation of the crew member to the profession. A long time stay on a ocean going vessel makes for a different be-haviour when compared to work on vessels of short sea shipping (coastal ships), in which case crew member have not been separated from home and family.

In all cases of marine labour work, the social organisation on a vessel is drasti-cally different from all other professional social organisations. Life on board has its own regulations and basically has a strict hierarchical structure, and way of functioning. The fact that a person on a ship works and lives in the same place, that he has to stay on the ship after his work has been finished, is one of the basic characteristics that influences not only the professional behaviour, but also the human behaviour of the seaman. Moreover, these factors shape also the opinion and belief for the profession.

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[16]In article one of the above mentioned directive and at paragraph (a) ii is clearly written that as a certificate or diploma is considered whatever title of education of whatever number of such titles, from which one may derive that the holder has attended successfully one of the educational circles of annex C. Annex C refers to a list of special structure education where paragraph 3 refers to shipping (No L 209/ 41-43).

[17]See A. Corres *The Greek Marine Labour Force*, Institute of Economic & Industrial Research, Athens, 1978, p. 27 (in greek).

There is a pyschological or sentimental effect on these people (seamen) that have to leave familiar places; such people may try to create places of equal familiarity with those they have created at shore.

The heterogeneity, however, of the seaman social group will create- in our opinion- many problems and difficulties. We are concerned about the possibility of coexistence (parallel life) and cohesion of elements that show, as crew members, a high degree of heterogeneity[18].

We may accept in effect that crew's country of origin and level of education certainly plays a basic role to adaptation, co-operation and overall ability of a person to fit into a crew group, but these factors cannot seen as providing solutions to every problem.

The subject of "nationality" of a person has a great social and sociological importance in every level of social organisation. Every person is a member of a society in which he was born, grown up and in which he "belongs".

The social inheritance of a person is transfered through any one given person's process of socialisation which results in the individualacquiring a identity. There are no person or people without identities, which means in simple words that there is no specific way of life without a certain language as a code of communication, without a specific behaviour which is determined by the social group from which one comes from. Every person "belongs to" somewhere and this place of origin determines his degree of communication. We see that there is something inevitable with the different civilisational origin of crew members for many problems to be created. These problems cannot be classified on bases of quality alone (educated or not, European or not).

A Greek seaman signing on a vessel belonging to Greek Passenger Coastal Shipping feels like he is in his own particular place. Everybody speaks the same language, has the same tradition, knows the Greek ports and Greek waters, has the same way of living as indeed do most of the passengers; everyone will return to his home and his family on leave. A seaman, however, coming from a Member State of the European Union will have none of the above characteristics though in legal and institutional terms he will be a "Greek". A foreign person will remain foreign in his own conscience and indeed, in the conscience of his Greek colleagues.

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[18]Experience of seamen signed on ocean going vessels with reference to foreign crew was bad. See A.Corres up.cit. p. 172. We cannot accuse differences in races or education as responsible factors (reference has been made for people coming from Asia) for a bad behaviour of ratings in Greek Ocean Going Shipping.

The Single European Market and the abolition of all nationality discriminations does not mean - in our opinion - in any case that one can abolish social origin and civilised inheritance, decisive factors which in effect mean a way of life[19].

8 THE ECONOMIC IMPACT OF THE FREE MARINE LABOUR MOBILITY IN GREECE.

The sociological analysis which has been so far seen, concluded, that two foreign people can never be the same and one cannot be considered as equal to the other in all respects, despite laws and regulations. Here, however, we have to stress it. No-one ever meant for the single European Market to invent a process by which nationals of the European Union will be somehow made homogeneous. What is meant is the establishment of a degree of labour mobility, so that supply and demand of labour is harmonised in every single market of European Union. This fact would bring a parity to wage levels everywhere, though wages cannot in theory be reduced below a certain minimum. In order to equalise labour demand and supply and establish equal wages for equal amount and quality of labour services, one must have mobility in all respects.

The efforts of European Union should be in the direction described above; i.e. to establish the highest possible degree of mobility of labour within EU This means that there should be a European network with information about labour vacancies. So, we need a system of information for labour demand within EU[20]. We may argue here that a kind of discrimination is possible to come from imperfections of information in the labour market[21].

Moveover, the problem in our opinion is one based on the theory of equalizing differences[22].

This theory stresses the fact that equalising tendencies of competition in the labour market is conditional on perfect mobility and on perfect knowledge. The theory of net advantages advanced the idea that competition equalises the

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[19]There remains to be determined the mechanismy through which the cohesion and cooperation of people at places of work will be achieved in such a way that nationality cannot provide an obstacle for the free mobility and living of working people in EU, where also the civilisational models will not be disorganised but will be preserved.

[20]See Green Book and especially efforts through EURES.

[21]R.F.Elliott (1991), *Labour Economics: A comparative text*, Mcraw Hill Book Co, p. 397.

[22]This theory is rooted into the writings of Adam Smith (see A. Smith,(1776), *The Wealth of Nations*, Chapter X). See also R.F. Elliott op.cit p. 313.

whole of the money and non- money advantages and disadvantages of different employments within a labour market and over the long run over wide geographical areas within which there is labour mobility.

The advantages and disadvantages of various jobs tend to equality. Dangerous and unpleasant jobs attract higher pay, jobs with better pension and health insurance arrangements have lower pay. Persons, however do not have the information required to evaluate the relative advantages of different jobs and these are discovered by experience. This means that there are enough transaction costs related to changing jobs and their experience cannot be obtained, ocean-going shipping is a sector where wage rates may be established and remain above the market clearing level[23] depending on the state of the freight market (it has been calculated that actual crew wager can be 20% higher than contractual wages if freight market is good and crew labour demand higher than supply).

As is well known, A. Smith's approach involves implicitly a set of shadow prices for each of the non-money aspects of jobs. Let us have a desirable market "good A". and an undesirable, "good B." "Good B" may incorporate some characteristics of having a job in Greek Coastal Passenger Shipping. Thus $U = f(A,B)$[24]. A seaman's preferences can be represented by a number of convex indifference curves drawn in the goods space as shown in **Figure 1**.

The average seaman's preference may be to move to the left hand direction, as higher levels of utility result from consumption of more of the desirable good and less of the undesirable good. The conclusion is that seamen accept to work in a job with unpleasant characteristics only it they are compensated by larger amounts of A. Thus OB0 should equal DW. Suppose that the competitively determined wage for jobs with displeasure OB1 = OW1 and that the competitive wage for jobs involving exposure to the next lowest level of displeasure OB0 = OW0. Then OW1-OW0 represents the implicit price that is paid in the labour market for exposure to an additional amount of displeasure equal to OB1-OB0. OW1-OW0 is the "shadow price" of the further increment OB1-OB0 to the displeasure, from level OB0. In this particular case the increment to the wage OW1-OW0 > the increment to consumption goods DA, which is required by the individual to compensate for the increased displeasure. A seaman would thus be willing to work in the job with displeasure level OB1 for all OW > DA. Conversely, if DW < DA, the price would be too low, and the individual would not be prepared to undertake the job involving exposure to displeasure level OB1.

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[23]See Elliott op.cit p. 352.

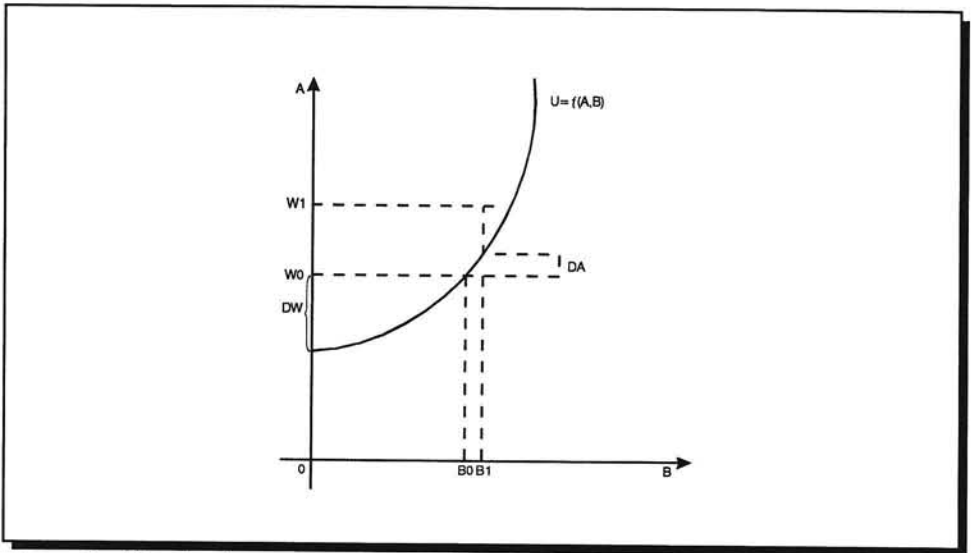[24]A quasi- concave curve. See Elliott op-cit. p. 317.

Figure 1: The shadow price of an increase in work displeasure, *(Source: Elliott up cit. p.318)*

9   FINAL CONCLUSIONS

As is shown above, real free mobility in Greek passenger coastal shipping is not possible for sociological and economic reasons.

And this despite the contents of the Green Book[25] where is written that the free mobility of persons is considered as one of the four "liberties" of the Treaty of Rome (article 3), but soon after is written that is the economic activity which is the basic element in this process (articles 48-66). Article 8A of the Treaty for the European Union has established the right of movement and settlement freely in any Member State of any citizen of European Union.

One interesting thing is that only the Single Market program understood the real importance of the problem, for it (the Council) extended the right of stay to all citizens of Member State of European Union regardless of their economic activity provided they have secured Social Security (Medical and Hospital care) and adequate means of living. The above is extended and to the job- seekers which have strong possibility to be employed (social security is not secured as yet for this people).

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[25]European Social Policy: *Green Book*, Commission, Com (93/ 551 in Greek.

The European Court has also established what was an objective of the Treaty of Rome for any citizen of European Union to exercise an economic activity in any Member State without any bad discrimination and also for the employment in the Public Sector, the right of the Member State has been restricted to those cases where an appointment has to do with exercising public power and responsibility in connection with safekeeping of the general interests of the State.

The core problem of all the above is of course, the mutual recognition of certain[26] diplomas and certificates as well as of certain professional specialisations, in which in our opinion must also fall the crew profession, in Member State of the European Union. Unfortunately, as this is written in the Green Book[27], the above effort i.e. to establish a real and essential mutual recognition of (and equivalent stateus for) professional qualifications at all levels across whole European Union, should constitute an urgent political priority. This means that an essential element of free mobility is lacking and this will be so for many years to come. The right to stay is something that is related to the right of work. The right to stay is related to the right of entry.

As it is also written in the Green Book for the last three years the Council discussed the Commission's proposals for improving the free mobility of working people without being in a position to find acceptable agreement.

Working people wishing to move for work to another Member State usually face rigid administrative processes, where the administration ignores the rights of the European citizen.

Of crucial importance, for labour mobility as mentioned, is the network EURES, which is responsible for the exchange of information about offered work positions and applications for employment in all Member State This network is targeted to provide an exchange of information on work conditions and living conditions in all Member State

Greek Passenger Coastal shipping is regulated in two instances by the Cabotage Council Regulation[28]: (a) as far as the liberation of cabotage is concerned and (b) the legislation that will apply to manning.

The Council Regulation which has been issued on 7th December 1992, tried to implement the principle of the free circulation of services in the Sea Transport in the internal (waters) of Member State (internal sea transport - cabotage). The

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[26] Especially, professions and specialisations, that are not governed by regulations.

[27] Op. cit. p. 51

[28] Reg. (EEC) No 3577/92 of 7/12/92 (cabotage)

Impact on Greek Passenger Coastal Shipping of free Movement of Labour

Regulation has been based on twelve reasons and one referred to the need of the establishment of the Single Market. The Single Market should contain, as argued, a space where the free circulation of goods, persons, services and capital should be secured. Exceptions then were introduced so as to avoid distortion of competition, to establish transitional periods, and to respect the fact that certain Member State have different development levels. The possibility has also been legislated for the Government of a Member State to appoint an EU. shipowner in a public service (most probably this introduces a treatment of the innumerative cabotage lines). The regulation also has included action in case of emergency (market disturbances, emergency situations).

The strange fact of cabotage regulation is that although the free circulation of services in sea transport within a Member State (internal sea transport - cabotage) for EU shipowners, the ships of which are registered in a Member State and fly that M.S's flag, has been in force since 1st January 1993, the reality is rather different.

Above ships have to fulfil all preconditions required for them to offer internal transportation to a certain Member State (including ships under EUROS) only from 1st January 1997 (i.e. four years preparation period).

Regulation had also defined certain terms like that of "EU Shipowners" without any discrimination. The regulation makes note that there may be expemptions for serious disturbances that may occur - like a permanent surplus of supply, a threat to the economic stability and viability of a substantial number of EU shipowners. All the above seem to suggest restrictions of free, pure, full and perfect competition...

As far as the free marine labour mobility is concerned - which is our main theme - the regulation provides differently for different ships, as shown in **Table I**.

Despite the above table, cabotage is not in force before certain dates come, as they are specified by the regulation shown in **Table II**. For Greece cabotage between island ports for regular lines of passenger transport and short crossing and for vessels below 650 GT is free on and after 2nd January 2004.

In the case of establishing the EUROS register, discussions that have taken place indicate that manning for cabotage will be 100% in accordance with the legislation of the receiving state.

So, the present regulation will be invalidated in cases where manning is treated differently for EUROS ships.

We may therefore conclude that due to the lack of a system that will: (a) recognise the professional and educational diplomas and certificates in EU,(b) provide

Type of ships	Manning	Greek passenger coastal shipping	Date remarks
1. Vessels in cabotage between continental ports & in regular (lines) cruises.	Flag state	Flag state	
Vessels below 650 GT	Recieving state	Greece	
2. Vessels in cabotage between ports in islands	Recieving state	Greece	The commision will examine the economic & social impact of the liberation of cabotage. Report is due before 1/1/97 to the council[*]
3. Commercial vessels larger than 650 GT in cabotage between islands ports[**]	Flag state	Flag state	1/1/1999

[*] On the basis of the above report, the Commission must submit to the Council, a proposal that may include modifications to the provisions referring to manning and to nationality, so that the final system to be approved by the Council in time but befor 1/1/1999

[**] When the relevant voyage comes first or follows a voyage to or from another state

(Source: EEC Reg. op. cit.)

Table I: Manning on basis of regulation 3577/92

timely information for job vacancies, over EU, (c) lessen the inability of a person to be present in time (due to distance) to undertake a job, (d) offset the existing differences in wages and working conditions between vessels owned by various EU shipowners, (e) offset lack of a common language and other sociological constraints analysed above; as a result, marine labour mobility is so far theoretical.

The only possibility of free marine labour mobility that we can see in our waters is when cabotage is fully established and EU shipowners come to operate Ro-Ro transportation in Aegean Sea. In this case, owners may compete for a Greek nationality crew, provided also that quality of service is maintained. This is inevitable for if fares continue to be regulated as is now the case, EU shipowners must have a way to compete their Greek competitors not only on quality of services, but also on service costs. Another bases of competition is the ability fo a shipowner to absorb losses (and for how long) until his competitor has vanished.

	S.N. Actions	Dates	Countries
1.	Cruising services	2/1/1995	Mediterranean, and along Spanish, Portuguese and French coasts
2.	Transport of strategic goods (oil, oil products, water)	2/1/1997	
3.	Services of vessels of 650 GT	2/1/1998	
4.	Regular lines of passenger transportationn and short crossings	2/1/1999	
5.	cabotage between islands ports	2/1/1999	Mediterranean, Canary islands, Azores, Madeira, theouta, Melilia, French islands along Atlantic coast and French overseas parts
6.	Cabotage between islands ports for regular lines of passenger transport and short crossings and vessels below 650 GT	2/1/2004	Greece

(Source: Regulations 3577/92)

Table II: Cabotage timetable

10 POLICY RECOMMENDATIONS

Greece should be concerned with the improvement of the quality of services provided to RoRo passengers on and after 2/1/2004 and thus "permit" better vessels to come freely into cabotage transportation.

As for the ownership of the vessels to come and their flags, one cannot pre - estimate. But despite ownership and flag, demand for Greek crew should change as: (1) transportation needs will rise, (2) vessel's size will increase, (3) speed may come up as a basic choice element on part of the passenger.

Competition among shipowners will most probably increase wages, and thus Greek crew will be attracted from other shipping sectors (ocean going, Mediterranean).

Differences in crew wages among EU vessels is not expected to vanish, so non Greek crew is not expected to come to Greek cabotage shipping, unless paid their "home" wages. This will have a bearing on costs.

If fares are freely formulated by supply and demand, certain Greek shipowners will most probably disappear following competition from non-Greek EU shipowners, but this does not mean that Greek crew demand will vanish, too.

Thus the mainpolicy recommendation for the Greek State is to prepare as many Greek people as they wish for cabotage crew to equivalent standards of European Competitors. While some Greek cabotage shipowners may vanish after 2/1/2004, demand for Greek crews may in fact rise. This demand will be satisfied at the expense of Greek crew found in Ocean going and Mediterranean Ships. This, however must be faced from now.

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FAST SELF-LOADING AND UNLOADING UNITLOAD SHIPSYSTEMS FOR COASTAL AND SHORTSEA SHIPPING POTENTIAL IN NORTH WEST EUROPE

By A. Sjöbris, N. Wijnolst, C. Peeters

A request for a new generation of ships' handling technology has been delivered by the industry and the ship operators. And their principle demand is that sea transportation must be an alternative which competes with land transport modes.

Currently, the traditional innovative S-curve of existing ship technology has reached its top level and is flattening out. It will not bring added value to the transport industry without enormous investments. Furthermore, a new generation of technology is demanded. In the mid sixties ship operators gave up their competition with the land transport modes. Unitization in the industry did not appeal to the shipping organisations, which found the investments to be too heavy and the technology too advanced to build up new systems suitable for the new handling techniques when the cargo quantity was not there. The time to switch gear into a new S-curve was just not possible.

In the late sixties and early seventies some new ship developments came to light. A leading example is the Finnflow system but several other smaller system ships were also built. The Broström group in Sweden built a pallet carrier named Tento which handled pallets on a conveyor between ships hold and the sheds, and which at the time were erected close to the waterfront. But the unit load carrier was not ready for the market. Rationalisation came from the US in the form of containers. These units forced themselves into a market which was by the land transport modes and they are still causing a nuisance in the European land transportation which failed to adapt its transport system to container handling.

One new S-curve in shortsea systems came by the development of the ferry traffic. The ferry service is in reality a shipping concept that strenghtens land transportation and land transportation capacity. Unit load systems of the land transports have made a slow development, much because of the variety of systems and the difficulty to make homogeneous units suitable for the existing infrastructure and warehousing.

Still, it is essential that a new type of unit is developed. It is no understatement to say that the new ideal intermodal unit load has not yet been born. It should

also be an advantage if the sea transportation could strenghten its position in order to be one of the parts to make up this new unit.

A number of obstacles make it difficult for the fast development of shortsea shipping and for reduction of costs for such operations.

* Requirements from shippers are formulated by the competing road transportation;

* A reduction of service levels must be compensated for by lower transportation cost;

* Costs will always be considered as the total cost from door to door;

* Added time for transportation must be compensated for by lower cost of transportation;

* Transport services must be easily available, as must all information about such services and about the performance of the transport when it is in the process.

The cost of sea transportation is very low and can compete comprehensively with land transport. In earlier studies it has been clearly shown that the additional operation to fulfill the door to door transport will raise cost levels considerably. This increase is so large that the advantage of the low cost of sea transportation is consumed. An entirely new system must be developed by the sea transportation industry in order to keep and increase the share of the short sea transportation business.

The Roadshow

The findings made in earlier projects have been presented in the report "Innovation in short sea shipping" from Delft University Press. The report was used as a background for discussions with the industry about the potential development of shortsea shipping. The ambition of these discussions was to discover the opinions of the ministries, operators, research institutes etc regarding the development of a shortsea transportation system that will minimize the cost of the intermodality and increase the frequency of a regular sea transportation system.

These discussions took place during the spring of 1994 in the following places:

BREMEN, Germany, February 2, 1994 at the Technical University of Bremen. Arranged by the Technical University of Bremen, and by Prof M Zachcial, with more than 60 participants from ministry, industries, universities and press.

DELFT, Holland, February 10, 1994 at The Technical University of Delft. Arranged by the Technical University of Delft, and by Prof N. Wijnolst, with about 30 participants from ministry, industries, university and press.

LONDON, UK, February 22 1994, at the Chamber of Shipping. Arranged by ABP, and by Mr G Rabbitts, with 27 participants from ministry, industries, university and press.

OSLO, Norway, Mars 2 1994, Norwegian Shipowners' Association Oslo. Arranged by Maritime Forum Short Sea Committee and by Mr Atle Minsaas, secr. of the committee. The meeting was attended by 25 participants from industry, ministry and university.

HELSINKI, Finland, March 18, 1994 at the Ministry of Transportation in Helsinki. Arranged by the Ministry of Transportation, Mr R.Kurki & Mr H. Favorin, and attended by 39 participants from industry, ministry and universities.

In general terms the reaction to the presentation was very positive. Everybody agreed to the outline of a new short sea shipping concept. Most of the audience were exited by the ideas and definitely looked at the subject in a new way.

Scepticism has been detected mostly on the operators' side; especially there are doubts about who might invest in such a system. One of the reasons for this is obviously the more diffuse picture of the cargo quantities. In Sweden shipowners show scepticism for the project, mostly because of the "lack of information" about cargo quantities to be shipped. Cargo quantity is normally what defines the potential of a normal shipping service: this does not apply to infrastructural cargo flows as these will be a part of a total flow.

The most explicit example is for new ferry services with a general demand for transporting passengers and vehicles. The reaction from ports and stevedores is also very positive in the long run. From first being resentful for the fact that the ports have to carry the full blame for the high costs, they gradually realise that they are loosing quantities that originally went through the port.

In their attempts to fill the free capacity they have scanned the whole hinterland for potential cargo, only to find that more and more cargo is going on the road. They realise the need for other services than the traditional port operation, receiving, storing and loading.

Such a new cargo flow will create new types of services even if these are not the traditional ones and such a flow will not affect existing port operations. In short, port operators are aware of the fact that the type of cargo concerned will not go their way if a new type of operation is not introduced.

Fast Self-loading and Unloading Unitload Shipsystems

Investment in a sea transport system is normally never a problem if there is some guarantee for the coverage of costs. This may be a cargo flow that can be shown to the investors or some strong body in shipping or other business sector that can garantee the investment. As an infrastructural resource this segment will probably not be a problem if the state wishes to have the sea transport capacity. If the state requires the service on certain conditions, the investors will, as is normal in the sea transportation business, raise the investing capital themselves, which means that the state does not have to raise the capital for a system. But the state will have to put up guarantees for the investment.

However, one of the more crucial questions is how the state can take a more active part in the total infrastructural planning, if there is no cost or other obligations for the state in sea transportation systems. At the same time one must have respect for the heavy investments and the raising of funds by the state to cover losses and the infrastructural investments of the land transport modes and the reluctance to take on more costs. It is essential that the sea transportation industry must show the cost benefits and the advantages of systems where cargo can be moved from road to sea. Research programs in all European states should be formed to identify these potential cargo flows. The cargo flow should then preferably be based on an intermodal porthopper system described in this report.

In **Figure 1** a system comprising an integrated network of porthopper systems is shown. This is a model based on a logistic layout of a system where the number of ports and the cargo flows as such are not analysed. By pinpointing a number of interchanging ports, several systems can be connected in a chain and the goods can be moved between a large number of ports, without heavy costs for interchanging the cargo units in the ports. As a result the cargo can be shipped in a sea system as close to its destination as practically possible, thus reducing the need for long distance trucking in the end.

The roadshow gave as a result a confirmation of a number of issues which has formed the base of the shipping concept presented. The strongest concern was caused the fact that the existing structure and cost of port operation must be changed in order to change the whole cost situation for sea transportation.

New transport systems must be brought forward where the whole transport chain is considered, incorporating intermodal transports. The new system must look deeply into all operational details in the transport system including the management, organisation, information transfer including booking and notifying of cargo, EDI and cargo tracking. The intermodal system must be organised and pre-planned. The land transport system can just as well be a partner in a transport system based on sea transportation.

Further research is needed in this area. The objective should be to find a proposal for the implementation of a system including the organisation, manage-
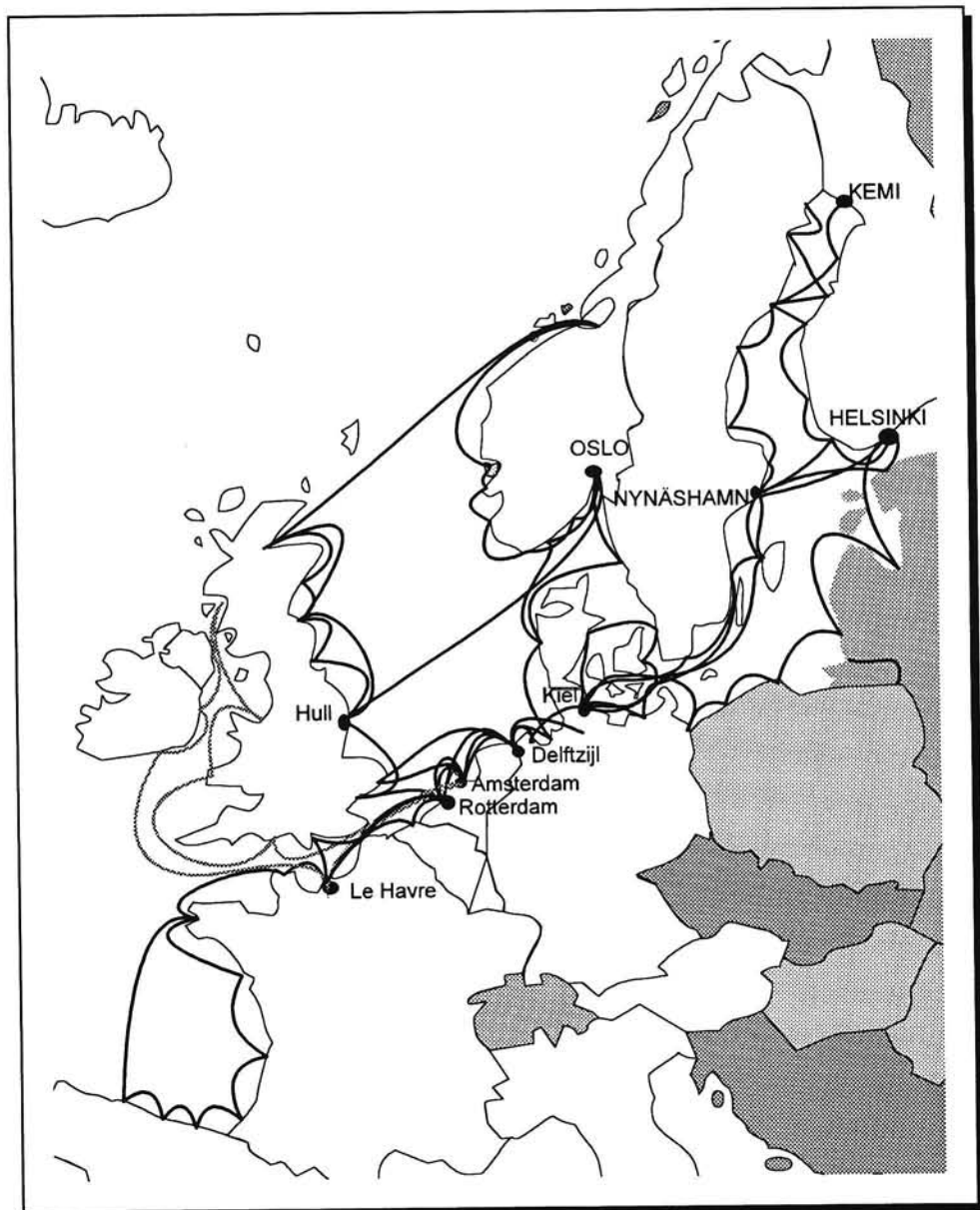
Figure 1 Example of an intermodal port hoppernetwork

ment and running of a complete system.

Fast Self-loading and Unloading Unitload Shipsystems

One of the main goals in the development of sea transportation systems is to find the most suitable load carrier for the shortsea intermodal transport. In the modern way of transportation this should not be a single issue for just the sea transportation but rather be integrated in the new standardisation of load carriers. A standardisation is needed in order to build up intermodality and is one of the most essential issues for the united Europe to determine and decide. Highest priority should be given to this issue in the standardisation committees. The problems to be solved are, in order without priority:

* The overall dimensions, with respect to the different transport modes and the pallet sizes so they fill the unit properly;
* Stackability;
* Fixing points;
* Cargo securing;
* Safety and security;
* Handling efficiency.

Even though these component parts are essential, it is important that all parties take action and plan towards a common goal of developing the shortsea and coastal sea transports leading to a competitive and useful transport alternative. This process must start as soon as possible. The timing for this is correct today and the window is open to changes. This opportunity must be used before the window of opportunity closes and before decisions about alternative extensions of the road and rail infrastructure burdens society in such a way that it fails to heed other viable alternatives.

COMPETIVENESS OF SHORTSEA SHIPPING PORTS:
THE CASE OF ZEEBRUGGE

By L. Maertens

Table of Contents

COMPETIVENESS OF SHORTSEA SHIPPING PORTS: THE CASE OF ZEEBRUGGE

1 INTRODUCTION

1.1 ENVIRONMENT FRIENDLY TRAFFIC

The ever-increasing demand for transport services has led to congestion of the road network. Overcoming this congestion by expansion of the road infrastructure is not possible in most cases. In some European countries (e.g. Belgium and the Netherlands) the road network has reached saturation point. Moreover, road haulage is increasingly met with social disapproval because of the burden it puts on the environment (exhaust gasses, transport of hazardous goods).

The rail modality faces problems of an entirely different nature. It is more environmentally friendly than road haulage and rail-infrastructure could perhaps cope more easily with additional traffic. Unfortunately, equipment and facilities are not always adapted to modern cargo carrying units (e.g. standard-size containers). The rail mode, in much the same way as short-sea shipping is confronted with high break-even volumes of traffic. Consequently, rail operators will only envisage investments in equipment and facilities if demand for rail services is relatively high. Moreover, most rail companies are still government controlled, which leads to an additional disadvantage given that these companies are often less customer oriented and less flexible.

In view of the above, short-sea shipping and inland navigation could increase their market share in spite of a number of unfavorable characteristics, which include:

* Long transit time as compared to road or rail traffic;
* Inability to provide door-to-door services;
* Ill adapted to customer-specific needs.

In order to shift traffic from the road or the rail mode towards short-sea shipping (or inland navigation), new policies are required to ensure cost efficiency and competitiveness.

1.2 EUROPEAN TRANSPORT POLICY

The European Commission is one of the policy making institutions that has understood the great need for change in the transport environment, partly because it has fathered some of the most important initiatives that will affect the transport situation in the near future. The demand for transport services within the European Union (EU) is expected to rise substantially. Forecasts of traffic growth within the EU over the next 10 years vary between 25% and 45%.

The liberalisation of East-West relations and the development of the EFTA will also affect the demand for transport services, but the quantitative evaluation of this increased demand varies considerably depending upon the forecasting institution.[1]

The European Commission's prime objective with regard to transport policy is to investigate alternatives which could enhance a smooth traffic flow and relieve the ecological burden. short-sea shipping, railway- and intermodal transport constitute some of the avenues the European Commission seeks to explore. These transport modes meet the objectives put forward by the Commission. Several shortcomings of the road mode favour the modes mentioned above, to the extent that they can alleviate some of the bottlenecks in the European road transport system, hence reducing congestion and pollution. A general policy framework concerning the transport of goods and passengers has been published by the European Commission in various publications during the last few years.

The most important publications are:

* COM(90) 218 final, June 27, 1990: *Green Paper on the Urban Environment*;
* COM(91) 452 final, November 7, 1991: *Single Market Communication Europe 2000*;
* COM(92) 46 final, February 20, 1992: *Green Paper on the Impact of Transport on the Environment*;
* COM(92) 231 final, Brussels June 11, 1992: *Guidelines for the development of a European Transport Network*;

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[1]The study: *Welchen Beitrag kann die Seeschiffahrt zur Bewältigung der Transportaufgaben im EG-Binnenmarkt leisten?*, conducted by the INSTITUT FUR SEEVERKEHRS-WIRTSCHAFT UND LOGISTIK, estimates the combined effects of the Single Market Initiative, the unification of East- and West-Germany and the liberalization of the East-West relations. The average yearly growth of demand for transport services in the European area, is expected to approximate 7.8% until the year 2000.

* 1992: White Paper: *The Future Development of the Common Transport Policy. A global approach to the construction of a Union framework for sustainable mobility*;
* 1993: White Book: *Growth, Competitiveness, Employment: The Challenges and Ways forward into the 21st Century*;
* 1993: Trans European Networks: *Towards a Master Plan for the Road Network and Road Traffic*.

The development of different *Trans-European-Networks* (TENs) which include the different modes of transport performs an important role in the implementation of the Commission's program.

The terms and principles of the TENs are expressed in the Treaty of Maastricht (Title XII and Article 129 b-d and Title XIV and Article 130 a-e) and the Presidency of the European Council in Edinburgh on 11/12 December 1992 (Conclusion, part C, Annex 3). In general, the main principles include:

* The increase of cohesion among Member States;
* The improvement of mobility;
* The facilitation of trade.

As a first step, individual working group were set up within DGVII (the Union's Directorate General for Transport of the European Commission) in order to develop Trans-European-Networks for the different modes, namely road haulage, trains, shortsea shipping, inland waterways and air transport. The European Commission also installed other working groups related to ports and the creation of networks for energy transmission and telecommunications. The Commission's objective was to co-ordinate the efforts of Member States in making the traffic of persons and commodities throughout the Union more efficient.

2   MARKET POSITION OF THE PORT OF ZEEBRUGGE

Zeebrugge can be situated among the medium sized to large ports in the range Hamburg-Le Havre with a total volume of 33.4 million tons and a market share of 4.9%. During the last decade, the port of Zeebrugge showed an average annual growth of 10.8%, while the average growth of the relevant range was 1.5%. The port of Zeebrugge is particularly important for European shortsea and feeder traffic. In the Hamburg-Le Havre range, the port of Zeebrugge has become a dominant player for ro-/ro traffic, container traffic, dry-bulk and general cargo.

In the Hamburg-Le Havre range, the port is the market leader for ro/ro traffic. The different ports in the Hamburg-Le Havre range grew on average with 7.5% per year, while the port of Zeebrugge had an average annual growth of 10.5%.

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Zeebrugge is also market leader for ro/ro-traffic to and from Great Britain with an average market share of 30% and a total of 769,000 units in 1993, see **Figure 1**.
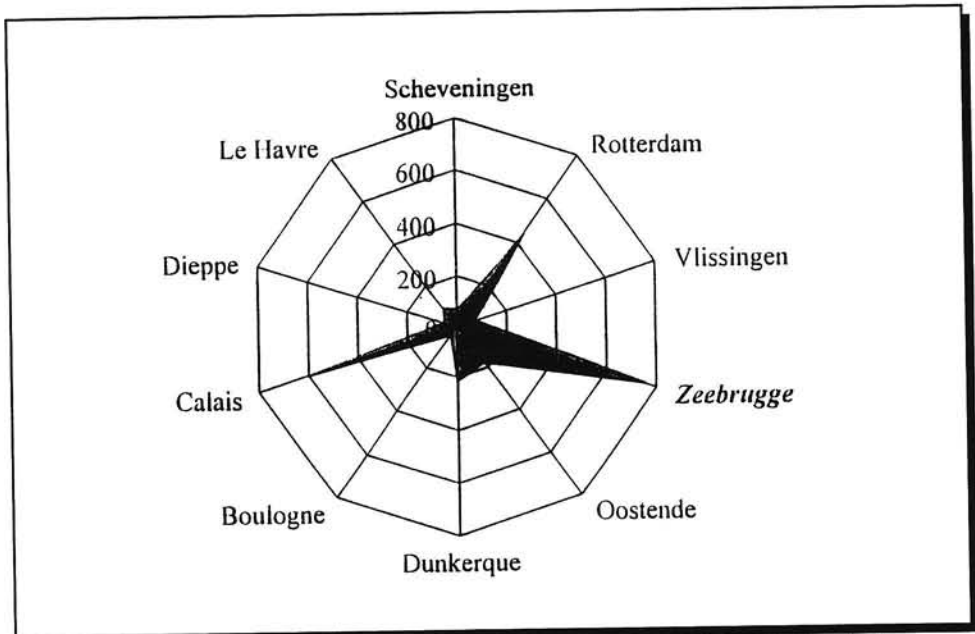
Figure 1: Market situation ro/ro traffic Great Britain, 1992 (x1000 units)

During the last four years, the following traffic volumes were recorded in shortsea trade, see **Table I**.

* Shortsea traffic in the main continental ports is of major importance and constitutes between 20% and 40% of total traffic volumes in the respective ports. For the port of Zeebrugge, this traffic is even more important with a total of 76.6% of total maritime traffic, see **Table II**. The numbers in **Table II** are for the last known year and include both intra-European traffic and feeder traffic (transhipment traffic). Transhipment in the port of Zeebrugge totals approximately 12% of total traffic with a volume of 3.6 million tons. Transhipment in the other ports in the Hamburg-Le Havre range varies between 8% (Bremen) and 19% (Antwerp).

The port of Zeebrugge is particularly interesting to study because it is characterised by several strengths which are discussed briefly.

* Zeebrugge offers regular services in relation to British destinations, spread from South to North England and serves eight different ports: Dover in the

	1990	1991	1992	1993
Skand. + Baltic	0.3	0.3	0.7	0.7
o.w. Norway	0.1	0.2	0.5	0.6
Range	1.0	1.2	1.3	1.6
o.w. Belgium	0.6	0.6	0.6	0.6
Netherlands	0.4	0.4	0.5	0.7
Germany	0.0	0.0	1.3	0.3
UK + Ireland	15.5	15.9	16.1	16.8
Iberia	nr	nr	nr	nr
Mediterrania	3.1	3.3	3.7	3.4
o.w. Algeria	3.0	3.1	3.4	3.1
Middle East	0.1	0.1	0.2	0.3
Other	1.4	1.5	1.5	1.6

Table I: Zeebrugge Traffic volumes per corridor, 1990-1993 (mln tons)

South, Purfleet and Dartford on the Thames (London), Harwich, Felixstowe in the East and finally, Immingham, Hull and Middlesborough in the North;

* The port offers, on average, one hour sailings to and from Great Britain; and weekly sailings to the Scandinavian ports;
* Four major categories of shortsea shipping services are available, combined passenger and freight, multi-user freight, dedicated freight and finally industrial inter-company traffic.

	Le Havre	Zeebrugge	Antwerpen	Rotterdam	Bremen	Hamburg
Skand. + Balt	4.3	0.7	11.0	25.8	7.0	18.2
H-LH range	-	1.6	-	-	-	-
UK + IR	7.6	16.8	8.2	44.2	2.1	7.3
Iberia	0.7	0.0	2.1	2.4	0.5	2.3
Medit.	-	3.4	-	-	-	-
Other	-	1.6	-	-	-	-
Total	12.6	24.1	21.3	72.4	9.6	27.8
% of total port traffic	23.3	76.6	21.2	25.0	31.4	42.9

Table II: Shortsea Shipping Corridor relations (mln. tons, last known year)

Zeebrugge is also important as a container port. The containers are generated mainly by shortsea and feeder traffic. Shortsea lo/lo-operations handled 84,000 TEU in 1993 but experience competition from to ro/ro-services which handled an extra 123,000 TEU.

Container feeder services include traditional feeder services to Britain and Ireland and to other deepsea ports such as Rotterdam and Hamburg. In addition, several Rhine terminals are served twice a week by sea-going barges. The total volume of this barge services amounted to more than 41,000 TEU in 1993.

In addition to traditional feeder services, Zeebrugge also had inter-company traffic for Ford Motor Company with a volume of 30,000 TEU for 1993.

Given the excellent performance of the port of Zeebrugge for container - and ro/ro services, the question arises what needs to be done to maintain this market leadership position and even to improve this position. In other words, what strategies can be identified that contribute to improve the competitive advantage of the port of Zeebrugge in the relevant range.

3   COMPETITIVE STRATEGIES FOR THE PORT OF ZEEBRUGGE

3.1 INTRODUCTION

The port of Zeebrugge is currently the market leader for shortsea ro/ro and container traffic in the Hamburg Le Havre range. The success of the port of Zeebrugge is reflected in continuous growth in shortsea shipping traffic volumes, showing an average annual growth which is higher than the average in the range.

Expectations as regards future trends are therefore positive, specifically on shortsea shipping traffic that is oriented to the north and the Iberian Peninsula. It has been suggested that future traffic volumes for Scandinavian trade may reach 2 million tons per year very soon and could eventually double to 4 million tons. Traffic to and from the Iberian Peninsula will develop very shortly with an estimated 0.5 to 1 million tons per year[2]. For the British market, average growth rates of 7% have been observed, despite low economic performance in the U.K..

Therefore, expectations are also high and it is suggested that this market will show substantial growth again. Finally, there are indications that feeder services

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[2]See: Policy Research Corporation N.V., Mark*tanalyse van het Wielingendok*, Study commissioned by MBZ, March 1994.

will also show further growth, as Zeebrugge is expected to become one of the main hub container ports in Europe.

In order to meet the increasing demand by customers for better services, substantial investments are done by the port of Zeebrugge. Investments have been made both to increase vessel turn around speed under strict time schedules, and to benefit from economies of scale in view of the trend of increasing vessel capacity for shortsea shipping[3].

3.2 THE IMPACT OF THE CHANNEL TUNNEL

Several events in the near future may have a major impact on existing traffic flows in the European Union. The port of Zeebrugge will also undergo changes as a consequence of these circumstances. In this chapter, the potential impact of the Channel Tunnel will be evaluated.

The Tunnel has two components:

* The shuttle, which as a matter of fact, is just a new link competing with existing ferry connections;
* The city-to-city rail intermodal service, which is a new mode.

The shuttle will reduce the competitiveness of Dover and Calais (as a seaport) however without in road miles. This service is the innovative element of the Tunnel as it is a true alternative viz. the shipping industry. Especially for long distance traffic a switch from road haulage to combined rail traffic is expected to occur.

Thus, the intermodal service may take rail container traffic for Italy and East Europe, reducing the cargo base of the container carriers. In general, the Tunnel represents a large supply-side injection into the market, which will inevitably reduce prices and increase the pressure on the margins of all other modes.

The switch from road to rail will be favoured by different market elements and notional and EU environmental policies. Continental restrictions on Sunday driving have already increased the costs of long-distance haulage, and the UK government is examining ways of restricting road traffic. Measures such as a carbon tax would not have a significant effect. Even a doubling of fuel price and duty in the UK would only increase road haulage rates by one sixth. Motorway

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[3]Most studies set the dividing line between the SSS and the deepsea fleet at 10,000 DWT (or 6,000 GT), see Policy Research Corporation N.V., *Analysis of the Competitive position of Short Sea Shipping: Development of Policy Measures*, Study co-financed by the European Commission, DGVII and the Department of the Environment and Infrastructure, Ministry of the Flemish Community, Flanders, August 1993, p I.9.

tolls, or a high annual taxes, could have more effect. Congestion may have its own deteriorating effect on service quality and would affect trailers moving through Kent and around London. Generally, physical restrictions on road transport could affect service quality adversely in the future.

short-sea shipping was recognised relatively late by the EU as a potential joint contributor, with intermodal transport, to the solution of the environmental problems caused by road freight, and the UK Government has lagged behind the EU. Most recently the UK Minister of Transport has begun consultations on a 44 ton concession for intermodal transport, which would allow intermodal operators to compete on level terms with TIR operators as far as payload weight is concerned (otherwise the combination of swap-body and chassis weighs more than a trailer).

This corresponds with EU practice in France, Germany, and Italy, where the concession is a 40 ton road limit, whereas the proposed UK limit will be 38 tons for both semitrailer and drawbar operations.

Several studies have estimated the potential impact of the Channel Tunnel on shortsea shipping from and to the U.K.[4]. Although an accurate assessment of this impact is impossible, it is expected that accompanied trailers will be affected more than unaccompanied traffic, especially in a first stage of the operations. It is also expected that the effects of combined transport (intermodal traffic) will be much stronger on longer distances than on the short distances. For that reason, it is expected that the port of Zeebrugge will be less affected by the opening of the Tunnel than other ports which are located closer to the Tunnel. In addition, Zeebrugge is market leader in ro/ro and shortsea shipping container traffic with a large distribution of U.K. ports from the South (Dover) to the North (Hull).

The impact of the Channel Tunnel on the northern ports of the U.K. is expected to be less important and for the port of Zeebrugge, the share of shortsea shipping to the north of the U.K. is continuously rising. The port also possesses a balanced distribution between accompanied - and unaccompanied traffic, is centrally located and has a large hinterland that is spread over Continental Europe. Therefore, expectations are that the impact of the Channel Tunnel will be predominantly on accompanied traffic while unaccompanied traffic might only feel an impact on long distance traffic.

The new strategy of Ford Motor Company that will be in effect once the Channel Tunnel will be operational and that includes shifting segments of its traffic from road/shortsea shipping (via Zeebrugge) to railway tunnel traffic seems to

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[4]e.g. The *Channel Tunnel: Prospects for users, investors and competitors*, <u>Drewry Business Publications</u>, 1993.

confirm this evaluation. Early this year, Ford announced that it will shift its long distance traffic between Valencia (Spain) and Dagenham (U.K.) to the rail mode. This traffic involves the transport of spare parts which are at present transported to Zeebrugge and then shipped to the U.K..

Once the Channel Tunnel will be operational; these volumes will be transferred to railway and sent to the U.K. via the Channel Tunnel. However, the shorter connections, on the one hand between Dagenham and Genk (Belgium) and on the other hand between Dagenham and Keulen (Germany) remain unaffected and will continue to use the port of Zeebrugge. Ford concluded that a shift from the present mode to the railway mode would not contribute to gain competitive advantage.

4 STRATEGIES FOR COMPETITIVE ADVANTAGE

The opening of the Channel Tunnel is not the only major evolution in the market that will affect the competitive position of shortsea shipping.

The most important other elements are:

* The recognition by public policy makers of shortsea shipping as an alternative for road haulage;
* The objective of public policy makers to reduce road haulage substantially in order to fight environmental pollution and congestion;
* The introduction of innovative techniques that will increase the competitive position of shortsea shipping;
* The expected increase of commercial traffic in the European Union.

All these elements might also affect the port of Zeebrugge and require the development of a strategic plan of action for the port, both in the short term and in the long term. Such a plan will ensure that Zeebrugge will maintain its leadership position and will create new markets.

This plan may build upon the following elements:

* Improvements in port infrastructure and superstructure will contribute to meeting the requirements of innovations in shortsea shipping, both in ship designs and transhipment methods. This will allow an even faster turn-around time making the port more attractive for fast cargo;
* An increase in the capacity of the port will allow to meet the new developments in shortsea shipping regarding economies of scale;
* Total transit time will be reduced by making hinterland connections more efficient;

* New potential markets should be entered, e.g. the Mediterranean market, and promotion activities should be developed on those corridors with a high development potential.

INTRODUCTION TO THE CORRIDOR-STUDY

By T. Kelchtermans

Ladies and Gentlemen,

I am honoured to address such an eminent public at this Second Conference on Shortsea Shipping.

As in our overcrowded continent, solutions for our daily traffic-problems must urgently be found, promotion for a more intensive use of other means of transport becomes almost a necessity.

The Directorate-General for Transport (DGVII), Commission of the European Communities initiated the so-called Corridor-study, which was executed by an association of Belgian, French and Spanish research organisations.

In this study, several policy recommendations were formulated in regard of statistical data collection, potential for the integration of Short Sea Shipping and promotion of SSS.

A better promotion of SSS is crucial in order to facilitate the interactions with major stakeholders. To sustain the necessary strategic plan for SSS across corridors, a new institutional structure could help to organise promotion and strategic planning activities. Hence, a so-called "European SSS-Promotion Service" (ESPS) could be established as a non-profit organisation. This organisation could contribute substantially to the improvement of the competitive position of SSS by:

1. Stimulation of alliances among SSS-operators on specific routes, in terms of both groupage and marketing, in order to improve the total service quality of SSS vis-a-vis other modes;

2. Stimulation of cooperation with other modes in order to improve the intermodal capabilities of SSS;

3. Stimulation of innovation, especially in vessel design to overcome existing competitive and technical weaknesses of SSS;

4. Strategic interaction with public and business level policy makers to implement the general policy measures described in this report as well as specific policy measures for specific routes.

The ESPS could perform a key role in the intra-EC co-ordination of activities related to SSS and act as the main coordinating body in this area.

A similar initiative for the development of a promotion service for inland naviga-tion is supported by the Flemish government. This initiative already shows promising results. The "VZW Promotie Binnenvaart Vlaanderen" is a Flemish non-profit organisation for the promotion of inland navigation. This non-profit organisation is also working on the reorganisation of the inland navigation market. For that purpose, it has commissioned in 1993 an in-depth study on the competitive position of the inland navigation sector in the national and interna-tional transportation market.

Although the issue is far from being recognized by all the parties involved, SSS and inland navigation could play a complementary role in the environment friend-ly transport of goods troughout the Community. The use of sea river ships could create opportunities for SSS to use inland ports of multimodal terminals inside the continent, hence alleviating the larger ports which are congested, specifical-ly in regard to their hinterland connections.

The integration of SSS and inland navigation requires, however, additional improvements in the existing inland waterways infrastructure. Several bot-tlenecks exist for the moment which reduce the efficiency of inland ports and terminals, particularly as regards their use for SSS-transportation. The develop-ment of multimodal terminals could substantially increase transhipment efficiency, hence overall speed of the mode. An initiative of the Flemish Ad-ministration for Water Inrastructure and Maritime Transport, a study was performed in 1993 on optimal locations for the development of multimodal terminals for inland navigation. An executive summary is available for all par-ticipants at this Roundtable Conference on Shortsea Shipping.

However, to maximise the functioning of SSS in this context, the SSS-mode should also be able to benefit from the same "advantages" as inland navigation, particularly in the ports and the maritime access channels, e.g. the exemption from pilotage in ports and maritime access channels.

Further research should focus on the potential for SSS in specific corridors. The attention in these studies should be focused on the viability and efficiency of specific implementations and potential projects, development of so-called "port-pairs" or specific case studies of SSS initiatives on well-defined corridors. A research project on the potential to develop specific "Port-Pairs" was recently formulated by Policy Research Corporation. This study will be co-financed by the European Commission DG VII, the port authorities of Zeebrugge (MBZ), and Policy Research Corporation. This study should also include the development of strategies for the development and management of "Port-Pairs" which could be identified as potentially interesting for the port of Zeebrugge.

Introduction to the Corridor-study

From a more general perspective, the attention should be focused on the development of unified and consistent statistical information. In terms of regulation, changes aimed to stimulate SSS, should include the harmonization of regulations regarding, e.g. flag requirements safety requirements, the status of vessels registered under second registers of Members States, liability rules etc.

Ladies and Gentlemen,

I am convinced that above mentioned problems wil be further discussed thouroughly during this Conference. I hope that these discussions will be very fruitful and that practical solutions will be worked out.

THE FUTURE OF EUROPEAN POLICIES FOR SHORTSEA SHIPPING

By C. Peeters. A. Verbeke and E. Declercq

Table of Contents

THE FUTURE OF EUROPEAN POLICIES FOR SHORT SEA SHIPPING

1   INTRODUCTION

This paper contains a detailed set of policy recommendations to the European Commission in the area of Short Sea Shipping (SSS). These policy recommendations result from a recent in-depth economic and managerial analysis of various important traffic corridors in the European Union (E.U.) and a number of neighbouring countries.

Two complementary corridor studies on SSS, initiated by the Directorate General for Transport (DGVII), Commission of the European Union, were undertaken in the period 1992-1993. The first study was executed by Policy Research Corporation N.V. (Belgium)[1]. This study analysed the competitive position of SSS in the following corridors:

* Benelux/Germany - Nordic Countries/Baltic Sea;
* Benelux/Germany - UK/Ireland;
* Benelux/Germany - Black Sea Area;
* UK/Ireland - Italy/Greece.

The second study was undertaken by an international consortium led by l' Institut Français de la Mer (France)[2] and analysed the following corridors:

* Spain/Portugal - UK;
* Spain/Portugal - Germany;
* Spain/Portugal - Greece;
* Italy - Black Sea Area.

The present paper focuses on the 10 government recommendations for European SSS policy contained in the former study. However, the link with the complementary policy suggestions formulated in the latter study is made whenever possible.

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[1]See Policy Research Corporation N.V., *Analysis of the Competitive Position of SSS: Development of Policy Measures*, 1993.

[2]See Institut Français de la Mer and associates, *Transports de Marchandises sur les grands Axes Européens - Recherche de Routes Alternatives Terre-Mer*, 1993.

In the second section of this paper, a large number of requirements is listed that must be satisfied to improve the position of SSS in Europe. These requirements follow directly from the two studies mentioned above.

In the third section, the 10 detailed policy recommendations to the E.U. for European SSS policy, developed in the report of Policy Research are described, given that they are in broad accordance with the 24 proposals of l' Institut Français de la Mer and associates, and primarily constitute an elaboration of those requirements that have particular relevance for policy matters at the level of the E.U.

2 REQUIREMENTS TO IMPROVE THE COMPETITIVE POSITION OF SSS.

The various requirements identified in both reports can be positioned according to their primary link with a specific element contained in **Table I**: Critical external and internal factors for SSS - competitiveness. Some of these requirements, when translated into policy recommendations, may obviously have a major impact on several elements contained in this table as will become clear in the next section, but in this section only the element with which the most direct link exists is taken into account.

2.1 REQUIREMENTS RELATED TO MARKET FACTORS

Both l' Institut Français de la Mer and associates and Policy Research have argued that more reliable market data are required on European SSS, as a precondition for potential transfers of traffic. This requirement has been transformed into *Policy Recommendation 1* to the E.U., see the next section.

L'Institut Français de la Mer and associates have also argued that a formal identification should take place of ports that can strengthen the regional market potential of SSS through a concentration of traffic (which would in turn improve the reliability and frequency characteristics of SSS). In addition, those ports should be identified which can aid in the development of SSS for specific types of cargoes. This proposal is obviously directed primarily to shipping companies and the ports themselves. As regards the latter, this requirement was also identified by Policy Research and it has been translated into *Policy Recommendation 2* to the E.U. in the next section, albeit as a measure meant to improve the internal and external (port related) technical factors of SSS rather than its market potential per se.

Category	External factors	Internal factors
I. *Market factors*	(1) Market size (total traffic volume on route) (2) Market growth per year (3) ")Market power of alternative transport mode(s)	(1) Market share (SSS-traffic volume on route X) (2) SSS-growth per year (3) Market power of SSS-firms
II. *Competitive factors*	(1) ")Total Cost structure of alternative transport mode(s) (2) ")Total service quality of alternative transport mode(s) (3) ")Time characteristics of alternative transport mode(s) (4) ")Frequency and reliability characteristics of alternative transport mode(s) (5) ")Integration of alternative transport mode(s) in door-to-door transport chains	(1) Total cost structure of SSS (2) Total service quality of SSS (3) Time characteristics of SSS (4) Frequency and reliability characteristics of SSS (5) Integration of SSS in door-to-door intermodal transport chains
III. *Financial factors*	(1) ")Financial structure of alternative transport mode(s) (2) ")Profitability of alternative transport mode(s)	(1) Financial structure of SSS-operators (2) Profitability of SSS-operators
IV. *Technical factors*	(1) Port infra- and superstructure (2) Availability of EDI and network systems (3) ")Technical integration potential of alternative transport mode(s) in an intermodal transport chain	(1) Technical compatibility of SSS-vessels with port infra- and superstructure (2) Access to - and use of - EDI and network systems (3) Technical integration potential of SSS in an intermodal transport chain
V. *Socio-political factors*	(1) ")Attitudes of major stakeholders (e.g. port authorities, industrial firms) toward various transport modes (2) ") Government regulation toward various transport modes	(1) Relationships of SSS-operators with major stakeholders (e.g. port authorities, industrial firms) (2) Relationships of SSS-operators with regulators
VI. *Other*		

") A high score for alternative transport modes in fact reflects an unfavourable environmental factor for SSS.

Table I: Critical external and internal factors for SSS-competitiveness

2.2 COMPETITIVE FACTORS

As regards the internal strengths of SSS, the total cost structure of this mode could be substantially improved, through financial incentives for newbuilding and rebuilding. This requirement, identified by Policy Research was translated into Policy *Recommendation 5* to the E.U., see the next section. In addition, l' Institut Français de la Mer and associates have argued that SSS - operators should be faced with only those port costs they created and not with imperfect approximations of these costs. Furthermore, they have proposed that the use of port services for loading/unloading should be associated with fixed prices for specific port activities (e.g. a fixed price for loading a container).

In the area of total service quality, the internal strengths of SSS could be improved through the introduction of a so-called "combined bill of lading", that would allow multiple inland terminal calls from port to port, to the extent that this bill of lading could be linked to a single administrative document, (equivalent to the one that exists in the road haulage sector). This would allow to avoid, e.g. customs or health regulation controls. Although a simplification of administrative procedures would undoubtedly facilitate the functioning of SSS in the E.U., this element was not included as one of the ten main policy recommendations to the E.U., as purely administrative improvements cannot be expected to substantially alter the relative competitive position of the various modes, but this measure is implicitly taken into account in *Policy Recommendation 10* of the next section, which proposes a strong intra-E.U. coordination of all policy initiatives, including administrative ones (see also infra).

The internal time characteristics of SSS can be ameliorated through a stronger co-ordination between SSS activities and specific port activities related to e.g. transit, storage or logistics.

As regards internal frequency and reliability characteristics, l' Institut Français de la Mer and associates suggested that existing liner shipping companies should co-ordinate their activities in terms of, e.g. time tables and itineraries. In addition, SSS operations should also make use of the feedering services provided by the very large shipping companies and the feedering services that link large E.U. ports with the final destinations of the cargo.

In order to provide a better integration of SSS in door-to-door intermodal transport chains, it was proposed by l' Institut Français de la Mer and associates to develop a network of multimodal nodal points that would improve the viability of SSS, through a concentration of traffic for, e.g. redistribution or groupage. A similar view was adopted by Policy Research, which also emphasised the need to stimulate the development of multimodal terminals, see *Policy Recommendation 6* in the next section.

2.3 FINANCIAL FACTORS

As regards purely financial factors, no specific requirements were identified. The view adopted here is that market forces should prevail and that no major problems exist as regards the financial structure or profitability of SSS-operators in general.

2.4 TECHNICAL FACTORS

The environmental attractiveness of SSS could improve substantially if specific investments were performed in port infra- and superstructure in the Cohesion Fund Countries and Eastern Europe, as suggested in *Policy Recommendation 7* in the next section. L' Institut Français de la Mer and associates have also suggested the development of inexpensive, standardised loading/unloading equipment in small and medium-sized ports. They also identified the requirement to ameliorate the infra- and superstructures of inland ports, which is consistent with the policy recommendation regarding multimodal inland terminals (see supra).

The requirement to increase the use of EDI and related systems was identified by both l' Institut Français de la Mer and associates and Policy Research; this issue is discussed in more detail in the next section as *Policy Recommendation 3.*

The external environment of SSS would obviously be much more attractive if the technical integration with other elements in the chain, e.g. as regards EDI, would be organised by the ports involved on specific routes themselves. Here, Policy Research identified the requirement to create "port-pairs" as traffic development champions, see *Policy Recommendation 2* in the next section.

Finally, both l' Institut Français de la Mer and associates and Policy Research emphasised the requirement of improved internal strengths of SSS as regards integration in an intermodal transport chain. Whereas l' Institut Français de la Mer and associates focused primarily on the need to unitise cargo, e.g. through increased containerisation, Policy Research also drew attention to the need for innovative vessel designs in SSS, as explained in *Policy Recommendation 4* in the next section.

2.5 SOCIO - POLITICAL FACTORS

Various important requirements were identified in the area of socio-political factors. Both l' Institut Français de la Mer and associates and Policy Research view a better promotion of SSS as crucial to the facilitation of interactions with major stakeholders. They are also in favour of a formal strategic plan for SSS across corridors. In *Policy Recommendation 9* of the next section, a new institu-

tional structure is proposed to organise promotion and strategic planning activities.

In terms of regulation, the two consultants agreed that external costs should be taken into account when comparing the total cost structure of alternative modes; this requirement was translated into *Policy Recommendation 8* to the E.U. in the next section.

L'Institut Français de la Mer and associates have suggested various other regulatory changes aimed to stimulate SSS, including the harmonisation of regulations regarding, e.g. flag requirements, safety requirements, the status of vessels registered under second registers of Member States, liability rules etc.. They have also proposed to provide the most favourable conditions to SSS as regards energy costs (in particular in the ports) and the unambiguous, full exemption of SSS traffic from value added taxes.

In this context, Policy Research has adopted a somewhat institutional perspective, arguing that all proposals and actions regarding SSS at the E.U. level such as the ones proposed by l' Institut Français de la Mer and associates should be the subject of formal co-ordination and strategic actions by a new organising agency, see *Policy Recommendations 9 and 10*.

2.6 OTHER

L'Institution Français de la Mer and associates have identified the need to ameliorate the accessibility of a number of inland navigation waterways for SSS-vessels. This has been taken into account in *Policy Recommendation 4* regarding the stimulation of the use of sea-river ships. In addition, they have argued that SSS-operators should benefit from the same advantages as inland navigation vessels, e.g. as regards exemptions from pilotage in ports.

3   TEN SSS-POLICY RECOMMENDATIONS TO THE E.U.

Given the requirements that need to be satisfied to improve the competitive position of SSS in Europe, as described in the previous section, the present section contains concrete policy recommendations to the E.U.. Although the research methodologies used by l' Institut Français de la Mer and associates on the one hand and by Policy Research on the other hand are somewhat diverging and reflect the core capabilities of each consultant, the previous section has demonstrated that a high level of complementarity exists as regards the requirements identified by the two consultants. Hence, the policy recommendations included in this section constitute a logical extension of the requirements identified in the previous section.

3.1 *POLICY RECOMMENDATION 1*: CREATION OF RELIABLE MARKET DATA ON EUROPEAN SSS.

As regards market data on SSS, it should be recognised that it is very difficult at present to assess the exact market size of specific traffic flows on specific routes and thus the market power of alternative transport modes.

An important problem in the analysis of existing cargo flows and in assessing the market potential of SSS, is the lack of reliability and correspondence of the available statistical data. Many data bases exist that contain shipping information; e.g. Eurostat's data base on external trade by mode of transport, Lloyd's Maritime Information Services, the Dutch BTS system or port data bases such as APICS in Antwerp.

For a number of reasons the comparison of SSS flows derived from different data bases is very difficult:

* SSS is not defined in an unambiguous fashion; hence, depending upon the definition used in an analysis, flows may vary considerably;
* When analyses are based upon external trade data, definitions of import and export may vary considerably depending upon the reporting statistical agency;
* Cargo flows are often desegregated into classifications of goods in order to appraise the importance of particular categories of goods. Unfortunately, many such classifications exist, e.g. SITC[3], NSTR[4], CN[5], etc., all of which are different in one or more aspects from the others. Cargo flows based upon different data bases using different goods classifications are therefore hardly comparable.

Eurostat data constitute the most valid European statistics presently available. The Eurostat data base provides up-to-date information on external trade of the E.U. member states: data is available from 1989 onwards. As the Eurostat data base is restricted to national statistics on the 12 E.U. member states, it faces limitations for studies of a much smaller scope (e.g. individual routes or inter-regional flows) or for individual SSS operators who want, e.g. to forecast future traffic demand in a certain region or transport relation. The Eurostat external trade database does not supply port or regional statistics and data on non-E.U. member states can only be compiled through the import data of the 12 reporting

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[3]Standard International Trade Classification of the United Nations Organization.

[4]Standard Goods Classification for Transport Statistics.

[5]Combined Nomenclature, since 1 January 1988 the statistical nomenclature of the E.U..

countries. Such demands would have to be met by national or port data bases, to the extent that they exist . Here, the above mentioned problems with regard to data comparison come into play: a statistic in one national or port data base does not necessarily mean the same thing in another one. To avoid such inconsistencies between data from different data bases, it is suggested that a data base be created which provides detailed information with regard to SSS. The need for detailed SSS statistics has often been observed by both researchers and policymakers. In a paper, included in N. WIJNOLST, C. PEETERS AND P. LIEBMAN, *European Shortsea Shipping,* Proceedings from the First European Roundtable Conference on Shortsea Shipping, 26-27 November 1992 at the Technical University of Delft, The Netherlands, Lloyd's of London and New York, 1993, it was demonstrated, through the use of a hierarchic decision model, that the shipping market in general expects the greatest contribution to an improvement of the SSS trade from the processing of relevant statistics[6].

Hence, *the first policy recommendation is that the existing Eurostat data base should be expanded to non-E.U. member states such as the EFTA and East-European countries. In addition, port statistics should be included in the data base so as to provide a means to create origin/destination matrices on a port-to-port basis.* Initially, these port statistics could be limited to a country's most important ports (mainports). As regards the role of small ports in the development of SSS and multimodal transport, it is suggested that these ports' statistics should be included in a further stage of the data base development.

As the current Eurostat data base on external trade by mode of transport is limited to import and export data, throughput - an important cargo flow in countries such as Belgium or the Netherlands - is either lost or needs to be compiled from other data bases. Here again, problems related to inconsistent data arise. Therefore, it is suggested that *data on throughput by mode of transport and goods in customs warehouses be collected.* Hence, the data base should cover the full spectrum of cargo transported in a certain country or on a certain transport relation, specified by mode of transport and by category of goods.

It should be recognised that the compilation of such a data base is a difficult undertaking. However, all the data mentioned above are currently available from various sources: national statistics offices, ports, UN, O.E.C.D, etc.. The problem is not so much the availability of data but rather the lack of correspondence among data from different sources. Consequently, *priority should be given to the establishment of internationally accepted procedures and definitions (import, export, goods classifications, etc.) for data collection. In order to convert data of previous years into a standard classification, an additional set of*

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[6]See A.J. BOS and H. DE VOS, *Information System for Improving Market Activities in the Short Sea Trade,* in: N. Wijnolst, C. Peeters and P. Liebmann, op. *cit.,* 1993..

transformation procedures will need to be developed. The creation of reliable data on the SSS-market may improve both the environmental attractiveness of SSS as perceived by customers and strategic planning by SSS-operators themselves.

3.2 *POLICY RECOMMENDATION 2*: CREATION OF "PORT-PAIRS" AS "SSS-TRAFFIC DEVELOPMENT CHAMPIONS".

An important paradox exists as regards the improvement of internal technical factors for SSS. It has been called the *'Delft Paradox'* by a number of European SSS-insiders. At the research conference on SSS at the University of Delft which was mentioned above, several experts explained the need to achieve scale economies in terms of larger SSS-vessels, higher capital investments in ports and a concentration of traffic flows on a few routes within major corridors. Simultaneously, a number of other experts expressed their concerns regarding the hinterland transportation problems that would arise from a concentration of SSS-traffic based on scale economies in a limited number of ports and the fact that such a concentration would reduce the possibilities of SSS to improve on its major weakness, namely its time, frequency and reliability characteristics vis-à-vis the road mode. In fact, this second view is shared implicitly in the E.U.'s White Paper on "The Future Development of the Common Transport Policy - A Global Approach to the Construction of a Community Framework for Sustainable Mobility". A reduction of the market power of the road mode in favour of SSS will only occur if SSS can build upon the existing pool of small ports in Europe.

Hence, *the policy recommendation to the E.U. is that all seaports in the E.U. should in principle be viewed as boarding points that can assist in the development of SSS.* No attempt should be undertaken, for example, within the context of developing Trans European Networks, to select a limited number of ports as potential catalysts for large scale SSS-development, as this would likely lead to new bottlenecks in hinterland transportation and a reduction of door-to-door transportation capabilities. The development of SSS on smaller scale routes requires "SSS traffic development champions".

Unfortunately many informal meetings held with a variety of business level policy makers, whether from the shipping or port sector, led to the conclusion that neither individual small shipping operators, nor individual small ports have the capabilities and/or entrepreneurial drive to generate such developments. Small shipping companies are mostly interested only in the shipping part of the business, from port to port, and not in creating door-to-door transport chains. In contrast, most port authorities are primarily interested in providing services demanded by their own port customers, not in providing new international door-to-door transport services to be "sold" to commercial or industrial cus-

tomers who presently use a transport option with a stronger involvement of alternative modes.

The policy recommendation in this respect is that the E.U. should stimulate the development of "Port-Pairs" which should act as "SSS-traffic development champions" on a specific route. Hence, it is suggested here that, e.g. feasibility studies or other research projects supported by the E.U. to stimulate SSS on specific routes should be funded in cases were two (or more) port authorities are involved at the outset of the project.

An example of a potential project that could fit in this area is the so-called "Baltic By-Pass" project that is promoted by a consortium including the Associated British Ports Goole (UK) and the Port of Rostock (Germany). The pilot project "Sealink" launched by the Commission and involving four ports in Germany (Rostock and Lübeck), Italy (Brindisi) and Greece (Patras) should also be viewed in this context. The main advantage of ports functioning as a pair is that co-operation between them can rapidly be established, e.g. in terms of co-ordinating EDI-proposals, identifying potential cargo flows and providing "dual" incentives to shipping companies and shippers to consider the proposed SSS-route. In fact, each "port-pair" should provide the services that can normally only be offered by large mainports and/or large shipping companies. In practice their activities should lead to the attraction of sufficiently large cargo flows on "thin" routes to make services possible between the two (or more) ports.

In practice, this recommendation does not hold primarily for dry bulk, which is mostly well organised already, given the concentration that often exists at the suppliers' side. It is not meant for ro/ro traffic either, which is already well-established on main routes and which mostly requires large and stable traffic flows with high frequency to be commercially viable. It does seem appropriate, however, for general cargo transportation. Here, both supply and demand are often very dispersed, but precisely given the challenge to generate reliable door-to-door services which far exceed a single port to port route, this constitutes a largely untapped area for policy actions.

Given that it was suggested above that a "port-pair" should act as the initiator of new SSS-routes for specific types of cargo, the first task of each port should not be to substitute for activities, which are normally executed by a variety of business firms such as shipping companies, stevedoring companies, hinterland transportation operators etc. but to set up a local consortium of interested partners. The local consortium at each end could then form an international, intermodal network. The first function of this network should probably always be to set up an appropriate EDI system with standard messages related to enquiry, offer, acceptance and confirmation of transportation services, thus linking in an appropriate way the different economic actors involved in international transportation, e.g. cargo owners, export agents, export hauliers, shipping

companies, counterpart agents (import), import hauliers, receivers of goods, financial institutions, etc.

The main problem here is obviously related to the nature of the data included in the system: none of the actors mentioned above would agree to provide information deemed confidential to the system, e.g. related to real freight rates. In any case, in the UK the development of a full EDI consignment tracking system could probably be made operational in the short run, through the use of the excess capacity of the UK and Irish customs clearance system, which has arisen as a result of the European Single Market. The identification and stimulation of "port-pairs" to act as "SSS-traffic development champions", e.g. through E.U. support for feasibility studies for specific routes will lead to an impact on technical factors, both in terms of environmental attractiveness (given the improved availability of EDI and network systems in ports) and internal strength (given the improved technical compatibility of SSS-vessels in an intermodal transport chain, and their better access to - and use of - EDI and network systems).

3.3 *POLICY RECOMMENDATION 3*: CREATION OF HOMOGENEOUS EDI-STANDARDS THROUGH AN EDI-DEVELOPMENT PACKAGE FOR PORTS AND MULTIMODAL OPERATORS

Most of SSS's traffic potential is related to its possible role in a multimodal transport chain. The extent to which SSS will be able to exploit this opportunity depends largely on its ability to link itself to other transport modes. It is generally accepted by researchers and policymakers that Electronic Data Interchange (EDI) has a crucial task in the scheduling and linkage of different modes. Consequently, attention should be devoted to the creation of an European EDI network. Currently, a number of projects on EDI are being carried out, some of them under the auspices of the E.U. (e.g. the Arcantel platform).

One should keep in mind that there are several aspects to the current EDI experiments numerous ports are undertaking. On the one hand, such experiments imply that port authorities acknowledge the contribution of EDI to intermodalism and are aware of the importance of adequately linking one mode to another. On the other hand, the various independent projects may generate different *de facto* EDI-standards, and pose various problems for the linkage of distinctive regional EDI-networks into one national or European network in the future.

Consequently, *the policy recommendation for the E.U. is to develop a support program, through which information and possibly financial and staff resources would be allocated to ports envisaging EDI projects*. This implies that the E.U. should create an EDI-development package for ports, possibly including a training scheme for specialised EDI personnel. These EDI specialists should be made conscious of the E.U.'s policy purposes, requirements and standards with regard to EDI and should implement these in the port network.

To the extent that EDI-development would be implemented by "port-pairs" and local consortia as already suggested, *the internal strengths of SSS could be improved through the support of EDI specialists to companies offering intermodal services, especially those engaged in SSS.* This could bring about a shift in the perception of EDI by the staff of the relevant companies: EDI would increasingly be appreciated as accessible, useful, even necessary. This incorporation of EDI in the company culture of SSS-firms is probably a vital cornerstone to the future success of intermodal transport.

As valuable as EDI may be, it is not a miracle cure. EDI enhances the intermodal flow of cargo, but does not provide the ability to react to unforeseen situations. It does not supply real-time feedback loops to shipper, mode operator or customer. For example, production techniques based upon the JIT-philosophy require the timely arrival of ordered components. In case the intermodal scheduling is inaccurate, alternative routings need to be available so as to ensure the arrival of the parts. Numerous other reasons exist that require flexibility of the transport system, e.g. transport of high value goods, goods prone to putrefaction, live animals, etc.. In this respect, road haulage in general has a superior ability to adapt to unforeseen situations. Although SSS can never achieve the same level of adaptability, it should be able to attract additional traffic by implementing a real-time information system.

A real-time information system implies that the customer, the shipper and the mode operator are at all times informed of the location of the cargo. This could be achieved through the use of, e.g. an electronic tracking system whereby each container or cargo unit would be equipped with a micro wave signalling device which is registered at regular time intervals and/or at border crossings, port calls, boarding operations, etc.. This information would be sent to the interested parties via a network or via satellite. Such a system would greatly improve the level of service of SSS; moreover, it could contribute to eliminating at least partially one of the weaknesses of SSS, namely its reliability. Nonetheless, it should be emphasised that the costs of such a system should be carefully weighted against the expected benefits. The creation of homogeneous EDI-standards across corridors, countries and transport modes, should improve the total service quality of SSS and its integration in door-to-door intermodal transport chains. Hence, the competitive position of SSS would be improved. Simultaneously, the technical capabilities of SSS would also improve, in terms of technical integration in intermodal transport chains. Given that ports would also be supported in implementing EDI standards, the environmental attractiveness of SSS would also increase, as regards competitive and technical factors.

3.4 *POLICY RECOMMENDATION 4:* STIMULATION OF DIFFUSION OF "ENTRY BARRIER ELIMINATING" SSS VESSEL DESIGNS

The report of Policy Research emphasised the potential of new types of vessels to make SSS competitive in terms of total service quality, time characteristics, frequency and reliability characteristics. The potential of 4 different types of SSS-vessels was demonstrated, each of them capable of substantially improving the competitive position of SSS vis-à-vis alternative transport modes. Hence, these 4 types could be called "entry barrier eliminating" (EBE) SSS-vessels. A distinction was made among *fast cargo ships, sea river ships, self-unloading bulk carriers and self-unloading and loading unitload ships.*

As regards the first category of EBE-vessels, namely fast ships, it appeared that many routes are viable, especially from the UK, but traditional operators may not be sufficiently entrepreneurial to enter into this market. Hence, operators of fast ships will mostly be newcomers in shipping.

Their competitive advantages will be that new services can be started without delay (as no new infrastructure is required), with a frequency and reliability that equals the quality of road transport.
However, fast ships can only function efficiently when EDI-network systems are present and port terminals are available with advanced handling technology. *What is required to create a diffusion of fast vessel technology is to:*

* *Stimulate and co-finance research into the technological development of light structures for fast ships;*
* *Stimulate the development of light weight intermodal unitloads for road, rail and sea;*
* *Develop flexible, automated cargo handling/transfer terminals in ports;*
* *Develop vessel traffic control systems and advanced shipboard navigation and operation systems;*
* *Engage in the early development of technical standards that will increase the long term competitive position of the manufacturing industry in Europe.*

The potential of the second category of vessels, namely *sea-river ships*, was demonstrated through a chemical tanker case study. Although this type of vessel is already widely used in the North of Europe (between the UK, Benelux, Germany, the Nordic countries and Poland and the other East European countries on the Baltic Sea), a new opportunity is the major new North-South corridor connecting the Baltic Sea and the Mediterranean Sea via the Volga-Don rivers and canals and the Black Sea. Sea-river vessels can operate 220 days of the year (the rest of the year, the rivers are frozen) on this 3000 km long system from St. Petersburg to Rostow. The potential of this route is enormous because of the availability of a large fleet of unemployed Russian and Ukranian

sea-river vessels, the low running and voyage costs of these ships, and the fact that the sailing time from the Baltic to the Mediterranean is short.

In order to further develop the use of *sea-river ships*, it is *necessary to provide dimensions to the river and canal systems in Europe along common standards so as to facilitate the design of ships, a work that is already initiated by PIANC.*

The third ship category, *self-unloading bulk carriers* are especially competitive on shorter routes (below 2000 nautical miles), which covers most of the dry bulk corridors in Europe, and the North-African countries around the Mediterranean. The closure of many coal mines in Germany and the UK, will increase transhipment and distribution flows. These represent an opportunity for self-unloading bulk carriers. The major opportunity comes from the development of low cost, flexible discharge systems onboard small bulk carriers. The reduction of the handling costs will not only reduce the overall freight bill, but will induce the development of new trade flows to and from small ports in Europe and of low value commodities, that could not be shipped in an economically viable way until now. These bulk carriers which range from 2,000-7,000 dwt, will not dramatically change the existing corridors, but will contribute to a dispersion of the corridors.

Corridors suggest large flows of goods, and economies of scale because of this large volume. A complete different perspective is the achievement of a network of hundreds of small routes, dispersed over Europe. As a result of the very low sea-borne transport cost, each small port could become competitive in its own right. The technological innovation in small ship self-unloading technology at low capital costs, could be the trigger to achieve this objective, which is also in line with Policy Recommendation 2.

Finally, *automated unitload ships* represent the fourth category of EBE-vessels. The use of such ships could create the same economies for small coastal ports in Europe as described above for self-unloading bulk carriers. The development of these ships could alter the competitive advantage of SSS vis-à-vis road transport, particularly in countries with a long coastline, such as the Nordic countries and Italy. An efficient, low cost unitload shipping system could alter dramatically the transport corridor between Benelux/Germany and the Nordic and Baltic countries. *A unitload based on the maritime container and the stackable swapbody could become the backbone of an alternative system that would substitute for long distance road transport in Europe. Its development should therefore be actively stimulated.*

The stimulation of EBE vessel designs may have a substantial impact on the market share of SSS on many routes and the internal competitive, financial and technical factors faced by SSS-operators. Given the higher overall service quality that can be expected from these vessels, improved relationships may result with customers.

3.5 *POLICY RECOMMENDATION 5*: STIMULATION OF NEWBUILDING AND REBUILDING OF SSS-VESSELS

The 7th Directive (90/684/EE.U.) of December 21st 1990 (O.J. L 380/27) on shipbuilding support created a situation where support for small vessels with a contract price lower than 10 million E.U.U is severely limited as compared to larger vessels. In addition, this same directive only foresees support to vessels with a metal casco. As a result, small SSS-vessels and innovative SSS-ships with a non-metal hull (e.g. polyester-GRP) are virtually excluded from government support measures. *Hence, it is proposed here to eliminate the words 'with a metal casco' in Article 1 of the 7th Directive. As a result, it would become possible to provide support for newbuildings of SSS-vessels with a non-metal casco.*

In addition, the present limits on financial support for small vessels could be altered in the case of *'innovative'* SSS-vessels, more specifically the so-called 'EBE' vessels described in Policy Recommendation 4. This change of the Directive on E.U.-support to shipbuilding in favour of SSS-vessels, will primarily influence the internal competitive, financial and technical strengths of SSS.

3.6 *POLICY RECOMMENDATION 6*: STIMULATION OF MULTIMODAL INLAND PORT TERMINAL EXPANSION

Policy recommendation 4 included the suggestion to stimulate the use of sea-river vessels in order to improve the competitive position of SSS in terms of, e.g. time, frequency and reliability characteristics and integration potential in a multimodal transport chain. The external complement of this recommendation that aimed to increase the internal strength of SSS-operators is the development of "state of the art" multimodal inland port terminals.

The further development of such terminals, especially in the Benelux and Germany, could greatly enhance the combined attractiveness of inland navigation and SSS. Hence, *the E.U. should stimulate the development of multimodal port terminal projects, which should be eligible for the "common interest" status in the port network.*

Policy Research recently developed a new methodology for the optimal location selection of multimodal terminals in the Flanders area (Belgium)[7], based upon a

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[7]Policy Research Corporation N.V., *Onderzoek naar de mogelijkheden voor het inplanten van multimodale terminals in het Vlaams Gewest,* Studie in opdracht van het Vlaams Gewest, Departement Leefmilieu en Infrastructuur; Administratie Waterinfrastructuur en Zeewezen, May 1993. An English summary of this study is available: *Flanders: the optimal location for multimodal inland navigation terminals.* Summary of the study, commissioned by the Ministry of the Flemish Com-

variety of qualitative and logistical parameters. The qualitative parameters include criteria such as the physical characteristics of the different sites, their quality and capacity, the possibilities for expansion, the environmental impact, etc.. The logistical parameters include technical determinants (transport costs, centrality), site specific determinants (public infrastructure facilities and waste disposal) and market specific determinants (customer base and potential demand growth).

A paradoxical side-effect resulting from the development of multimodal terminals may be the need to create strategic alliances with alternative (in this case complementary) transport modes, especially road transportation. Such alliances may benefit road hauliers, given that some of their core business is now threatened by increased competition, congestion and unfavourable government regulations. A redefinition of corporate strategies will likely include the assessment of possibilities for intermodal co-operation. It is self-evident that the availability of well-equipped multimodal terminals may induce road haulage firms to search for ways to co-operate with SSS-operators. In this context of strategic co-ordination, it is also suggested that *these multimodal terminals should be eligible for government support through an extension of the concept of combined transport as defined by the E.U. to include multimodal transport involving SSS. At present combined transport is still defined primarily in terms of road or rail transportation whereby, e.g. a truck or container (20 ft or larger) may use different transport modes, see Council Directive 92/106 of December 7th, 1992 (O.J. L 368/38). Hence, multimodal transport of, e.g. general cargo or goods that are repackaged in a terminal is excluded from this definition. To allow government support for multimodal transport, Council Regulations 1107/70 of June 4th, 1970 (O.J. L 130/1) and 3578/92 of December 7th, 1992 (O.J. L 364/11) should be altered in order to include multimodal transport involving SSS.*

Hence, support would become available for:

*   *Investments in infrastructure;*
*   *Investments in fixed and mobile assets for boarding;*
*   *Investments in vessels or rolling stock used exclusively for multimodal transport.*

The improvement of multimodal inland port terminals is especially important as various case studies have convincingly demonstrated that often there is not just a simple choice between on the one hand SSS and on the other hand road transportation. The choice is mostly one between a "lower" or "higher" use of SSS. In this context, multimodal inland port terminals may contribute to im-

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munity, Department of the Environment and Infrastructure, Administration for Water Infrastructure and Maritime Transport, June 1993.

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proving the competitiveness of the "higher use of SSS"-options, given the lengthening of the SSS-voyages without boarding.

3.7 *POLICY RECOMMENDATION 7*: STIMULATION OF PORT DEVELOPMENTS IN COHESION FUND COUNTRIES AND EASTERN EUROPE

The four Cohesion Fund countries (Greece, Ireland, Portugal and Spain) with a per capita GNP of less than 90% of the Community average are eligible for support to infrastructural projects. The Member States Group on Ports and Maritime Transport, set up in the context of the formation of Trans-European-Networks, has developed operational criteria to be fulfilled by these Cohesion Fund countries when submitting port projects. One of the criteria to be satisfied in this context is the use of environment friendly transport modes for project related traffic, with a focus on SSS at the maritime side.

In the Member States Group on Ports and Maritime Transport it was argued that financial support for port infrastructural projects, even within the framework of the Cohesion Fund could lead to distortions of competition, given that the Cohesion Fund leads to funding of, e.g. 85 % of the cost of a project. However a "Formula" was developed, including various criteria, such as each project's financial and/or socio-economic return, the application of which should avoid distortions of competition.

Hence, the E.U. should further stimulate the submission of SSS-related port projects for Cohesion Fund support as this constitutes a unique opportunity to achieve both a stronger economic development and a reduction of negative external effects in the relevant Member States.

It was also suggested that insufficient port infra- and superstructure in various *Baltic states* is responsible for slow SSS-growth. In these nations, support for, e.g. *feasibility studies and port master plans should also be focused on SSS-development with the E.U.*. In meetings with Eastern European countries, E.U. officials should perhaps not try to discourage the growth of road transport networks in these nations, but they should at least focus the attention of public policy makers on the negative external effects associated with road transportation and on the benefits and opportunities associated with SSS. The impact of this policy recommendation is primarily in the area of technical factors that will improve the environmental alternatives of SSS.

3.8 *POLICY RECOMMENDATION 8*: INTERNALIZATION OF EXTERNAL COSTS CREATED BY THE VARIOUS TRANSPORT MODES

The need for internalisation of external costs created by the various transport modes has since long been recognised at the E.U. level. It constitutes a building

block of the White Paper on "The Future Development of the Common Transport Policy: A Global Approach to the Construction of a Community Framework for Sustainable Mobility". The road transportation sector still does not pay fully for the external costs it generates. Unfortunately it is not evident that, e.g. higher fuel taxes would lead to substantial shifts in traffic.

A number of other case studies demonstrated that at present SSS is often not chosen in spite of a lower cost to the shipper as compared to the road mode. In other words, customers are often prepared to pay a higher price for the road mode given its time characteristics, flexibility, reliability, etc.. Hence, in contrast with conventional economic theory, it is suggested here that *the road mode should be regulated in those areas that constitute the major weaknesses of SSS. For example restrictive measures, such as the prohibition of road transport during week-ends may substantially affect the competitive position of SSS, given that its time characteristics constitute one of its major weaknesses, vis-à-vis the road mode. In general terms, the E.U. should act as a driving force to achieve a consensus among Member States as to homogeneous measures aimed to reduce the attractiveness of the road mode, but which are different from mere tax increases.*

3.9 *POLICY RECOMMENDATION 9*: CREATION OF THE "EUROPEAN SSS - PROMOTION SERVICE" (ESPS)

SSS has remained a relatively "unknown" sector for many potential customers and interested parties, especially in the area of general cargo transportation. It is suggested here, that only a new organisational structure would contribute substantially to ameliorating this situation. Hence, the *"European SSS-Promotion Service" (ESPS) should be established as a non-profit organisation*, with 4 main goals:

1. Stimulation of alliances among SSS-operators on specific routes, in terms of both groupage and marketing, in order to improve the total service quality of SSS vis-à-vis other modes;

2. Stimulation of co-operation with other modes in order to improve the intermodal capabilities of SSS, especially in the area of EDI and VTS;

3. Stimulation of innovation, especially in vessel design to overcome existing competitive and technical weaknesses of SSS. This third goal is very important as many SSS-operators and representative organisations are conservative in terms of adopting innovations; this attitude may sometimes be beneficial to the sector as regards, e.g., safety standards, but it is detrimental to the diffusion of innovations. Hence, it is very important that the ESPS should act as a catalyst for the diffusion of knowledge on

innovations among the many conservative and individualistic actors in the SSS-sector;

4. Strategic interaction with public and business level policy makers to implement the general policy measures described in the other sections of this chapter as well as specific policy measures for specific routes. The ESPS could perform a key role in the intra-E.U. coordination of activities related to SSS and act as the main co-ordinating body in this area, see also *Policy Recommendation 10.*

It is proposed here that the board of directors of the ESPS should consist of a representative of DGVII (chair) and representatives of (a) the sector itself; (b) the various E.U.-Member States; (c) (potential) SSS-users; (d) regional branches of the ESPS.

The regional branches could be set up per Member State or SSS-route. In addition, ad hoc commissions could be established to stimulate specific external or internal factors related to SSS. In order to allow an effective functioning of the ESPS, especially as regards continuity in its actions, a Central office should be set up. The Central office of the ESPS should consist of a staff with at least a general manager, an assistant and a secretary. It is suggested here that it could be funded for 50% by the E.U. and 50% by the Member States.

The financing of the regional branches could, e.g. be done for 25% by the E.U. and 75% by the Member States. Given the 4 goals of the ESPS mentioned above, the regional branches should focus primarily on goals 1 and 4. Goal 1 refers to the stimulation of co-operation within the SSS-mode, not to achieve industry collusion, but to strengthen the position of this mode vis-à-vis alternative modes. Goal 4 is related to promoting SSS within specific routes in particular Member States. In principle, the creation of the ESPS could contribute to an improvement of all external and internal factors related to SSS in function of the focus of its activities.

3.10 *POLICY RECOMMENDATION 10*: FORMAL INTRA-E.U. CO-ORDINATION OF SSS-SUPPORT MEASURES

Several projects in favour of SSS are presently being supported by the E.U. However, the danger of fragmentation is high in this respect. For example, in a recent paper, included in N. Wijnolst, C. Peeters and P. Liebman, op. cit. 1993,

an overview was given of a number of E.U. supported projects in the area of coastal shipping and SSS[8].

This overview illustrated the variety of policy initiatives related to SSS. However, it is clear that as the number of these initiatives will increase, espe- cially in the area of research, *formal co-ordination is required to avoid duplica- tion and the development of contradictory policy options.*

Seven major areas of research were identified to be supported by the E.U., where overlapping efforts should be avoided:

1. Research related to SSS-data, as discussed in *Policy Recommendation 1;*

2. Research related to SSS-feasibility studies for specific routes, as dis- cussed in *Policy Recommendation 2;*

3. Research in the area of EDI and Vessel Traffic Control Systems in terms of the requirements discussed in *Policy Recommendation 3;*

4. Research and multidisciplinary evaluations regarding innovative ship types such as the ones discussed in *Policy Recommendation 4;*

5. Research aimed to identify and establish multimodal SSS-terminals in Europe, including inland terminals, as discussed in *Policy Recommendation 6;*

6. Research on potential improvements of port efficiency in Eastern Europe and the Cohesion Fund countries, as suggested in *Policy Recommendation 7;*

7. Research related to an efficient functioning of the European SSS Promo- tion Service (ESPS), the establishment of which was proposed in *Policy Recommendation 9*. More specifically, an operational marketing strategy and marketing plan should be developed for the ESPS. In addition, software should be developed for cost comparisons and investment analysis of SSS-projects.

This policy recommendation will also lead to an amelioration of the situation of SSS as regards all internal and external parameters.

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[8]See M. GARRATT, S. GARSTON, C.G. RABBITTS, W.A.THEOPHILOPOULOS, *History of Com- munity Networks in the UK* in: N.Wijnolst, C. Peeters and P. Liebman, op. *cit.,* 1993.

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4   CONCLUSIONS

The ten policy recommendations to the E.U. formulated in this paper result from in depth research into the internal strengths and weaknesses as well as the external opportunities and threats, which presently characterise SSS in a number of large European corridors.

It is important to realise that these policy recommendations should be adopted in their entirety in order to maximise the effectiveness of European SSS policies. Therefore, it may be appropriate to formulate a *Masterplan for European SSS* at the level of the European Commission. This Masterplan should include all the recommendations discussed in this paper and should address the problems of their implementation in practice. Here, the focus should be on the mobilisation of the required financial, human and other resources and the expected timing of the recommendations' adoption.

INSTITUTIONAL AND SOCIOECONOMIC ISSUES IN GREEK FERRY SERVICES

By S.G. Sturmey, G.Panagakos, H.N. Psaraftis

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INSTITUTIONAL AND SOCIOECONOMIC ISSUES IN GREEK FERRY SERVICES

ABSTRACT

This paper aims at presenting the main issues concerning institutional and socio-economic problems in Greek coastal shipping. In particular, issues concerning the implementation of the EU Regulation on maritime cabotage are given emphasis and discussed throughout the paper. It is seen that many changes will have to take place to harmonise existing national legislation with the new regime that will take place in 2004..

1 INTRODUCTION

As a nation with small mainland and a plethora of islands, Greece depends essentially on its ferry services to maintain its economic, political and social cohesion. Without these ferry services, many of the inhabited islands would become uninhabited. In strictly economic terms, if the services are examined on a route by route basis, their maintenance cannot be justified. However, the route by route basis is not a correct way to examine the situation. The justification for maintaining the services, is based upon the following considerations:

* The economic value of the whole is almost certainly greater than the sum of the values of the parts and the loss to the vacation industry, particularly in social welfare, of the islands which cannot be served economically on a year round basis would be considerable;

* Many of the uneconomic islands are uneconomic because of lack of rational development, not because they are incapable of development;

* The influx of the island populations to Attica would worsen conditions in an already overcrowded area, which is approaching an environmental disaster, and would create economic costs which would be immense; and

* An integrated plan for the development of alternative centres of activity to the Athens/Piraeus agglomeration would also help the presently disadvantaged islands by reducing the transport costs of meeting their needs and rendering their exploitation viable.

The system by which the uneconomic services are supported is ingenious and enables assistance to be given without any state subvention. But:

* The system establishes monopolies in the service of popular islands to the detriment of the quality of service enjoyed;

* The ferry fleet has aged to the point where its ability to continue to serve the islands is becoming a matter of doubt; of the 71 mainline ferries in the fleet, 27 will reach the age of 35 years within the next ten years;

* Current practices are contrary to the letter and spirit of the EU Regulation on liberalising maritime transport, and so must be changed; and

* The dual obligation placed on ferry owners, namely, to serve islands they don't want to serve, and also islands they do want to serve, in accordance with the detailed terms of the Ministry and never in accordance with their own judgements, has held back the proper development of the Greek ferry fleet and leaves it vulnerable to a take-over by non-Greek EU shipping lines.

This paper is a product of a project on Greek coastal shipping sponsored by the Hellenic Industrial Development Bank (ETBA). Complete details can be found in Psaraftis (1993) and in a companion paper to this one (Psaraftis et al, 1994). It is organised as follows. Section 2 presents the institutional framework. Section 3 presents the socio-economic issues. Finally, Section 4 presents a summary of the results and recommendations of this paper

2   INSTITUTIONAL FRAMEWORK

2.1 GREEK LEGISLATION

Basic definitions: The Code of Marine Law defines "coastal" shipping as the transfer of passengers and cargo between Greek ports. Coastal shipping is reserved exclusively for ships flying the Greek flag. Only ships registered in one of the Greek registries can fly the Greek flag. Precondition for such registration is Greek nationality. According to the Code mentioned above, Greek nationality is granted to ships, the majority shares of which are owned by Greek nationals or Greek firms.

Ship types: Greek law defines the following ship types: A ship which can carry more than 12 passengers is a passenger ship. All non-passenger ships are cargo ships. Based on their employment, passenger ships are divided into liners which move passengers between certain ports (on pre-specified lines) and "tourist

ships" which execute round voyages. Tourist ships are further divided into professional tourist ships which move passengers on a freight basis (cruise ships or chartered yachts), and pleasure ships which are non-professional ones. Ships which are specifically designed and constructed for the carriage of vehicles are called "ferry boats". Ferries which in addition can carry more than 12 passengers are called "passenger-car ships", while those which are not "passenger-car ships" are called "cargo-car ships". Furthermore, ferries are divided into those of "closed type" if the entire main deck is covered by super-structure, and those of "open type" if the above condition is not met.

Age limits: With certain exceptions (passenger ships which carry up to 49 passengers and pleasure ships), Greek ships can only be registered as "passenger ships", if at the date of registration their age does not exceed the 20 years. Furthermore, Greek passenger ships are not allowed to serve the coastal liner trades if their age exceeds the limit of 35 years. It should be mentioned that the entry limit to the Greek passenger fleet (20 years) applies to all passenger ships, while the exit limit (35 years) concerns only the liner passenger vessels, meaning that cruise ships or ships employed on the Greece-Italy lines are not subject to the exit limit.

Cabotage: The right to transfer passengers between Greek ports belongs ex-clusively to liner Greek passenger ships. This does not apply to the drivers of professional vehicles, who can be transferred by Greek "cargo-car ships", as well. Direct transfer of passengers between Greek and foreign ports and vice-versa can also be executed by foreign-flag passenger ships, on the basis of reciprocity.
The right to carry cargo between Greek ports belongs exclusively to Greek cargo ships of up to 1,000 G.R.T. This limit does not apply to "cargo-car ships" employed between Greek ports. The use of Greek cargo ships of more than 1,000 G.R.T. is allowed for the carriage of certain commodities in bulk (cement, oil products, ores, etc.). The upper limit of cargo volume which can be carried by Greek passenger ships is 5 tones per shipper. Ships serving "thin lines" and the carriage of vehicles are exempt of this limitation. Direct carriage of cargo between Greek and foreign ports and vice versa can also be executed by for-eign-flag cargo ships (with no limitation on tonnage), on the basis of reciprocity.

Entry into fleet: Shipowners willing to introduce a new vessel in the Greek coastal trade are obliged to place an application for a license (feasibility certifi-cate) with the Ministry of Merchant Marine. Following discussions with the Consultative Committee[1], the Minister decides on the matter within 60 days.

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[1]The Consultative Committee has 7 or 8 members depending on the subject to be discussed and is presided by the General Secretary of the Ministry of Merchant Marine. The Committee is formed by high-rank officers of the administration and a representative of the shipowners' association. The members of the Committee are replaced every year.

Line types: The coastal network consists of a number of lines, which fall into one of the following categories:

Main lines	:	They originate in Piraeus and connect ports in different provinces.
Secondary lines	:	They originate in ports other than Piraeus and connect ports in different provinces.
Local lines	:	They connect ports in the same province. The connections between points of mainland Greece and the opposing islands, as well as the crossings of narrow strips of sea water (narrower than 3 nautical miles) are considered local lines.

Allocation of ships: The passenger-car ships of open type are only employed in sheltered waters and along distances of no more than 10 nautical miles. The minimum tonnage of ships employed on the longer routes of Piraeus-Corfu, Piraeus - Dodecanese, Piraeus-Crete and Piraeus-Chios-Mytilene is 1,700 G.R.T. The minimum required tonnage for the medium-distance connections of Piraeus - Samos and Piraeus-Eastern Cyclades is 1,000 G.R.T.

The allocation of ships to the lines of the network is a complicated process. For the main lines, the process involves the submission of applications by the interested ship operators for either the winter (months November through March), the summer (April through October), or the entire year, and the subsequent approval by the Minister of Merchant Marine (MMM) following discussions with the Consultative Committee. Prior to the submission of applications, the MMM has the right to determine (and he usually does) the following for each season of the year:

* The number and sequence of port calls on each line;
* The required number of round trips per week; and
* The schedules of the voyages.

The number of the ships to be employed on each main line is determined by historical data and projections on passenger and vehicle traffic volumes, the distances involved, as well as any other idiosyncrasy that each line may present.

The selection of ships to be employed on each main line for the winter season or the entire year is based on the technical characteristics (passenger and car capacity, age, speed and ability to call safely at the ports of the line) of the ships, the owners of which have expressed interest. Between ships of similar characteristics, those which have been built or converted by Greek shipyards and those which have been financed by Greek financial institutions are preferred.

If the MMM has not exercised his right to determine the number and sequence of port calls, as well as the required number and scheduling of the round trips on each line, prior to the submission of applications by the ship operators, he maintains the right to modify the schedules proposed by the operators with respect to those matters. Furthermore, he should: (i) avoid simultaneous departures of more than one ships employed on the same line, unless such an arrangement is dictated by specific transport needs, and (ii) make sure that ships remain for at least six hours at the port of origin between consecutive voyages. If this is not possible, the Minister may force ships to spend one night per week at the port of origin.

After the winter season, ships on a yearly contract keep on duty only if the number of idle days during the last winter season was no more than 60 for the annual survey and usual repairs, or 90 for conversion, remodelling or re-engining. If the number of ships meeting this condition is not sufficient to cover the summer needs, additional ships are employed among those which have served the same line during the previous winter season with acceptable number of idle days. If even then the needs are not met, other ships may be employed.

Having in mind the high seasonality of the traffic volumes that characterises the Greek coastal network, restrictions like the one mentioned above aim at securing the provision of adequate transport services during the low-revenue winter season. For the same reason, ships employed during a summer season are obliged to retain their crews hired during the following winter season (with the exception of the 60-90 day immobilisation period), regardless of the winter-time ship employment status.

Similar procedures are followed for the allocation of ships to the secondary and local lines.

A basic characteristic of the way ships are allocated to the lines of the network is the ability of the MMM to determine the ports to be called on each line. In this way, shipowners who are willing to operate their ships between ports with acceptable levels of traffic are now forced to serve additionally and at no cost for the public budget, little islands with very low traffic volumes. In fact, a shipowner who has submitted application for a specific line cannot refuse an approved schedule if the MMM has added up to 2 extra port calls on each direction, and this addition results in an increase of the proposed round-trip distance by up to 10%. For the islands which cannot be served in this way, the law makers have provided a totally different procedure.

Thin lines: An extensive part of the Greek legislation on coastal shipping deals with the "thin lines" (the literal translation from Greek is "infertile lines"). The term concerns lines of very low traffic, which cannot be served profitably by independent operators. According to the Code of Marine Law, the Minister of Merchant Marine (MMM) has the right to sign contracts with Greek ship

operators in order to meet the sea transport needs of the country along "thin lines" by employing Greek passenger or cargo ships on a fixed schedule. The cost of such services is borne by the Greek government. There are three thin line categories: (i) main thin lines, which concern the transport of passengers and/or cargo, (ii) the mail thin lines, which concern the carriage of mail and (iii) the tourist thin lines, which relate to tourist needs. The thin line contracts result from public tenders. Details of the bidding and contacting process for each and every thin line category are determined by relevant ministerial decisions. For each thin line the sequence of the ports to be served, the desired number of round trips per week, the contract period (which cannot be extended beyond 5 years), as well as the technical requirements of the ships to be considered (tonnage, passenger and cargo capacity, speed, e.t.c.) are set prior to the tenders by the MMM, following discussions with the Consultative Committee.

Employment of other ship types: The procedures described above concern the passenger-car ships serving the coastal network. Cargo-car ships are allowed to be employed only after obtaining a relevant license by the MMM, which is issued if the new ship would not seriously affect the economic exploitation of the existing passenger-car and cargo-car ships on the line of interest.

The necessary procedure for the employment of Greek passenger ships between Greek and other Mediterranean ports is much simpler. The only requirement is a written statement to be submitted by the interested shipowner or his authorised agent to the Ministry of Merchant Marine at least 30 days prior to the inauguration of the new service. The statement must contain the detailed schedule of the new service.

Freight rates: Freight rates were set by the Greek legislation as early as in 1926. Since then, the law makers were trying to protect the users of coastal services from possible exploitation by the ship operators by determining upper limits to the freight rates. However, they also determined lower limits to the rates in an effort to protect ship operators from dumping practices. Furthermore, "... any direct or indirect partial or complete refund of the freight rate to the passenger or the shipper in the form of a grant or a commission ..." was considered illegal. Later on, the lower and upper limits to the freight rates were replaced by a single rate. Passenger and cargo rates on the main and secondary lines are determined by the MMM after consultation with the Consultative Committee. On the local lines, freight rates are determined by the local Port Authority and approved by the MMM. These rates are compulsory and any agreement setting higher or lower rates is forbidden. Fares paid on board are higher than the normal ones by 20%. Passenger-car ship operators of the main lines are allowed to offer discounts of up to 20% on the vehicle fares for round trip voyages. The vessel chartering rates of passenger ships are set freely.

Specific discounts are granted to certain categories of passengers and cargoes by ministerial decisions. In fact, shipowners and operators accuse the govern-

ment for making excessive use of that provision. Indicatively, it is mentioned that parliament members and their private cars, members of families with more than 3 children, the students, reporters, military personnel, the Ministry of Merchant Marine personnel, pensioner seamen, athletes, boy scouts, members of theatrical groups, as well as the agricultural products are granted discounts which range from 20 to 100%.

Economic incentives: On the other hand, marine companies owning and operating coastal ships are exempt from any tax, duty or other government fee. In addition, the Greek liner passenger ships are exempt from pilotage charges, and the same is true for Greek cargo ships of less than 1,000 G.R.T. A discount on the light dues is also granted to the Greek liners.

Number of passengers: The highest number of passengers, which can be carried at any given point of time by a passenger ship is determined by the Ministry of Merchant Marine based on the technical specifications of the vessel. High penalties are imposed on owners carrying more passengers than allowed. Exceptions to the rule are only permitted on occasions of extraordinary transport needs (i.e., due to a marine accident or due to massive transfer of voters during election periods). A 1974 law, which is still in force, goes in great length to determine the procedure of passenger number surveillance: "At the port of origin, every intermediate port of calling, and at the port of destination, prior to passenger embarkation/disembarkation, the ship master is obliged to assign a ship officer to every embarkation stairway of the ship who, together with a representative of the local Port Authority, are responsible for counting the disembarked and embarked passengers".

Composition of crew: Crew members are Greek registered seamen and officers holding the appropriate licenses. Crew composition is determined by a series of decrees and ministerial decisions. As a general rule, deck personnel is determined by the gross tonnage of the ship, the engine-room personnel by the total horsepower of the main engines, the radio personnel by the number of passengers and the area of navigation, the administration personnel by the number of passengers, the accommodation personnel by the number of passenger berths, and the kitchen personnel is determined by the ship's gross tonnage.

Technical specifications: As with other ship types, the construction, outfitting, surveys and operation of coastal ships are determined by a number of international and national regulations. Among the international regulations, the avoidance of collision at sea convention, the SOLAS, MARPOL and the loading line and capacity determination conventions, as well as the technical specifications of the various classification societies are indicatively mentioned. There are national regulations on propulsion means, marine outfitting, safety means, fire-fighting equipment, telecommunications, cargo lifting devices, medical supplies, passenger accommodation, crew accommodation, carriage of special cargoes,

shipbuilding, repair and conversion surveys, as well as the annual and periodic ship surveys. It should be mentioned, however, that the only reference to new-technology ships in the Greek legislation is a Presidential Decree of 1981 on the safety regulation of dynamically supported ships.

2.2 MARITIME LAW AND POLICY

As a number of the E.U., Greece is bound by the provisions of formal Regulations issued by the Council of Ministers. These Regulations, therefore, constitute a part of Greek law, breaches of which can lead to action by the Commission of the E.U. Some of these Regulations cover maritime transport. While only one Regulation, that on maritime cabotage, covers coastal shipping directly, the existence of the other instruments dealing with sea transport needs to be noted. In particular, they may be used as precedents in matters concerned with the application of the competition rules to maritime transport.

The Treaty of Rome, which in 1957 established the European Economic Community, contains a section dealing with transport. In one of the articles in this section it is stated: "The Council, acting by means of a unanimous vote, may decide whether, to what extend and by what procedure appropriate provisions might be adopted for sea and air transport". Until 1979, it was thought that sea transport could not be subject to the competition articles of the Treaty (specifically 85, 86 and 87) unless there was a unanimous decision of the Council of Ministers. In 1979 the Court of Justice ruled that the competition articles of the Treaty did apply to maritime transport.

The first Council regulation relating to maritime transport was issued in the same year. This was Council Regulation (EEC) No. 954/79 of 15 May, 1979, concerning the ratification by Member States of, or their accession to, the United Nations Convention on a Code of Conduct for Liner Conferences. This regulation does not affect coastal shipping, but it could cover the Adriatic ferry services between Italy and Greece if these came under the umbrella of a liner conference, or if the Commission perceived that a body akin to a liner conference had become active in the trade.

The preamble to this first Regulation proposed that "... the Commission will accordingly forward to the Council a proposal for a Regulation concerning the application of those rules (that is, those incorporated in the Regulation) to sea transport." (Our bracketed insertion). In fact, four regulations were issued on 22 December, 1986. The numbers and titles of these are:

- 4055/86, applying the principle of freedom to provide services to maritime transport between Member States and between Member States and third countries;

- 4056/86, laying down detailed rules for the application of Articles 85 and 86 of the Treaty to maritime transport;

- 4057/86, on unfair pricing practices in maritime transport; and

- 4058/86, concerning coordinated action to safeguard free access to cargoes in ocean trades.

These four regulations constitute the first part of the common maritime transport policy of the E.U.

These four regulations have been described by the Commission as dealing with the external aspects or shipping. Further measures, it was claimed, would be needed if all aspects of the Union's objectives in the field of maritime transport were to be met. In August, 1989, the Commission proposed a four part programme of what it called positive measures, namely:

* The establishment of a Union ship register (EUROS);
* The improvement of port-state control within the Union;
* A common definition of a Union shipowner; and
* The application of the freedom to provide services to maritime transport within Member States.

It will be noted how the title of the last item in the programme reflects the title of Regulation 4055/86, adopted in 1986. To date, this is the only part of the programme of positive measures to have culminated in a Regulation.

The full title of the Regulation is: Council Regulation (EEC) No 3577/92 applying the principle of freedom to provide services to maritime transport within Member States (maritime cabotage) and it is dated 7 December, 1992.

As is usual, the regulation is in two parts, namely, the preamble and the operative clauses. The preamble contains elements of the historical background, followed by clauses stating objectives to be achieved and generalities on the modalities for their application. Statements in the preamble are non-operational, but what is said there can often provide clues to the interpretation of operational provisions. The preamble is followed by the operational section, that is, the body of the Regulation.

There are two statements in the preamble which are of particular importance to Greece. Both of these are the result of pressures from the European Parliament and are fully reflected in appropriate operational provisions. One statement speaks of implementation being "gradual and not necessarily provided for in a uniform way for all services." The other states that "public services entailing certain rights and obligations for the shipowners concerned may be justified in

order to ensure the adequacy of regular transport services to, from and between islands."

A detailed discussion of the entire Regulation is not necessary. Only articles 1, 4 and 6 should be highlighted here because of their importance to the future of Greek coastal shipping.

Article 1 gives freedom to provide maritime transport services within a Member State to all ships registered in, and flying the flag of, a Member State, EUROS included, as from 1 January, 1993. Article 6, however, grants exemptions from the implementation of the provisions of the regulation for certain countries. For reasons of socio-economic cohesion, the derogation[2] for Greece are:

* For cruise services, until 1 January, 1995;
* For transport of strategic goods (oil, oil products and drinking water), until 1 January, 1997;
* Regular passenger and ferry services, until 1 January 1999; and
* For island cabotage and services by ships of less than 650 GRT, until 1 January, 2004.

Article 4 provides that a Member State "may conclude public service contracts with or impose public service obligations as a condition for the provision of services on shipping companies participating in regular services to, from and between islands". Such public service contracts shall be made on a non-discriminatory basis in respect of all Community shipowners. Taking article 4 in its entirety, all possible protection is provided for the maintenance of the Government policy of ensuring the provision of year round services to the islands for reasons of both social justice and territorial integrity.

3   SOCIOECONOMIC ISSUES

As stated earlier, for reasons "of socio-economic cohesion", a deferral of the full application of Council Regulation No. 3577/92 has been accorded to Greece until 1 January, 2004 "for regular passenger and ferry services and services provided by vessels less than 650 GRT". The ferry services, which are the concern of this part of the paper, are like Damocles. Unless the unimaginable happens and Greece should leave the Common Market, the sword will fall on schedule. Whether, in its fall it will kill the industry or whether it will simply make some noise as it hits the steel helmets of protection the industry has forged for itself, depends on Greece. The EU has given Greece eleven years, of

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[2]The use of the word "derogation", in the sense is is used in the Regulation, is akward in English and betrays the original language of the text. In fact, there is no equivalent word in English; we will use the word defarral

which one has already passed, to prepare itself in defence against the falling sword.

3.1 HOW THE SHIPPING OF OTHER MEMBER STATES MIGHT REACT

No attempt will be made to forecast in quantitative terms the extent to which the shipping of other Member States will invade Greek waters in 2004. The extent of this invasion will depend on two factors, the relative importance of which is difficult, if not impossible, to forecast.

The first factor is the extent of preparedness of the Greek ferry services to meet the challenges which may arise. This is a matter which is partly in the hands of shipowners themselves, but it is also a matter which depends very much on Government and the relevant ministry, the Ministry of Merchant Marine. What needs to be done in Greece will be covered in Section 3.2 of this paper.

This will do little to enable the possible level of preparedness to be forecast. One can state the obvious now: the better prepared Greece, at all levels, is to meet the competition, the less likely are other shipowners to take the risk of a major invasion; the lower the standard of preparedness, the more it will be seen as providing easily grasped spoils.

The second factor is that before 2004 the Channel Tunnel will have opened and experienced ten years, more or less, of operations. Any present forecast of the number of ferries which will displaced and whether they will have found alternative employment before 2004 must be guesswork. The more ferries there are laid up looking for work in 2003, the greater the competition will be to Greek ferries in 2004. There is a small rider to this, which will be mentioned later in this part of the paper under the sub-heading "Influx of capital".

For various reasons, the experience of other European countries which opened their coastal shipping to foreign tonnage, in advance of the Regulation, does not provide much help in trying to make a quantitative analysis because the geographical circumstances of countries are so different. In Britain there are some comparable routes, but the routes do not make up a system and there is no overall regulatory authority as in Greece. There is also a dearth of data. Unfortunately, the main source upon which we relied for our non-quantitative tentative conclusions remains confidential (November 1993) and cannot be cited.

The tentative conclusions which have been drawn from such statistical data as could be found and the impressionistic evidence gathered from diverse sources are:

* Inferiority of ships or the standard of service provided act as a direct incentive to the entry of competition;

* It is more likely to be the top end, rather than the bottom end, of the passenger market which will attract competition from the shipping of other Member States, although the trend in the Greek market towards dual purpose ships serving both public and service operations and island vacation services will blur the distinction; and

* Shipowners of other Member States are likely to be sensitive to what seem to be unexploited opportunities.

Concerning the first conclusion, the fate of the Swansea and Cork Lines and the replacement of their unsatisfactory ship by a Strintzis vessel is well documented. High speed, new technology ferries can increase traffic on a route, something which EU shipowners, contemplating entry to Greek trades, will not ignore. During its first seven months of operation, the catamaran SeaCat Scotland carried 330.000 passengers and 75.000 cars on the Stranraer/Belfast route, nearly double the predicted volumes.

Within the existing system there are at least two possible unexploited opportunities which are likely to be exploited in attempts to by-pass crowded Piraeus. One might be more inter-island services, with co-ordinated connections between new technology ships and feeder ships taking passengers and cars to other islands, receiving imports directly from abroad and serving near islands: Crete springs directly to mind in this connection. The second unexploited opportunity is very near to the alternative mentioned to the inter-island services. This would be the establishment of fast direct services between some of the larger island and the north of Greece, particularly Thessaloniki. A Greek line did pioneer this during the 1980's.

In Greece, the industry is regulated in order to achieve the objective of ensuring year round services to all the inhabited island which are part of the nation.[3] A number of these islands generate enough year round trade that shipowners want to provide services to them; others generate so little trade that shipowners, if they were considering their own commercial interests, would not assume the obligation of providing a service. The Ministry, in order to avoid any charge to the national budget in subsidies to induce owners to provide the commercially unattractive services, has very neatly linked the right to serve the attractive trades with the obligation to serve the unattractive trades, this coupled with

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[3]On all matters related to the system of regulation practiced by the Ministry, the reader will find additional information in two other publications, namely, S.G. Sturmey *Ring in the changes*, Naftiliaki, no. 1022, Summer 1993, pp 25-31 and Greek Sea Bridges by Katerina and Stanley Sturmey, Athens, December 1993, pp 2-12.

exemption from income taxation on the profits earned. Thus, the industry has developed in a completely non-competitive structure. Both the Ministry and the industry face fundamental changes in their actions and thoughts. Some sections of the industry are struggling against the imposed strait-jacket; other sections have adapted themselves to it so fully that they cannot imagine any more comfortable dress.

When the sword falls, it will be the coastal passenger and vehicle carrying ferries on which it will fall. It is these which are most likely to attract the attention of shipowners from other Member States. Just like Greek shipowners, they will be unwilling operators in the unattractive trades, but for various reasons they may find themselves willing to accept the burden of these in return for a presence in the attractive trades. The Ministry will no longer be able to make the overt linkage, as at present. But it will be able to provide inducements to shipowners to undertake the unattractive services, although it will be unable to cast a non-competitive net over all, as at present.

It seems possible that some are thinking that other Europeans will be deterred from entering the existing cabotage services because of their over-regulated state. This is unlikely; the EU will understand that if the system of regulation is not changed, Greece will be in breach of the Regulation, even if goes out of its way to invite competition. In practice, however, there are four reasons why shipowners in other member States, desirous of entering the cabotage services, may be interested in the public service routes, since the inducements offered to shipowners to serve these routes must be offered on a non-discriminatory basis. These reasons are:

* All year round employment of their ships;

* The operating economy of serving a poor island where it can be done without diversion from a route serving rich islands;

* To obtain operating slots in ports where the number of slots is limited; and

* The increasing emphasis on a dual role for ferries.

There are relevant comments to make on each of these points.

Year round employment

Year round employment will not necessarily be sought by other European operators. Some European owned catamarans go as far afield as Australia to find profitable employment in the northern winter. It is difficult to see how the Ministry could expect, or insist, that all ferries remain in Greek waters all the year. One possibility which has to be provided for is vacation season only operators, whether Greek or others.

On the other hand, owners may not want to send their ferries abroad for the slack season, or the ferries may not be suitable for such a transfer. If such ferries are not participating in the public service activities, then the chance of making a profit over the year would be seriously restricted. It would seem reasonable that the Ministry should issue public service contracts to interested shipowners only for the number of ships required to meet public service needs. The contract would specify frequency of sailings, characteristics of ships and so on, according to year round need, but should not be for specified ships. An owner would then have the possibility of using a large ferry to meet public service and vacations needs in the summer, with a smaller ferry to meet public service needs only in the winter, so long as the contractual terms are met.

It is worth nothing here that the present system does not guarantee that public service needs are always adequately met. There were complaints from other islands during the 1993 summer. If the obligations to provide these services are in the form of clear contracts between shipowners and the Ministry, the owner would have the possibility of bringing in another ship, perhaps chartered from another owner when, for any reason he is short of tonnage to fulfil his contractual obligations. He would also have the incentive to do this since he could feel sure that, in the face of a failure, he could lose the contract and the port slots granted to him.

Operational economy

In the pursuit of operational economy, a great deal of initiative should be left to shipowners. In preparing the ground for this, the Ministry, in consultation with representatives of the ferry owners, would need to identify the islands coming into the public service category. These are the islands, the obligation to serve which no owner, if he were considering his own commercial interest, would assume on a year round basis. Having identified the islands concerned, the Ministry would need to define the extent of, and the conditions deemed necessary for, a service which would ensure the continued viability of those islands. The definition would include matters such as the maximum fares for standard class accommodation and the charges for carrying vehicles, which the inhabitants of each island could be expected to bear, the frequency of service needed and a reasonable duration of the voyage each way.

On the basis of this identification and definition, calls for offers to undertake these services would be made to ferry owners, both Greek and non-Greek. Shipowners interested would then make offers to serve some of these islands, which offers should specify the compensation demanded. This could be in the form of an annual fee paid by the Government for providing the service, which is what the Regulation has in mind. But the Government is unlikely to be ready for such a deal and would probably be thinking of compensation in the form of guaranteed traffic rights in terms of the award of suitable slots - see below - on attractive routes would be served in the course of serving unattractive islands.

The call for offers would be competitive, with both Greek and foreign lines having the right to tender. There would also be competition outside the range of the public service requirement.

One could well imagine an owner concluding a contract under which he might use several ships to maintain the conditions of the contract. Each contract would impose an obligation and grant rights. The competition would be in the rights. There would be no obligation on an owner to take up his rights, and no guarantee that if he failed to attract an economic volume of traffic he would be protected. He would have a slot, which no other owner could use, except by delegation from the owner with the right. The rights would cover the use of a slot on the attractive island, but no guaranteed volume of traffic; the obligation at the public service island would also cover the use of a slot, with the obligation to use it and a guaranteed minimum of traffic.

The current system of licensing of routes militates against the use of new technology ships. For economic operation, these ships need high load factors and minimum time in port. Such ships are unlikely to have any place in winter operations. In the summer, however, an owner with a public service contract and obligations, with slots at attractive islands on the route, might use high technology ships to fulfil his obligations. In the summer, both ships may call at the attractive ports, but in the winter only conventional ships would be used.

The present system, despite its theoretical neatness, in fact gets the worst of two worlds in the sense that owners are subject to all the restrictions of a regulated system and a good deal of the lack of certainty of an unregulated system. Under the Regulation, only the fulfilling of the public service obligations can be regulated by contract; a contract can oblige a shipowner to make a certain number of calls each week throughout the year at Folegandros (a low traffic island) and the right to make additional calls if he finds it profitable. It can, as an induce, grant him rights to make calls at Santorini (a high traffic island) and grant him slots there at times arranged in relation to his calls at Folegandros, but it cannot oblige him to make use of all his rights at Santorini. In the summer it might even be that he would choose to use a new technology ship to call at both islands on some days of the week, but in the winter he would lay-up or send the new technology ship elsewhere.

Operating slots

An analogy with aviation is inescapable. Even in a fully unrestricted airline system, the capacity of airports, flight control systems, noise and pollution considerations control the number of flights, the type of aircraft, the hours of operations and even the conditions of take-off and landing at most airports in the world. A number of slots are available each day and each airline wishing to make calls at airport X has to co-ordinate its services with the availability of slots throughout its route.

Institutional and Socioeconomic Issues in Greek Ferry Services

Within the Greek ferry system, there are severe capacity and environmental problems at a number of mainland and island ports. It is essential that a detailed survey of each port be made. It is not enough that the berthing capacity is sufficient to handle all the ships which may wish to make calls. The survey has to look at the urban factors on the landward side of each port and the quality of life for the residents as well as the physical capacity of roads to handle extra traffic.

In 2004, an increase in the number of ships wanting to use the ports must be expected and arrangements must be made to determine the number of slots which can be made available during each 24 hour period, taking into account all factors. Certain ports are clearly at saturation point in one or other aspect of their physical or environmental conditions. The three major mainland ports in the ferry system, Igoumenitsa, Patra and Piraeus have clearly reached capacity in one or more of their aspects; indeed all three are operating beyond capacity in important aspects. In two cases, further expansion of the ports is not to be contemplated and alternatives are needed; both Lavrio and Rafina are under-utilised. Flisvos may be able to handle ferries carrying only passengers and cars, for example high technology ships. The building of the Rio/Antirio bridge should permit the spreading of a lot of the Patra load to Rio.

Strictness in the use of slots would be needed and permits to use particular slots should be based on a realistic assessment of the sea speed, the loading and unloading times and the time needed to manoeuvre ferries to ensure that they can be punctual in berthing and departing and so do not block the next time slot. Some of the problems in this connection arise because ferries are licensed to carry too many vehicles, so that time is wasted trying to coax the last few vehicles into the available space. Watching loading and unloading operations, it is clear that some ships, even some lines, handle passengers and vehicles much more slowly than others. Many of the ships are unable to maintain their accredited speeds which are still listed as they were on their maiden voyages thirty years ago. It seems also, that schedules are based on a quay to quay distance divided by the accredited service speed, without count of the time taken to clear and enter port and the time to work up to service speed once outside the port.

Another striking point in watching ferry operations in ports, is the skill with which captains can put their ships into small spaces, quickly and without scratching any paintwork. But no matter how skilful they are, the smaller the space in relation to the size of the ship, the slower the operation; in saying this, however, it needs to be recognised that the newer, or recently refitted, ships have more gadgets which increase their handiness compared with smaller and older ships. Despite all this, the new style ferries, that is, those which are conventional in general shape, hull form and propulsion, but more built up than the traditional ferries to provide better facilities for vacation travellers, because of their greater area of superstructure are very much more affected by wind than

are the lower built ships. Many islands in Greece are very windy many days of the year. Manoeuvring times are, therefore, often much greater for these ferries than for the older ones. This needs to be taken into account in fixing the slots.

Dual role

Originally, ferries entered the island trades to meet the needs of islanders. This is still their basic function and it is essential that the entry into force of the cabotage regulation does nothing to impede the continued fulfilment of this function. As the vacation demand for travel increased, additional passengers were shoe-horned into the available space of existing ferries. Vacation travel was seen as the Cinderella. If people really insisted on travelling, despite the conditions, the ferries would carry them, but specific provisions were rarely made. This situation has persisted to this day in Ministry policies and in the attitude of many ferry owners; a good example of this is that something so basic as being able to make a return reservation at the time of commencing a journey is still impossible. On the side of the ferry owners, change arrived in 1987 by the entry into service of a ship which had been reconstructed in accordance with a philosophy that the Procrustean system of fitting people to the size of the available beds was out-moded and that travel within Greek system could be an enjoyable experience, not a part of a preparation for eventual martyrdom.

In the years of 1987 through 1993, 30 regular passenger and vehicle ferries of 1.500 GRT and over joined the ferry fleet. Of these, 23 were new style ships catering for both the public service routes and the vacation needs of Greek and foreign vacationers. These ships are bigger, more luxurious and, in general, faster than the conventional ferries. It is essential that their characteristics be recognised and they be given the freedom to exploit the facilities they provide, so long as public service needs are not ignored. It may be expected that ships owned in other Member States of the Union which do try to compete in Greek waters will be akin to these 23 ships and any attempt to deny them the freedom to compete, even if Greek owned ships are being treated in a parallel fashion, will evoke charges of discrimination which would prove very difficult to disprove.

At this point it is useful to summarise what is the job of the MMM in relation to the cabotage services. There are three aspects of it. First, it must ensure that the inhabited islands are properly served and that the ship owner is able to make a reasonable profit in doing so, unless it can be shown that his failure is due to faults on his side. Second, it must ensure that through the allocation of operating slots the number of ships permitted to use each port does not exceed either the physical or environmental capacity of the port. Third, it is not the job of MMM to endure that all shipowners make a profit, nor to interfere in any way in their operations outside the public service sector, although they must retain the right to expel sub-standard ships from the service, to penalise owners the ships

of which are non-punctual in entering or leaving their slots and to prosecute ships which cause pollution.

Influx of capital

The arguments developed above are based on the assumption that the liberalisation of Greek cabotage trades will lead to shipowners in other Member States of the Union putting some of their ships to compete in the opened trades. They might, however, react in another way by seeking to establish an ownership basis in Greece by purchasing all or part of some Greek coastal shipping companies. If a Greek company owns a ship, the ship is Greek. But how much of the capital of the company must be held by Greek nationals?

At the present time, with a fleet the average age of which is over 25 years, the ferry industry does not appear immediately as being in a healthy state. Many of the companies, unless they are sitting on large cash reserves, must have a relatively low capital value. With uncertainty regarding the future, the value of the goodwill must also be low. Such companies could present attractive targets for take over by other shipowners who could use the base thus acquired to launch a large scale entry into the de-restricted industry. When 2004 arrives it could then be found that the "Greekness" of shipping companies operating in the public service sector is illusory, that they are Greek shells, filled with non-Greek management and money.

The sort of trans-national companies which would be created by these purchases were once highly regarded as being a means by which management skills and technology would be transferred from richer to poor countries, while broadening the employment base in the latter. Later, however, when it was found that all important decisions were taken by the richer partner and exclusively in relation to his interests, the enthusiasm for such operations cooled considerably. It would be an unhappy day for Greece, if an activity as vital to the nation as the maintenance of the sea bridges should become a secondary consideration of non-Greek interests controlling an important Greek ship operating company who might decide that to invest in a Ruritanian-flagged gambling ship offered a better corporate return than the replacement of an over-aged ferry. They might even decide to transfer the ship to the open Ruritanian flag and have her convert into a gambling ship, without her being over-age.

The message is that it would be easier to deal substantively with a real Greek shipping company, or a real foreign shipping company, than with a half-and-half. The fact that the trans-national shell might have a prestigious panel of Greek directors, does not alter the fact that in business power resides in the money bags.

3.2 HOW GREEK SHIPPING SHOULD REACT

There is a basic difference between Greek ferry operations and those in other Member States of the EU. This is reflected in the contents of two of the sections of this paper. **Section 3.1**, dealing with the reactions of shipping in Member States, is about shipping as an economic activity. Shipping is also an economic activity in Greece, but in talking about reactions in Greece, one has to talk about bureaucrats and politicians. Shipping in **Section 3.1** works within an overall framework of rules, but within those rules it has freedom of action. Shipping in **Section 3.2** also works within a framework of rules but, in addition, there are sets of regulations which leave the shipowner with little economic freedom.

How the parties should react to be well placed in 2004, depends on their starting point, that is, the 1993 status. Two points are to be noted in this regard.

The first point is the anxiety of the drafters of the Regulation that the process of liberalisation should be orderly. This is perhaps less apparent in the final text of the Regulation than in the preparatory and explanatory notes which were made, and in the Resolution of the European Parliament on the matter. They were very conscious that, both legislatively and operationally, because of the difference in the level of development, securing the necessary harmonisation would be more difficult for Greece than for other countries, with a greater risk of creating serious disturbances in the internal transport market. Harmonization was the key word: liberalisation and harmonisation are two processes that have to go hand in hand. The deferral accorded to Greece was specifically to enable Greece to achieve the needed harmonisation.

The second point is that, within the unwavering belief in the need to establish a competitive system with full and non-discriminatory access to the shipping of other Member States, the public service need was recognised as well as the institution of compensation to shipowners for undertaking commitments which, if they were considering their own commercial interests, they would not assume.

The system of regulation practised by the Ministry has already been described. Here, it is only necessary to look briefly at certain effects of the system and to its overall consistency with the principles of the Regulation.

The first effect to note is the age structure of the ferry fleet. This is shown in **Table I** covering the 71 mainline ferries of 1,500 GRT and over in mid-1993. New technology ships are not included.

Unless a special waiver is granted, a vessel cannot remain in the fleet beyond the age of 35 years. Within the next ten years 27 ships, 38% of the fleet will become due for replacement, including two which reached 35 years in 1993.

Type of ferry	No.	0-14yrs No. %		15-19yrs No. %		20-24 yrs No. %		25-29 yrs No. %		30-35 yrs No. %	
Traditional	48	2	4	5	10	14	29	18	37	9	19
New style	23	2	9	7	30	14	61	-	-	-	-
Total	71	4	6	12	17	28	39	18	25	9	13

Table I

Obviously, shipowners are going to look to the Ministry, for indications of its future policy, before they commit themselves to the investment needed.

Between 1981 and 1990, the average age of vessels in the coastal fleet increased from 14,5 years to 21 years; a recent study gives the average age at the end of 1992 as 25 years. These figures apparently relate to the total coastal fleet of over 400 vessels. For the mainline ferries the situation is less unfavourable than for the total fleet; at mid 1993 the average age was 23 years. The adverse age structure strongly suggest that the policy pursued by the Ministry has placed due burdens on ship operators in serving public interest routes.

In this respect, the present situation is precarious. That the industry has survived at all is largely due to the lack of attractive investment opportunities. It is evident that the fleet is in desperate need of new investment. The task of the Ministry is to design a policy which protects the interests of island populations, is compatible with the Regulation, and permits to shipowners serving those public interests to make profits at an adequate level.

One other aspect of the overall policy which needs to be examined is the compulsory retirement age of 35 years. Obviously, all ships in the cabotage trades, whether Greek of foreign, must be safe and must be capable of maintaining the sea speeds and cargo and passenger handling rates needed to enable them to respect the time slots allocated to them. Given the conditions on all routes, a well constructed and properly maintained ship should have a safe, and economically viable life, of more than 35 years. Provided the inspection services are efficient and honest, and so can be relied upon to weed out ships which, whatever their age, are not up to a standard, there seems no reason to impose an arbitrary limit. Shipowners, themselves, will quickly dispose of a ship which is not economically viable because the costs of maintaining it to standard are too high.

In view of the number of ships due to be replaced before 2004, and bearing in mind that some of those which will not then have arrived at the age limit will need replacing because they can no longer maintain their classification, it is urgent that the Ministry determine the lines of its new policy so that owners can make rational decisions on fleet replacement and not be tempted to sell out, if they receive what appears to be a suitable offer. Until the Ministry clarifies future policy, it is not possible for owners to make a fair assessment of the present long term value of their enterprises.

Another cause for concern is that the device used to harness the profit motive to provision of a public service is contrary to the principles of the new Regulation. The device consists of limiting the competition on popular routes, by the creation of a quasi-monopolistic situation on each, in order to ensure their profitability, which provides the essential carrots for shipowners to accept the public service obligations. The system has proved incapable of handling new technology ferries and is in trouble dealing with the new type of generally larger ships built with the vacation market in view. As long as there were few of these ships, the problem could be handled. But now that one third of the main line ferries of over 1,500 GRT are in this category, the problem cannot be ignored.

The situation in the services to Ancona from Patra and Igoumenitsa is striking. During the period June through August 1993, 36 ships were operating on the route, of which 34 are Greek owned, but only 14 were Greek flagged; the other two are Italian vessels. The 20 Greek owned ships which are not Greek flagged consist of the majority of the vessels specially equipped for the sea bridge service, transporting lorries which formerly use land transport through Albania and Yugoslavia.

The concept of public service in the industry, as it is at present apparently defined by the Ministry, will need to be modified to bring it into accord with the provisions of the Regulation. It is clearly envisaged in the Regulation that shipowners who accept the obligations of providing such services may be compensated. The character of the present system has been sufficiently touched upon in **Section 3.1**, that there is no need to repeat it. The real questions to be faced: Since the shipowner is only permitted to serve the islands he would like to serve, under conditions he does not choose, does this bring all the cabotage ferry services under the umbrella of public service obligations as set out in the Regulation? Is it, therefore, compatible with the Regulation that competition occurs only at the point when licenses are awarded and that thereafter market shares will continue to be determined by the Ministry? It is obvious that the answer to both questions must be "No".

The present licensing system needs to be fundamentally changed, even scrapped, if the industry is to be able to meet the challenge of 2004 and it need to be changed soon. It must allow shipowners the time to make decisions about their future planning and to find and put into service any new ships which they

might decide are necessary to ensure their competitiveness. It must, also, allow experience to be gained in the operation of the new system so that any glitches in it can be ironed out before everyone is actively engaged in meeting the challenges which 2004 is likely to present. Before 2004, both legislatively and operationally, the Greek system has to be harmonised so effectively that it will be other shipowners, not the Greek, who will find it difficult to compete.

There are other activities which it is essential to carry out within the next few years. One of these, the survey of ports, both mainland and island, to determine the number of operational slots available, has already been covered.

Another activity which is important for the Ministry to make a clear survey of the vessel capacity needed to handle the true public service trades as defined by the Regulation; the definition is "obligations which the ... shipowners in question, if he were considering his own commercial interest, would not assume or would not assume to the same extent or under the same conditions". Once the dimensions of the need are known, a policy for meeting it can be developed. This survey should cover:

* Acceptable frequency of service for each island;

* Acceptable capacity, speed and voyage duration of the service; and

* The existence of viable alternatives which could be used in emergence situations.

The real function of these public service operations must always be kept in the centre of the picture, namely, the maintenance of the economic, political and social cohesion of the nation.

The essential task of the shipowners is to ensure that the quality of service offered is as high as is possible. This does not mean luxury, but attention to the complaints which are voiced by ferry users regarding non-punctuality, the poor quality of most ferry food, the lack of attention to the maintenance of facilities used by passengers, the impossibly long itineraries of the "milk run" ships with calls as eight or even ten ports, so that relatively short journeys take hour upon hour to complete, and the impossibility of booking return passages. It seems unbelievable that at a small airline ticket agency one can book a round the world service, whereas on the ferries one cannot book a return passage, or a passage with more than one stage.

The industry as a whole seems unresponsive to the needs of passengers and of the lorries carrying freight, and to their complaints. If this "take-it-or-leave-it" attitude does not change, the perception of European ship owners will be that they can come in and quickly establish their supremacy. The regulatory system is rightly criticised by most shipowners. But they must come to terms with the

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fact that the system is overprotective of them all, and while choking them with skimmed milk, ensures that none of their colleagues get any cream. Once the cabotage restrictions are lifted, the cream will be available to be fought for. To be able to succeed in even joining in the great cream scramble, the shipowners must, to revert to our original analogy, have provided themselves with protective headgear against the sword which will fall on 1 January, 2004. There will be no hand-outs of cream.

4 SUMMARY

This summary will set out what the Ministry has to do, and when, in the preparations for the entry into force of the EU Regulation. It must always be borne in mind that the survival of the Greek ferry fleet is neither the first, nor even the second concern in Brussels. Eleven years were given for the preparations and it must be expected that, if all is not ready, the attitude of the EU will be unsympathetic. What is needed form the Ministry is:

* A clearly defined and thought out policy, announced before the end of 1996, setting out the parameters proposed for a competitive system for the post 2003 period;

* A clear definition, before the end of 1998, of the fleet needed to maintain the public service operations and the arrangements proposed to secure the continued undertaking and profitability of these operations;

* Agreed and clear figures, announced before the end of 2000, of the intended capacity of each port and its facilities and equipment in, say, the year 2003; capacity to be expressed in terms of the number and duration of the time slots which will be available during the operational hours of each day; and

* The definition and announcement before the end of 2001 of the procedure which will be adopted in calling for bids from European and Greek operators for providing public interest and free market services, taking into account the announced competition policy.

Given that these matters, although essentially political in nature, concern the whole national economy of the future and that there will be two, or possibly more, general elections before the Regulation enters into force, it is essential that these policy decisions be taken in a national context and that the policies presented are based on a consensus between the main political parties, the coastal shipowners associations and the trade unions and other organisations concerned.

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UK ROADS TO WATER INITIATIVE:
A FOCUSING STUDY

By J.L. Packer

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UK ROADS TO WATER INITIATIVE:
A FOCUSING STUDY

This paper draws upon a study undertaken on behalf of and paid for by the Department of Transport. The results of that work are the property of the Department of Transport which has granted permission for publication of this paper.

The views expressed in this paper are the author's and may not necessarily reflect those of the Department of Transport.

1   INTRODUCTION

The UK Department of Transport, in July 1991, held an industry seminar on the subject of encouraging the use of water transport, where feasible, for moving freight in preference to road. This initiative was part of Ministers' overall commitment to support the use of more environmentally-friendly modes of transport.

The seminar recommended that the Department investigate the scope for further research designed to assess the feasibility or otherwise of encouraging more use of the water mode. This focusing study was commissioned as the first research project and the practical way of moving forward from the seminar.

The objective for this outline study was "to target productive areas for initiatives and for further research into the potential for short sea, coastal and inland shipping, for both the Government and commercial interests". The study was to identify where water could be competitive for internal UK movements and where there could be scope for reducing or eliminating the road transport element of external movements by encouragement of greater use of regional port facilities.

The study is a basis for focusing the discussion on the next steps, on the policy options and on the actions to be taken by the various parties including research in depth into the target productive areas.

2   THE STUDY METHODOLOGY

The work was carried out using a wide range of published and unpublished sources and in consultation with a range of interests in the shipping, freight and port industries. The study was in three parts, the statistical analysis, cost modelling and the opinion survey.

2.1 THE STATISTICAL ANALYSIS

Internal UK traffic flows: the prime source was the Department's Transport of Goods by Road, the annual report of the Continuing Survey of Road Goods Transport; the small statistical sample limited the analysis that could be undertaken but more detailed probing of the survey data ascertained the broad flows between the eleven economic regions by commodity groups. More comprehensive unpublished statistics for rail traffic flows were available from the Department. Coastal shipping flows, true coastal movements between ports on the GB mainland, were determined using UK Port Statistics and other information. The results of the statistical analysis were checked during the interview survey and by specific commodity and industry studies. A detailed study was undertaken of UK petroleum product distribution by pipeline, road, rail and coastal shipping.

External UK traffic flows: the prime sources were UK Port Statistics and the Department's 1991 Survey of Origins, Destinations and Transport of UK International Trade. This latter survey enabled analysis to be undertaken of traffic routings by shipment mode for unit load traffic between the UK and Europe. Careful interpretation was required because of the limited 2% sample. The survey proved to be less useful for distributed semi-bulk traffic but a good picture was obtained by augmenting the data with some specific commodity studies for steels, wood products, animal feeds, grains, etc.

2.2 COST MODELLING

Cost models were developed to test the competitiveness of the water option and the alternative traffic routings within the target areas identified by the statistical analysis. The cost comparisons were made under current cost relativities and external environmental conditions. Analysis was subsequently undertaken at the margin to examine the relativity between the different cost elements in the transport chain and the factors which might change the relationships. Cost structures were developed for:

* Road haulage: articulated bulk tip trucks and unit load articulated trailers;
* Port and terminal costs;
* Short sea unit load container and RoRo, and short sea bulk ships: by type, size, speed, distance, market or built up capital costs splitting into the at sea cost and the port interface cost (including ship time in port).

The cost models studied included:

* Coastal bulk versus road haulage direct, with/without a local road delivery;

* Bulk and semi-bulk traffic to/from Western Britain versus shipping through an East Coast port and trucking across;

* Unit load "coastal highways", particularly Scotland-South East England with various levels of cargo imbalance, frequency, volume etc.

* Continent-UK by alternative routings for container and trailer traffic for various origins and destinations, but concentrating on northern UK traffic.

2.3 OPINION SURVEY

Interviews were conducted with senior management in companies representing shipowners and unit load operators, port operators, inland haulage companies and shippers and importers. The interviews provided a survey of opinions as to the potential for water, many of which are incorporated in the conclusions (see 5.0). They also provided a practical check on the figures in the traffic flow analysis, the cost models and the specific commodity studies.

3   GENERAL OVERVIEW OF THE FREIGHT MARKET IN THE UK AND ROADS TO WATER POTENTIAL - see Table I

3.1 INTERNAL FREIGHT

The growth of road freight has been particularly marked in Great Britain increasing from about 100 billion tonne kilometres in 1979 to just over 130 bt/km and 1505m tonnes in 1991. Improved road freight efficiency has brought about changes to distribution systems and heightened expectations about cost competitiveness and service quality (flexibility, speed and reliability). Moreover, a high proportion of total inland freight movements are concentrated within a central triangle of London-Teesside-Liverpool - distances of no greater than 400 km (250 miles). Relatively few road journeys are over 4 hours. Even Scotland to London can be achieved in 8 hours giving overnight delivery. These are distances (and times) at which shipping cannot normally compete other than for non-time sensitive freight such as warehouse movements (where still in existence) and low value bulk cargoes. The only significant true coastal movements remaining are of petroleum products, stone and coal where large movements are matched with coastal sources and coastal delivery.

3.2 EXTERNAL FREIGHT TRAFFIC

Unit load and dry bulk traffic through UK ports totalled 166m tonnes in 1991. Unit load was 58mt of which 45mt was short sea with Europe. Dry bulk was 108mt of which some 50% was distributed and collected bulks, moving internally throughout the UK and thus major road users. Routing is determined as much by considerations of relative service quality and transit time as by relative transport costs. As a result, much unit load and higher value semi-bulk traffic is carried over longer land routes rather than taking a sea route to a port closer to the point of origin or destination.

3.3 POTENTIAL ROADS TO WATER TARGET AREAS

The study's analysis shows that potentially the most productive areas for roads to water targeting would be:

* The protection of existing coastal distribution traffic (31 million tonnes a year, 75% oil product) from the threat of further conversion to road;

* The identification of long haul internal traffic which can be converted to water under marginally changed conditions;

* The re-routing of external traffic with the Continent, Eire and Northern Ireland, through ports closer to the points of origin and destination of the traffic. This requires that the shipping connections to these ports are competitive in cost and quality of service terms;

* The identification and implementation of measures to reduce the effect of high costs at the port interface.

An order of magnitude assessment of the possible roads to water conversion potential to target is shown in **Table I**. These are theoretical figures to show the maximum potential and some conversions are more feasible at today's costs than others. A conversion target of up to 3.5% of existing internal road traffic tonne-kilometres might be possible, and this will be mainly long haul road traffic. The percentage may appear to be small but this is a considerable volume of traffic and well worth targeting.

4 SOME PARTICULAR RESULTS OF THE STUDY

The study contained much detailed analysis. It is only possible to cover some of the broad results in this paper:

INTERNAL 1991	MTonnes	300km	Over 450km	%Tonne-kms
Road	1505	83	20	78.4%
Rail	136	14	4	9.6%
True Coastal Shipping	31	20	14	9.4%
Pipeline + Waterway	31	-	-	2.6%
				100.0%

EXTERNAL (Imports + Exports = 75% with Europe)

	MTonnes	
Unit Load	58	
Distributed Dry Bulk	52	(50% of total dry bulk)

ORDER OF MAGNITUDE SAVINGS TO TARGET

	Mtonnes	% of road traffic Tonne-kms
Internal Traffic:		
"Coastal Highway"	2	1.0%
Coastal Bulk	3	0.8%
Re-Routeing External Traffic:		
- Continent	6	1.2%
- Ireland	3	0.5%
		3.5%

Table I: Great Britain freight market overview

* It is evident from **Table I** that coastal shipping will have to penetrate much further into longer haul road movements to have a significant effect on levels of internal road traffic. However only 14m tonnes (1%) moves by road over 450km and virtually no bulk commodities move by road over 300km. In contrast, coastal shipping movements are dominated by petroleum products (75%) and by stone aggregates and coal whilst other coastal traffic is now insignificant.

* Much external traffic, both unit load and medium/high valued semi-bulk, is not transiting through ports nearest their points of origin and destination indicating significant scope for roads to water initiatives. In particular northern unit load traffic with Europe routed through southern ports in 1991 amounted to 5mt and through Haven ports (Felixstowe, etc.) to 3mt; much of this traffic was with France and Belgium but for Germany, the Netherlands and Denmark the volume totalled 2.5mt. Similarly the routing for higher valued bulks, steels, wood products, grains, animal feeds, etc., depends on a number of factors besides cost alone.

* The at sea cost per kilometre is a small fraction of that for road haulage. The problem is the high "port interface" cost which, including all port charges, cargo terminal handling costs and ship time in port costs, is some 40% of the through cost for unit load and 60-80% of the through cost for bulk cargo. On current cost structures coastal unit load shipping is not generally competitive with road haulage direct over comparable distances below 800km and coastal bulk is not generally competitive below 400km where the consignee's depot is at the discharge port and 600km where delivery is inland.

* The port interface is the major cost and critical element in the transport chain with a sea routing. The conundrum is that high port costs are often largely due to low and irregular throughput; the ports are not going to make the investment necessary to reduce costs and ship time unless volumes are high and certain whilst coastal/short sea shipping systems competitive with road cannot be based on irregular and uncommitted traffic flows. Regional ports need services competitive on cost and quality which is difficult to secure when traffic flows are small. Putting the efficient handling systems on the ships might be the answer but this generally requires high cost dedicated ships and less flexible shipping systems.

* For external unit load traffic, small price and service quality relationships can change the routings and make considerable differences to inland road miles. The short Channel crossings, with their higher frequency of sailings and shorter overall transit times, generally provide a more attractive service package. This accounts for the considerable volume of northern UK traffic routing through southern ports [similarly for the volume of Ireland traffic transiting via Scotland and the shortest sea crossing]. Routing German-Yorkshire traffic via the Humber ports is shown to give a through cost of some 20% lower than via the Channel and a reduction in the UK road distance of nearly 300km. Larger savings can be achieved for traffic shipped through inland ports on the Rhine and for French and Iberian traffic shipped by container direct to northern UK ports, but service quality is poorer and only non-time sensitive traffic is currently attracted to such services.

5   THE CONCLUSIONS

The conclusions of this initial focusing study were presented as key issues or results with a listing of options to be considered for further action within a number of areas.

5.1 TRAFFIC FLOW DATA AND STUDIES

There is a need for more data on the nature and volume of internal Great Britain long haul traffic, and more analysis of external flows and the available detailed origin/destination data. The following should be considered:

* A supplementary, detailed survey to the Department's Continuing Survey of Road Transport;

* A corridor study of road haulage traffic along the main arteries - e.g. Scotland-South East - to assess road to rail/water potential;

* A study of traffic flows/routings between GB and Northern Ireland and GB and Eire;

* Additional analysis of the Department's 1991 "Origin, Destinations and Transport of UK International Trade" and a follow up survey in 5 years to assess the impact of the Channel Tunnel;

* Participation in various EC and European studies.

5.2 PETROLEUM PRODUCT DISTRIBUTION

The scope for halting and reversing the decline in petroleum distribution by sea, with its consequential increase in road mileage, should be considered by Government and industry.

5.3 DRY BULK SHIPPING

In the dry bulk sector, encouragement should be given to potential roads to water conversion to offset negative trends. For external traffic this means encouraging routings via the nearest port and broader port coverage thus avoiding concentration on single port entry with nation-wide delivery. The short sea industry needs to be responsive to opportunities and incentives in terms of roads to water conversion. The following should be considered.

* Establishment of a "sea freight promotional desk" [within Government] to act as a clearing house for all roads to water issues and future policies; to encourage communication within the short sea sector; to encourage importers/exports to minimise road haulage; and possibly to provide funding of feasibility studies for potential roads to water alternatives.

* A technical and economic feasibility study into low cost coastal bulk barge feeder systems for grains, animal feeds etc. and coastal/river barging systems for re-distribution of stone and coal to riverside wharves.

* Special measures for domestic short sea shipping so that it is strong and responsive.

5.4 UNIT LOAD SHIPPING

Unless there is a significant change in cost structures coastal highway services may be feasible only if linked to international traffic. For external accompanied freight, there is potential for re-routing through Northern ports (without changing current cost structures) by conversion to unaccompanied trailers and containers. It would be further enhanced by increasing competitiveness of the northern ports and through greater shipping service frequency. The target is 3.5 mtpa.

In support of such switching it may be worth considering:

* In relation to port developments, adjusting planning procedures to take account of need to reduce road haulage mileage;

* Based upon rigorous cost/benefit analysis adopting discriminatory measures such as road weight regulation, port taxes and motorway tolls;

* Use of co-ordinating agents - such as the proposed "sea freight promotional desk" and regional port federations - to develop and promote new markets, improve port productivity and competitiveness;

* Identify opportunities through further studies.

5.5 PORTS

This is a critical area. Ports need to reduce handling costs and improve turnaround times since this is the major element in the sea transport chain. Competitive, well-served regional ports are also crucial to reduce road mileage.

Options to consider include:

* A study of UK port charges and terminal charges to assess whether these distort modal choice;

* Promotion of northern ports to reduce road mileage;

* Possible funding of ports infrastructure as an influencing rather than as a reactive mechanism;

* Extend inland waterway grants to coastal shipping with an emphasis on reducing the cost of handling systems and dust suppression and greater flexibility on the 5 year throughput guarantee criteria.

5.6 SHIP TECHNOLOGY AND SHIP-TO-SHORE HANDLING SYSTEMS

The scope for improving roads to water potential through ship design appears to be limited. High port costs may often be the result of low or irregular throughput and this is difficult to correct through technology. Instead research into low cost, rapid, automated ship-to-shore transfer systems should be considered.

5.7 EQUALITY WITH RAIL

There must not be (or seen to be) inequality between rail and water if these modes are to be encouraged at the expense of road. In this respect, the 44 tonne lorry concession for combined transport movements to rail heads should be extended to shipping where traffic is being taken off the roads. Infrastructure equality between rail and sea ports might also be studied.

5.8 PLANNING

Location of industry has a key part to play in reducing road mileage. Industry should be encouraged to utilise ports as suitable locations for assembly, warehousing and distribution centres. Measures should be considered to ensure effective utilisation of waterside land in the roads to water context. An option is to extend Enterprise Zone status to ports areas where relocation of industry could also reduce road mileage.

5.9 THE IMPACT OF POLICY MEASURES AND ENVIRONMENT ASSESSMENT

Large shifts from roads to water will not occur under prevailing cost and service quality comparability's. However, if "external costs" were fully reflected this could alter modal shares. To establish whether incentives might tip the balance in favour of a switch to water an assessment needs to be made of the full external cost savings.

A range of discriminatory measures should be examined - including road tolls, speed restrictions, driver hour restrictions, port taxes/rebates, "carbon tax", lorry weight incentives - to assess their impact on creating modal shift. The

review should include comparison with measures applied in Europe. This study produced a number of models which could be used in the assessments.

ABSTRACT

UK ROADS TO WATER INITIATIVE

A FOCUSING STUDY FOR THE UK DEPARTMENT OF TRANSPORT

The objective of this outline study was "to target productive areas for initiatives and for further research into the potential for short sea, coastal and inland shipping, for both the Government and commercial interests". The study was to identify where water could be competitive for internal UK movements and where there could be scope for reducing or eliminating the road transport element of external movements by encouragement of greater use of regional port facilities. As a clear brief to policy makers the study should lead to research into the targeted productive areas.

The study is firstly a detailed overview of internal and external UK traffic flows. Cost models then test the competitiveness of the water option and the alternative routings in the target areas identified. Secondly it provides a focus on the roads to water issues together with a number of key options for Government and industry to consider. The study provided much detailed commodity and traffic flow targeting.

Broadly the most productive areas for roads to water are:

* The protection of existing domestic coastal distribution (32 mtpa, 75% oil product) from the threat of further conversion to roads.

* The identification of long-haul internal traffic which can be converted to water under marginally changed conditions, including the feasibility of a coastal highway service.

* The encouragement of the re-routing of external traffic, with the Continent, Eire and Northern Ireland, through ports closer to the points of origin and destination of the traffic. This requires that the shipping connections to these ports are competitive in cost and quality terms.

* The identification of, and implementation of, measures designed to reduce the effect of high overall costs at the port interface.

MARITIME RESEARCH PRIORITIES FOR EUROPE

By Th. H. de Meester

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MARITIME RESEARCH PRIORITIES FOR EUROPE

1   WHY R&TD IN THE MARITIME SECTOR?

Research and Technical Development (R&TD) receives much attention, not only here over the past two days and just from this selective group . But why do we need, or want, R&TD and why in the maritime sector?

For the maritime industries: Maritime industries include a wide range of sectors: shipowners, shipbuilders, equipment manufacturers, port operators, etc., for which there is the need for continuous innovation for reasons of international competitiveness and drive for maximum efficiency.   Other directly related sectors, such as pilotage, port management and forwarders are strongly influenced by, and can benefit from such continuous developments.

For the authorities and politicians: Here I rather limit myself to the European context and consequently the European Commission, the European Parliament and the Council of the European Union.   Their interest is wider and the objectives are formulated in detail.   To give some examples, I may quote from Decision No. 1110/94/EC dated 26 April 1994, notably the considerations:

Article 103f of the Treaty states the Community's objectives in the area of research and technological development as being to strengthen the scientific and technological bases of Community industry and to encourage it to become more competitive at international level while promoting all research activities deemed necessary for the implementation of other Community policies.

The purpose of Community R&TD in accordance with the objectives laid down in the Treaty should be to foster a prosperous Community based on industrial competitiveness, quality of life and sustainable development;   whereas it is also desirable that it contributes to supporting economic growth and a high level of employment.

Community R&TD activities should continue to focus on *generic and pre-competitive research of multi-sectoral application*;   whereas more synergy between these activities and those undertaken in the context of Eureka should be sought.

Small and medium-sized undertakings are able to make a significant contribution to the innovation process and should play a substantial role in the *implementation* of Community R&TD activities;   Therefore, particular attention should be paid to the specific needs of such undertakings in order to facilitate their access

to information, encourage them to take part in Community programmes and enhance their ability to exploit their results where appropriate.

The Community R&TD effort should concentrate on activities which are carefully selected in accordance with well-defined criteria.

And lastly, why R&TD from the perspective of the researchers....I will let you fill that in for yourselves.

2   OBJECTIVES AND CRITERIA

Although it would be tempting for a shipowner's representative to set priorities where the most immediate result will become tangible for the shipowner/operator, I thought I should try to take a somewhat more neutral position. But, at the same time, one comes to the realization that R&TD should have a clear *practical aim* and should certainly not become an aim in itself.

In the context of the 4th Framework Programme on R&TD, selection criteria for Community activities are set out quite clearly:

Community research, technological development and demonstration activities should complement the activities undertaken in the Member States, be in accordance with the principle of subsidiarity and focus on clearly defined objectives. The research activities should yield short-term, medium-term or long-term advantages and contribute to achieving maximum cost efficiency, the means being commensurate with the objective set.

I could, but won't, go into the detail of the scientific and technological objectives as laid down in the Annex III of the aforementioned Decision. However, I would draw your attention to some of the paragraphs in the Annex:

The Community support for R&TD activities will continue to focus on generic, pre-competitive research of multi-sectoral application. This activity also include the JRC's (Joint Research Centres) research and support activities of an institutional character as well as scientific and technical support activities suited to a competitive approach. Further, Community actions will be orientated towards certain major topics in order that European research is able to contribute, in the most effective way, to the solution of problems with which industry and society are faced. There will be no financing of product or process development.

Eureka will remain the principal vehicle for supporting R&TD activities which are nearer to the market. The synergy between the Community's activities and Eureka will be improved. To this end, while preserving the specific features of each framework, the following objectives will be pursued: flexible and active

cooperation between representatives of Eureka projects and of Community projects through regular exchange of information, guidance of proposed R&D projects towards the most appropriate framework and improved interaction between Community policies and Eureka projects, in particular through greater Community participation in these projects whilst respecting Community procedures.

With respect to demonstration projects, the objective is to prove the technical viability of a new technology, together with, as appropriate, its possible economic advantages. The projects will be pre-competitive, and should as such focus on the application of new technologies and involve participation by both producers and users.

Within each research area, particular attention has been paid to the opportunities for cooperation and coordination between national, Community and, where appropriate European activities. Other than shared cost action centred on selected research, increased use of concerted actions will allow promotion of this cooperation in a wider range of areas, while always respecting the criteria listed in Annex II. Similar attention must be given to ensure complementarity between JRC institutional research activities and shared cost ones.

More specifically on transport, is stated:

> The Communication from the Commission to the Council over the future developments for the common transport policy specifies that the essential aim of research for a European transport policy is to contribute to the development integration and management of a transport system which is more efficient, safer and compatible with the environment and with quality of life, promoting sustainable mobility of people and goods.

In order for this goal to be achieved, a European approach will be developed to exploit the *synergy between the different Community and national activities, as well as those of the other international organizations*. The research activities will be developed at two levels:

- A European strategic level;
- A network optimization level.

Research will be conducted within a coherent and coordinated framework, taking into account the results available from *other programmes*, in particular industrial technologies, telematics, environment, energy and targeted socio-economic research in order to achieve the objectives of the common transport policy.

The research activities will principally address the identification of needs requiring new technologies, the evaluation, and the overall integration and validation of technological innovations developed in the other themes.

On the maritime area, integrated research and demonstration projects should permit optimization of the performance of short sea shipping systems, new sea/land/river interfaces, which include new port facilities, making use of manpower in a way which respects the needs of safety and protection of the environment with an efficient traffic management system.

For those directly involved in R&TD, I think that a thorough reading of this European Parliament and Council Decision is a must.

Of course, R&TD is not limited to, or restricted by the 4th Framework Programme which is, as I said, complementary.

3   4TH FRAMEWORK (CO)FUNDING OF R&TD PROJECTS

Since figures, especially large ones in ECU appeal to most, I will show you the final amounts and breakdown as fixed for the 4th Framework Programme:

	Ecu million (current prices)	
First activity (Research, technological development and demonstration programmes	9 432	(¹) (²)
Second activity (Cooperation with third countries and international organizations)	540	
Third activity (Dissemination and optimization of results)	330	(³) (⁴)
Fourth activity (Stimulation of the training and mobility of researchers)	744	
Maximum Overall Amount	11 046	(⁵) (⁶)

ECU million
(current prices)

Indicative breakdown of the themes
and subjects in the first activity

A. Information and communication technologies		3 405
1. Telematics	843	
2. Communication technologies	630	
3. Information technologies	1 932	
B. Industrial technologies		1 995
4. Industrial and material		
technologies		1 707
5. Measurements and testing	288	
C. Environment		1 080 ([7])
6. Environment and climate	852	
7. Marine sciences and technologies	228	
D. Life sciences and technologies		1 572
8. Biotechnology	552	
9. Biomedicine and health	336	
10. Agriculture and fisheries	644	
(including agro-industries, food		
technologies, forestry, aquaculture		
and rural development)		
E. 12. Non-nuclear energy		1 002
F. 13. Transport		240
G. 14. Targeted socio-economic research		138

You will notice the subdivision into four main activities.

The amounts will be made available in about equal shares for the periods of 94-96 and 97-98. In practice, tendering will start only in 1995.

4 INDUSTRY INPUT

In the spirit of the procedures and objectives as described above, the Commission services, notably DGs III, VII, XII and XIII, have organized a number of workshops within the industries, aimed at, or including, aspects of waterborne transport.

The experience of the maritime industries were not altogether positive and as a consequence the MIF Short Sea Panel has included the following paragraph in its report for the Rotterdam MIF Plenary meeting, later this month:

"Notwithstanding the apparent efforts made by the different Commission services to liaise on the initiatives taken, the Panel feels that there is inadequate coordination in the Commission approach. In view of the overlap and/or cross links between the various areas of interest, it is deemed necessary to create full transparency of competencies in specific areas, such as the setting of (policy) priorities, decision on the distribution of the finances and which (sub) areas will fall under which heading (e.g. EDI in maritime transport could fall under transport, but also under information and communication technologies.)

As a consequence, associations represented in the MIF have so far had difficulty in formulating and submitting precise proposals as well as in making specialists in the various fields available for what seemed to be repetitive meetings.

It is understood that the MIF Marine Resources Panel came to a similar conclusion.

In the Workshop on Waterborne Transport organized by the Commission services of DG VII in October 1993, the following sub-areas were discussed in working groups and recommendations developed:

W.G 1.1	Short Sea Shipping
W.G 1.2	Demands on inland waterways transport
W.G 2	Port facilities and land-sea interface
W.G 3	Tankers and dangerous cargoes - other ship types
W.G 4	Maritime Safety
W.G 5	Enhancement of the effectiveness of human resources in shipping
W.G 6	Marine, navigation, traffic management, logistics

The Working Group on Short Sea Shipping came forward with the following recommendations:

D.073/94aa
WORKSHOP ON R&D FOR WATERBORNE TRANSPORT
WORKING GROUP 1.1: SHORT SEA SHIPPING

Theme:	Integration of Fast Waterborne Transport systems in the logistical chain.
Rationale:	Commission White Paper on a Future Common Transport Policy and the Maritime Industry Forum (Athens Report and the current ongoing work in Panel I)

Policy Objective: Short sea shipping has to play a major role in the future of European transport.

RESEARCH ISSUES

1. Research on tradeflows and structural changes within these flows and related (new) trade statistics. Design of structural models of trade, the supply-side of shipping and monitoring models of the modal split. (EEA, Eastern Europe, Med.);

2. Research into the full integration of short sea shipping of unit loads, bulk commodities and passengers, in the logistical transport networks:
   - Research into the competitiveness of short sea and sea-river shipping in relation to other modes; i.e. shippers preferences and reasons, commodities and geographic considerations;
   - Identification of obstacles;
   - Identification of transferable cargoes/passengers (from land/air to the sea and waterways).

3. Research into the development of standardized cargo units, in line with the need of European trade and industry, for the combined use on land and at sea, and the smooth interchange between the different modes;

4. Research into the ship - terminal interface, with emphasis on:
   - the elimination of obstacles and the reduction of transit time and transport cost;
   - the harmonization and simplification of procedures (ship, passenger and cargo).

5. Research into the introduction of total quality systems, in order to stimulate the efficiency and further enhance the safety, as well as improve the awareness and image of short sea shipping;

6. Research into new ship - terminal systems related to:
   - Fast passenger & cargo ships;
   - Automated unitload ships;
   - Automated bulk ships;
   - Sea - river ships;
   - Other ship types;
   - Prospective markets for ships & equipment.

7. Technological and operational research on new ship types as mentioned under 6.:
   - Implementation and evaluation of new systems, with special emphasis on the diffusion of innovation;

- Advanced ship design and construction technology and advanced equipment and materials;
- Setting of design and operational world standards.

8. Research into the quantitative environmental aspects of short sea shipping systems in comparison to other transport modes. The environmental and external costs of operation for comparable transport chains is to be determined to create a basis for policy decisions.

9. Research into the comparison of overall performance and underlying reasons between European and non-European shipowners:
   - Research into comparison of operating cost structures of European and non-European shipowners; financial and other benefits accruing to them; ownership structure and the capital base for investment;
   - The strategic, commercial and managerial policies of European shipowners and operators in comparison with their non-European counterparts;
   - The development of tools which allow the detailed qualitative monitoring, evaluation and feedback of European maritime policy measures.

[These issues are equally applicable to short sea deepsea and sea-river shipping.]

5   PRIORITIES IN R&TD ON MARITIME TRANSPORT

The aforementioned recommendations are focused on short sea shipping in a narrow way, due to the repartition into sub-groups of the Workshop.

There is, of course, a substantial overlap of areas of interest and of priority for both short sea and deep sea shipping. In addition, and with reference to chapter III setting out the sub-activities in the 4th Framework Programme, wider and generic R&TD like on industrial and material technologies will also benefit the maritime industries.

On the basis of what has come out of the still ongoing discussions in recommendations and priority areas for R&TD on waterborne transport, I can give the following provisional, but what would seem agreed, list of areas requiring short/medium-term action, without the sequence setting any priority:

* Research into the competitiveness of shortsea and sea river shipping in relation to other modes;

* Research on intra-European trade flows and structural changes within these flows and related (new) trade statistics;

* Research on cargo containment units - this notably since the current ISO containers do not meet the shippers' requirements for competing with road transport - taking into account existing constraints on dimensions and the international impact

* Information technology in the transport chain, stimulating lean information management including EDI;

* New methods of maritime educatin ando training, including the use of "virtual reality"/ simulators;

* Safety of shipping in coastal waters including research into vessel traffic management, taking account of developments in the telecommunication and positioning systems area, including assessment of the experience gained in other transport modes

* Research on integrated ship control systems (ISC) including further development of standards for informatin technology equipment.

* Optimising the total costs from the design stage, including the construction costs and the operating and maintenance costs;

* Research on more efficient processes and technologies for collection and treatment of garbage and solid wastes;

* Research into new ship-terminal systems, such as for automated unitload and bulk ships, sea river ships, fast passenger and cargo ships;

* Research into the comparison of operating costs structures of European and non European shipowners; financial and other benefits accruing to them; ownership structures and the capital base for investment;

* Where appropriate, R&D to *include* the human resource element (e.g. training and human fatigue).

6   CONCLUSION

The Community policy is complementary to the activities developed in Member States and also governments cannot and will not dictate private industry initiatives.

Where (co)-financing with public funds is involved, the condition of pre-competitiveness is important. This relates to generic research, development and demonstration projects.

It is encouraging to note that, notwithstanding the confusion on exact competencies and lack of coordination within the European Commission on R&TD, as it is experienced from the outside, recommendations from the industry are being picked up.

Under the APAS programme, bridging between the 3rd and 4th Framework Programme, a number of studies on Waterborne Transport have already been launched, e.g. on Vessel Traffic Management and Information Systems, human resources, the structure and organization of maritime transport, the potential of shiftable cargo, the relevance of informational and communication technologies for shipping, and others.

I think that we are on the right track. Some may argue that insufficient public funds are made available by the Community and individual member States to the vast tasks that lie ahead. I do not know; what I do know is - and I repeat - that R&TD must not become an aim in itself.

Objectives for R&TD will no doubt change or evaluate over time and thereby also the priorities. For the forthcoming years, however, the above list should give a fair representation of the priorities.

There is, no doubt, still much work ahead to improve the quality and efficiency of short sea shipping and to bring about a shift from land to sea of, notably, long haul cargos.

COMMENTARIES

THE SETTING-UP OF FEEDERING/COASTAL SERVICES, A SOLUTION FOR THE MEDIUM SIZED PORTS OF THE ATLANTIC ARC?

By T. de Raymond, A. Taieb

Commentary by H. de Meester

It was a pleasure to read this well set out paper, the more since it could lead the way to a workable analytical method for evaluating short sea transport potentials.

For such an evaluation the main elements to be considered are:

* Actual trade flows from/to regions;
* Geographical and infrastructural conditions;
* Market prices of land transport modes;
* The cost element/overall costs of sea transport.

Other elements can and do play a role as well, however, such as the generic effect of new services on new trades, preconceived ideas and reluctance within the trade to change long existing practices, offer and demand of specific cargo containment units, and shippers/forwarders direct interest in owned road transport activities.

In relation to actual trade flows, the authors are very confident that detailed data flows of categories of products are available. Regrettably, I do have some doubts on this, a feeling which finds support in the difficulties experienced by the researchers that carried out the so-called "8 corridors study" for the European Commission. In fact, the creation of the single European market brought with it the removal of the important statistical sources of the customs of Member States. Regional sources such as from Chambers of Commerce hardly seem to exist or are unreliable and supplied on voluntary basis only by the industry.

Market prices of land transport modes show important differences as well as seasonal and short term fluctuations. These prices vary from country to country, region to region and along distances. For the purpose of the exercise I should think that the kilometre prices of 0.8 ECU is relevant on the understanding that trucking is limited to certain payloads and two heavy 20' containers (TEU) cannot be trucked in one haul.

The cost elements and/or overall costs of maritime transport seem to be well covered. It is a pity that the figures underlying the calculations - which form part of the original consultants report, so I understand - are not included in the paper.

The cost differences in ports are substantial with e.g. so-called commodity related T3 tax in Spain representing a complicating factor.

I compliment the authors with the inclusion of the adjustment parameters - without giving a judgement on the compensation levels used - notably in relation to the "unit cost of time", what is described as the "hub effect" as well as the allocation of the flow between the chains with respect to generalised costs of the letter.

The approach through the measurement of sensitivity toward the level of freight rates is particularly interesting. Although not clearly stated in the paper I understand this to relate to the compensation for an actual maritime leg only i.e. ships day costs including bunkers, but excluding port dues, port handling, etc. which would remain unaltered by the level of freight rate.

The authors rightly distinguish between "coastal flows" - usually described as domestic or intra European trade - and feeder traffic.

At present, the feeder trade is by far dominant in containerised short sea shipping. The costs of feedering is, in principle, included in the ocean (through) rate and thus absorbed by the deep sea operator. Subject to market conditions, the operator will seek compensation for these costs where other than "base ports" are concerned.

It will be realised that the weighing of elements of quality of service and cost comparisons may well differ between shippers and ocean lines, a matter which complicates the analysis.

I do appreciate the inclusion of the aspect of repositioning empty containers. The authors rightly refer to the so-called cabotaging of empties, whereby the deep sea operator makes the container, freely of even with a contribution, available to a coastal operator or other transport mode for use to carry domestic cargo. Due to the very depressed ocean rates however, it is rather exceptional that empties, notably standard boxes, are repositioned by sea in the described way. It is just no a paying proposition.

Although I preferred to address the methodology, I cannot escape from giving some personal comments on the specific project proposal for the Atlantic Arc.

I fail to see why Le Havre is not included, a port which is called at directly by many of the deep sea lines, or served by feeder. It seems unrealistic to ignore

the land haulage from the hinterlands of Bordeaux and Nantes to Le Havre, in particular in competition with feedering via Liverpool.

Also, it is not altogether clear to me whether any account has been taken of the current freight rate levels in the market for domestic and feeder traffic.
I would add that a major European operator recently completed an in-depth study on the feasibility of a feeder between French ports and Liverpool - including some domestic trade. The outcome dramatically failed to meet the economic conditions set and the project has been abolished.

Personally, I got very uneasy seeing the number of potential traffic. Call it an educated guess, if you like, but I simply cannot believe it is there.

CONCLUSION

The methodology followed would appear to be most valuable. Regrettably, the underlying details on costs and for the parameters were not included in the paper.

As you will be aware, the Maritime Industries Forum is very active in promoting short sea transport with the aim to bring more cargo from the land modes to the sea. The activities of the Short Sea Panel are focusing on measures to take away hindrances - operational and procedural - and ways to promote short sea with the trade (shippers and forwarders). A major issue that was identified by the Panel was the need for reliable information on potential traffic.
It will be very worthwhile to test the methodology and the calculation model described in this paper on what we hope to be reliable statistics on trades between European regions.

Lastly and superfluously I think, I would observe that although a model as described can be an important tool to identify potential traffic, it cannot form the (sole) basis for decision making on the setting up of new liner services and/or investments.

PREREQUISITES FOR IMPROVEMENTS OF THE SHIPPING IN SOUTH-EAST EUROPEAN REGIONS

By W. Förster, B. Zigic, W. Simon

Commentary by H.N. Psaraftis

With the collapse of the USSR and its satellite states, monumental changes are about to occur in the pattern of trade in these countries, not only internally, but also vis-à-vis the rest of the world. Also events in the former Yugoslavia have caused significant changes in the pattern of trade in that area of Europe, in view of these changes. To do so, the authors focus on shortsea shipping, and examine several scenarios in two "corridors", one between Middle Europe and Ukraine, and one between Middle Europe and Greece.

My comments are divided into two sections, general and specific.

General comments

The topic of the paper is of great importance, not only as far as the transport industry of shortsea shipping is concerned, but ultimately for the state of the economies and the welfare of the countries involved. In that respect, the paper identifies some key areas of concern, and as a result raises the level of awareness of what are the problems and what can be done about them.

It is of course clear that this paper, by focusing on these two corridors, does not attempt to provide a global solution to the transport problems of this area of Europe. And indeed, the global problem is of monumental difficulty, and one that would take many years to formulate, let alone analyse and solve. For instance, the connection of these regions to the Far East is an important problem in which shortsea shipping is expected to play a role, by providing an efficient link in the regional distribution of cargo that is carried to "hubs" this area by deepsea shipping and then transhipped to regional ports and, vice versa. The entire logistics of this operation is a particularly non-trivial problem

Of course, this paper does not intend to cover this specific problem and other similarly important issues. Nevertheless the exposition in the paper does indeed provide a flavour of some of the main issues of this global problem.

Specific comments

Of the two corridors that are presented, I will focus on the Middle Europe to Greece one because I am personally more aware of the main issues for this problem than of issues on the Danube or the Ukraine.

Before I proceed however with the Greece to Italy link, I just wanted to ask the authors what solutions they propose for the traffic that originates in the Black Sea and is destined to Middle Europe. Their analysis seems to be focused more on outbound traffic (traffic out of Middle Europe) than on inbound traffic. Given the non-homogeneity and imbalance of traffic in the two directions, a question is whether the alternatives they propose are designed mainly to optimise outbound traffic. If this is not the case, I would appreciate some further clarifications.

Regarding now the corridor between Middle Europe and Greece (via the Adriatic) the paper indeed paints an accurate picture of the situation identifies some of the key alternatives. If the main conclusion of this analysis is that roros are the main alternative to land transport, it is clear that this is the solution that is being pursued by shortsea shipping operators. The fact that the marketplace has identified this as a viable alternative is perhaps the strongest proof about its merit.

An interesting development is that Strinzis Lines has recently purchased a new Italian roro (I think the design is the one displayed in Figure 5 of the paper), which is being converted to accommodate more passengers and cars. The ship, although owned and operated by a Greek company, will fly the Italian flag, and is expected to join the expanding fleet of roros between Greece and Italy.

One point that is not stressed in the paper but which I think is very important is that for the Greek to Italy link the most serious bottleneck is port capacity. The analysis of the paper assumes Patras as Greece's main gateway to Italy, and it is. However, the capacity of the port of Patras is clearly inadequate to handle to expanded roro traffic. Such is the case for the port of Igoumenitsa, our second gateway. clearly, if these ports do not increase their capacity, severe congestion would occur (both from the marine side and from the land side), and this would make the roro alternative less attractive than what is shown in the paper. Transit time and cost will be kept under control only if a solution is found to the port problem. A similar case can be made for Italian ports, but my impression is that it is the Greek side that has a more severe problem.

If the huge investment cost to expand port capacity is internalised, that is, if the users of these ports are required to pay for the infrastructure improvement (for instance in terms of higher port fees and ultimately higher fares), it is not clear whether the roro alternative would still come out on top. The EU cohesion funds could bear some of this cost and help keep the roro alternative attractive, but I would be interested in the authors' assessment of this particular issue.

Overall, this is a very good paper, and I want to compliment and thank the authors for their effort.

METRO COASTAL SHIPPING

By J. Truau

Commentary by E. Sambracos

The author has addressed an interesting paper based on the results of a study for the "5 year Development Programme for the port of Marseille-Fos". This study was carried out at the initiation of the Marseille-Provence Chamber of Commerce and Industry.

The title of the paper is "Metro-Coastal Shipping" providing a new sea transport concept with a focus on the Mediterranean Arc including Italy, France and Spain.

The paper is generally well written and consists of four sections:

I.   The context
II.   Hypotheses and methods
III. Simulations and results
IV.   Underlying organisation of logistics.

The contribution of the paper is due to the presentation of quantified findings concerning the comparative cost of road transport and sea transport as well. More specifically, the diagrams derived from the cost research, provide concrete results. These results could be set as a foundation base for policy making at the sector of sea transport and especially at the sector of multimodal transport.

It is also characteristic that clear results arise regarding the attainment of competitiveness and economy, when the goods are carried by trailer only, without tractor. This type of organisation, as the author correctly points out, requires close collaboration with one or more international carriers, as well as centralised international organisation.

This method has a theoretical value and in fact, as the author has mentioned, an organisational structure combined with a minimum load on call comprising trailers plus additional cargo constituted by trailers and their tractors and driver, is a more realistic approach.

The paper should be completed by some specific economic parameters that were taken into account for the calculation of road cost, so that a more comprehensive comparative analysis to be demonstrated.

Nevertheless, one question does occur; namely if the "metro-coastal shipping" and the "Mediterranean Arc" could be expanded to Greece, where the trailer could be carried through Greek ports towards Italy and so on.

BALTIC BULK SHIPPING IN THE 1990'S: HOW TO MATCH AN AGEING SHORTSEA FLEET WITH INCREASING DEMAND

By L. Ojala, S. Lall, M. Svendsen

Commentary by K.H. Breitzmann

OVERVIEW

The paper of Ojala, Lall and Svendsen deals with an important and complex market, the Baltic bulk shipping, for which only very few analyses are available. A remarkable part of total Baltic sea transport of about 300 million tons annually is allotted to bulk cargoes and served by 1500 ships. Tremendous changes are under way, concerning, for instance, amount and structure of bulk cargoes of Eastern European countries, their fleets and ports. So the paper should be welcomed as a contribution to fill a gap in the actual technical literature.
The main parts of the paper are concentrating on:

1. Major trends in bulk trades within the Baltic Sea;
2. The structure of shortsea bulk tonnage employed in the Baltic;
3. Freight rates and trends in some bulk shipping costs;
4. Conclusions on future developments and policy recommendations.

1 MAJOR TRENDS IN BULK TRADES WITHIN THE BALTIC SEA

The study shows that Baltic sea transport includes a lot of different cargoes. Table I brings together valuable information on kinds of cargoes, parcel-size, cargo handling and cargo value. In subparagraph 3.1. some important groups of cargoes are missing, for example oil and oil products or consumer goods.
For further studies it seems to be necessary to analyse cargo flows and to differentiate between trades within the Baltic Sea and with ports outside the Baltic.
In some trades the parcel-size is changing. For instance in Eastern German ports gravel is discharged from large bulk carriers.

The authors present interesting statistics on cargo handling in ports of the Eastern Baltic region in Table II. and some aspects of future port developments are mentioned. From the commentators point of view one of the policy recommendations should be to prepare studies on future port developments, which are covering the whole Eastern region. There are several studies, already, for individual ports showing that there is a danger of immense future contradictions.

2 STRUCTURE OF SHORTSEA BULK TONNAGE IN THE BALTIC REGION

Using mainly Lloyd's Maritime Information Services the authors give details on bulk and general cargo tonnage. There are new and modern ships, but a big part of the tonnage is overage. The necessity to replace older vessels conflicts with increasing newbuilding prices.

There is a clear trend to larger vessels. The newbuildings should be analysed more deeply in order to show trends in vessel size, speed, cargo handling equipment etc.

3 FREIGHT RATES AND TRENDS IN SOME BULK SHIPPING COSTS

The paper says that freight rates of the Baltic spot markets are increasing for larger vessels since September 1993. But for a longer period, already, smaller ships up to 1000 dwt can not earn the money to invest for replacements.

The insurance cost for cargo and hull insurance for older vessels is growing causing a pressure on shipowners concerned.

A comparison of crew costs between Scandinavian countries is given. In the same time for the future market developments it is very important, too, to analyse the quite different level and structure of costs of Eastern European shipping companies.

4 CONCLUSIONS AND POLICY RECOMMENDATIONS

Several signals indicate, according to the authors, increasing movements of bulk cargoes within the Baltic. But to underpin this forecast, for largest bulk cargoes like coal, grain, ore, timber, paper etc., special prognoses are needed taking into account the changes in Eastern Europe.

One of the most interesting conclusions is that in the next years a shortage of larger vessels may occur leading to a higher freight rate level. That, consequently could ease the problems of financing newbuildings for individual owners. But all together a high amount of ship financing is needed what calls for solutions in this field.

For different reasons the authors see a growth of contract market shipping of specialised owners. Another group of shipowners will consists of high-quality competitive operators of Western countries whereas a third group is characterised as low-cost, low-quality operators from Russia, Poland and the Baltic states with mounting problems of financing of newbuildings. As that may result in dangers for environment and security of shipping, policy recommendations concerning the development and financing of Eastern Europe shipping are necessary, too.

SHORTSEA SHIPPING FROM HINTERLAND PORTS BY SEA-RIVER GOING VESSELS: STUDY OF THE INFLUENCE OF A FREE CABOTAGE POLICY

By J.L.J. Marchal

Commentary by M. Garratt

Professor Marchal's paper is concerned with the development of an appraisal system which would provide a methodology to evaluate intermodal transport projects in the field of waterborne transport.

He has developed a sophisticated algebraic model which takes into account an extensive list of exogenous variables. This is clearly designed to provide an objective comparison of different modes of transport on a cost based 'level play-ing field'. It is therefore appropriate to cost benefit analysis, particularly where the issue at hand is the development of inland waterway track. The model appears to be very comprehensive, but does not take into account the size of the market available and, therefore, does not deal with the volume: frequency dilemma which faces the waterborne carriage of intermodal traffics.

Professor Marchal has used his model to examine both a short haul option in direct competition with road haulage, and a longer haul opportunity where a relatively small sea/river craft competes with a combination of road haulage and 'cross Channel' ferries.

His model demonstrates that short haul intermodal waterborne freight does not offer an attractive proposition. However, his model does indicate that sea/river craft would be competitive where the 'competition' also involves the use of maritime transport. That is, there is a good case for extending the length of haul 'inland' for waterborne freight.

The paper would benefit by providing a more explicit description of the calcula-tions, presented in the conventional form which transport companies would recognise; e.g. charter/line rates, bunkers, port charges and so forth. A more thorough explanation of the port cargo handling charges and road haulage rates used would also be helpful. The paper does deal with the practical problems of 'triangulation'.

There is no question that a modelling technique such as described in the paper would be a very useful guide to public sector policy. There is a considerable danger that public funds are invested in infrastructure designed for commercial exploitation without regard for overall community benefits but, instead, on the basis of narrow commercial interests. A model as is described could act as a 'checking' system to ensure that benefits were of a public and not a private na-ture.

However, because the distribution and assignment of cargo is based on commercial market mechanisms, it is important that a model does not recommend opportunities which, in practice, cannot be brought to fruition. Difficulties can lie in the lack of trade volume to justify a competitive frequency or in the pricing behaviour of integrated transport operators keen to protect existing shipping services, often operating over short ferry routes which do not exploit the advantages of waterborne freight.

The model would, accordingly, benefit from a 'matching' demand model which allowed the viability of a route to be tested against the cargo available the scheduling demands of shippers and the market share required by a given operator. It would also be important to provide verification of the cost (or charges) made by infrastructure operators (ports), and by road distribution companies. The highly varied nature of port charges is a significant threat and distortion in the field of shortsea shipping.

If waterborne freight is to be able to justify public sector investment in infrastructure, it will certainly be important that a similar theoretical framework is available as for road investment, in order to make a coherent case.

AN ALTERNATIVE SYSTEM FOR SHORTSEA SHIPMENT OF ROAD VEHICLES

By J. Igielska

Commentary by K. Fear

1 INTRODUCTION

The basic idea behind the proposed trailer cassette concept is to load unaccompanied trailers on to cassettes and move, load and transport them in a manner similar to containers.

The stated aims of the system are as follows:

* Eliminate stevedoring work on board the vessel;
* Raise safety standards at sea;
* Reduce cargo handling costs;
* Reduce time spent in port.

The system is trying to achieve the speed of service and convenience of a Ro-Ro transportation system with the lower cost and high vessel utilisation which is part of a containerised or Lo-Lo transportation system.

2 EXISTING FREIGHT TRANSPORTATION SYSTEMS

Within Europe the Ro-Ro vessel is viewed as an integral part of the transportation infrastructure, as a link in the road or rail network. It is possible to transport goods from the UK into mainland Europe, using Ro-Ro, within 24 hours. The cost of moving goods by Ro-Ro is in excess of Lo-Lo and is therefore used to transport goods of high value or where there are tight delivery schedules to meet. Vehicles can arrive at a Ro-Ro port and be allowed access to the vessel within an hour of departure. Vessels are turned round in an hour or less. The only Ro-Ro operator currently committed to operating a high speed vessel capable of transporting freight vehicles is confident of turning round 100 heavy goods vehicles in 30 minutes. While unaccompanied trailer systems are slower to operate, it should be possible to load or unload conventional trailers at a rate of up to 80 per hour, where time is of the essence.

Another of the main advantages of a Ro-Ro system of transport is the limited requirement for onshore handling equipment. Ro-Ro vessels are more expensive for their size than container vessels due to the more complicated structure and the need for internal and external vehicle ramps and lower density of loading. However, a Ro-Ro operation does not need a length of quay against which to operate. Remote mooring and berthing dolphins combined with a shore ramp can

be used instead. A container vessel needs to berth against a length of quay capable of carrying a ship to shore container crane, or be equipped with a ship mounted container gantry crane. The speed of loading containers on to a vessel, even with the fastest design of container crane, ranges from only 20-30 containers per hour per crane with similar performance to be expected from a purpose-built ship-mounted container gantry crane. The performance of mobile container cranes is considerably less than these figures.

In addition to a ship to shore crane, expensive equipment is needed to move containers around the terminal and for stacking. The service currently available for containers is not usually an end to end service although these services do exist. Containers being delivered to a departure terminal could be left stacked for 24 hours before being loaded on to a vessel and could be carried to a number of ports before reaching their final destination.

While the above is, hopefully, interesting, what relevance does it have to the proposed "Alternative System for Shortsea Shipment of Road Vehicles" or, more accurately, unaccompanied trailers? The proposed system of trailer cassettes appears to be trying to achieve the speed and convenience of a Ro-Ro transportation system with the lower cost and high vessel utilisation which is part of a containerised or Lo-Lo transportation system.

3 PROPOSED ALTERNATIVE SYSTEM FOR SHORTSEA SHIPMENT OF ROAD VEHICLES

The proposed use of trailer cassettes attempts to make up for the weakness in the conventional Ro-Ro and Lo-Lo transportation systems. The aim of improving the safety record of Ro-Ro vessels is an important point to address. The proposed use of trailer cassettes suggests that vehicles becoming unlashed and moving on the vehicle deck is a contributory factor in the accident record of Ro-Ro vessels. The paper does not indicate clearly how the cassettes are made suitable for stacking within the vessel. It appears that this would require the addition of some form of corner posts or sides to the cassettes as the trailers themselves are not stackable. This would be critical to the success of the system and it should be noted that the corner post system on standard container flat-racks are not suitable for stacking. Therefore, a significant amount of R & D work would be required to establish the feasibility of this aspect of the system.

While it is apparent that the use of trailer cassettes and a specialist cellular vessel would improve the stowage factor over a Ro-Ro vessel, this would not be as high as a container vessel due to the space occupied by both the cassette and the trailer.

The idea of an improved, standardised lashing system on board a Ro-Ro vessel is worth pursuing further, but it should be a system which is suitable for both unaccompanied and accompanied heavy goods vehicles. While the suggested use of the trailer cassette would decrease stevedoring time on the vessel, the work required in the port prior to the arrival of the vessel would be increased.

When considering the turnaround time of the proposed system by comparing the existing loading performance of both Ro-Ro and Lo-Lo operations, it is difficult to see that the use of trailer cassettes would decrease the time that vessels spend in port. The loading rates for both Ro-Ro and Lo-Lo quoted in the paper seem to be conservative, but those for Ro-Ro are particularly low. Where speed is of the essence it should be quite feasible to achieve a rate 5 times that stated. In addition to this, the system would not be possible to operate at many existing ferry ports which do not have lengths of open quay against which the vessels berth and where ready access to the ship's side could be provided for the cassettes. Vessels could only operate between ports equipped with handling equipment suitable for trailer cassettes.

4 CONCLUSION

The paper entitled *"An Alternative System for Shortsea Shipment of Road Vehicles"* has identified and addressed some important aspects of the Ro-Ro and Lo-Lo transportation system. Having identified various aspects, the paper does draw conclusions which are different from those stated below:

* The safety of securing road vehicles on board vehicle decks of Ro-Ro vessels should be investigated, improved and standardised. The system adopted should assist in reducing the time spent securing vehicles;

* The utilisation of the existing Lo-Lo transportation network for a shortsea end to end operation should be examined. Part of the current network should be streamlined for a high speed container service which would be aimed at the unaccompanied freight market.

It is true that both Ro-Ro and Lo-Lo transportation systems have their shortcomings, but both serve a particular need in the transport market. The idea of a trailer cassette operation would involve an enormous amount of investment, both for vessel and port operators, to accommodate only unaccompanied freight trailers. Rather than arrive at a new system which is unproven and may present shortcomings of its own, it would be better to address the problems of the existing transportation systems.

MODAL SPLIT ANALYSIS IN GREEK SHORTSEA PASSENGER/CAR TRANSPORT

By H.N. Psaraftis, V.F. Magirou, G.C. Nasos, G.J. Nellas, G. Panagakos, A.D. Papanikolau

Commentary by M. Zachcial

As described in the paper, the purpose of the presentation is to show the application of a modal split model for passengers and vehicles in Greek coastal shipping. The approach presented deals with different ship types such as conventional ferries, fast ships, and air transport. The paper describes in detail the database concerning lines and routes fares, fleet passenger and vehicle traffic. as well as legal regime.

The main chapter of the paper is No. 3 which deals with modal split analysis. A total of working steps are analysed:

STEP 1: Choose a workable (but hopefully relevant) subset of the entire network for the analysis;

STEP 2: Make aggregate demand projections on this network up to 2004;

STEP 3: Make some assumptions on what kinds of transport modes provide service on this network, and for each evaluate the transit times for the relevant links of the network;

STEP 4: Make some assumptions on the fares charged by each mode:

STEP 5: Calculate the monetary value of the time of the passengers;

STEP 6: Run the logic model to determine the modal split on each branch of the network;

STEP 7: Interpret results and perform sensitivity analysis.

The paper shows excellent statistical results with respect to aggregate demand projections. The exponential equation reveals a more than satisfactory R2 of 95% and a high t-value of >21.0. Next to that, the paper shows he O/D-tables for both 1990 and the year of forecast 2004.

The modal split model of type:

$$F_c = \frac{\exp(a_i + bp_i + ct_i)}{\Sigma(a_k + bp_k + ct_k)}$$

solves for the fare charged (p_i) and the trip time used (t_j). The values of a, b, and c are parameters of regresssion.

The modelling approach used by Psaraftis et. al., seems to be an adequate manner of evaluation and simulation. As a result, in 2004 about 32% will take a plane, 40% will go by conventional ferry, 3.3% will take the hydrofoil, 3.7% will used passenger ferries, and 21% will go by fast passenger/cargo ferries. The study shows that 60% of traffic will go by conventional passenger/cargo vessels, while 40% will go by fast passenger/cargo vessels.
The paper meets high-level statistical methods and contains sound statistical results. To conclude, the methodology applied is absolutely suitable to assess the modal split relationship in Greek shortsea shipping.

Besides statistical analysis the paper contains an economic feasibility analysis. Interesting enough, a parametric analysis was performed on decisive parameters (i.e. utilisation of vessel's capacity and return on investment). Besides other results, the paper indicates overproportional relative cost of fast ships, low value of time etc. The paper's methodology might be used by other countries for similar situations and markets.

SHORTSEA SHIPPING: VIA OPTIMA?

By R.J. Martens

Commentary by C. Peeters

The paper identifies the problems which hinder an efficient integration of shortsea shipping (SSS) within existing transportation chains, based on several recent studies regarding the volumes of cargo which could be shifted towards SSS. The paper also proposes solutions in order to improve the integration of SSS, given substantial changes in the application of logistical concepts.

In a first step (section 2), the author describes the market in which existing cargo volumes could be transferred from road haulage towards SSS. He also briefly discusses the impact of changing logistics on the market environment of SSS. Given this information, the author identifies in a second step (section 3) several barriers to the optimal development of SSS in Europe. The 'Via Optima' concept is presented in section 4 as the "backbone of pursuing an improved competitive position of the shortsea shipping sector" (p. 12). However, in our view, this concept should be considered as one of many elements that could improve the competitive position of SSS in Europe. Its relevance should not be overestimated nor its applicability generalised to all European corridors without proper research.

A first problem with the model is related to the function of SSS. Using the Via Optima-concept leaves no room for more flexible systems such as feeder systems or multi-call routes (see e.g., N. Wijnolst, C. Peeters, Anders Sjobris and E. Declercq: *"Multimodal Shortsea Transport - Coastal Superhighway"*, Delft University Press, 1994). The 'sales manager' who controls origin and destination of the route in the Via Optima, lacks this decision power if SSS-vessels have several port calls. Specifically, the provision of 'fixed terminal capacity' to reduce call-times then becomes almost impossible to realise.

A second problem is related to the corridor notion. A corridor is viewed here as a set of commodity flows along similar routes in the Union. This concept assumes the existence of substantial volumes.

Given that the necessary investments for the Via Optima are substantial (EDI, retention of capacity, etc.), the concept will only be viable if economies of scale can be obtained. Hence, all inter-corridor traffic will be excluded from the advantages of this system because these cargo flows, which may be important for a specific region or port, have per definition a lower volume (otherwise they would be part of a particular corridor).

It is clear that the author aims to demonstrate the possibilities of SSS to integrate itself in existing logistical chains. The proposed solution, however, is not necessarily optimal from a strategic management point of view.

SSS-operations can choose between two major strategic options. They can choose to compete with alternative transport modes or to co-operate with these other modes. Both options can be considered at the level of the relevant corridor and at the level of the port-to-port routes within these corridors. The concept is visualised in **Figure 1**.

The author builds upon the concept of a 'sales manager' with an office at the origin and the destination of a particular traffic corridor, who would control all flows of goods from origin to destination within that particular corridor. This approach implies a competitive perspective vis-à-vis the other modes, whereby SSS-operators would introduce door-to-door services in competition with existing JIT-services in road haulage. Under present market conditions, the viability of such a market approach can be questioned. This approach, reflected in quadrant 1 of **Figure 1**, is thus an unrealistic target for SSS.
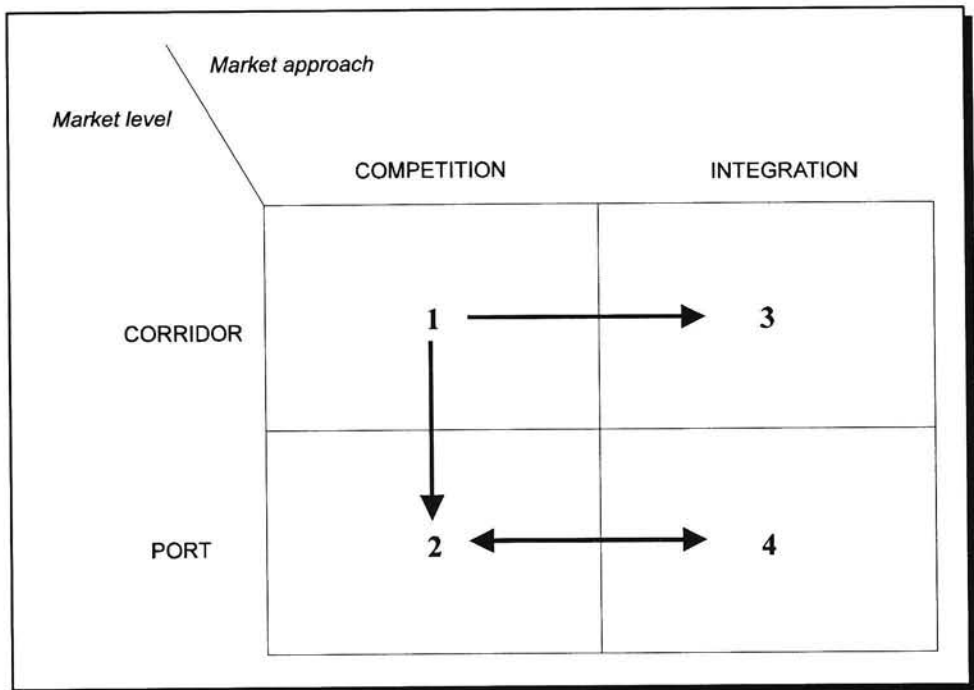
Figure 1:   Market level and market approach

Such an approach is only viable at the level of a limited number of ports. This is visualised in quadrant 2 of **Figure 1**. This represents the notion of 'Port-Pairs',

whereby economic actors two (or more) ports co-operate both in research and operations in order to identify the market segments in which the competitive position of SSS could be improved. The advantage of working at this level is, that this improvement can be complemented with intermodal co-operation in the corridor beyond the port-to-port routes, see quadrant 4 of **Figure 1**.

If, on the contrary, improvements are suggested at the level of the corridor, the integration within existing door-to-door road haulage concepts should be emphasised. This will require a focus on cargo flow adaptation rather than cargo flow control. This adaptation can be obtained by improving efficiency and flexibility of SSS in intermodal transportation chains. This is represented by quadrant 3 in **Figure 1**.

The presentation of several supporting concepts such as Electronic Data Interchange (EDI) and Geographic Information Systems-databases (GIS) for transport applications is interesting, but their economic viability is doubtful. At present most GIS-systems are designed for road haulage and are hardly used even in that sector, due to the substantial investments associated with their implementation. GIS could possibly contribute to a long-term maximisation of efficiency, once all other requirements are fulfilled. These requirements are related to increases in speed and improvements as regards the reliability and flexibility of SSS, both in maritime transport and (port)transhipment. This requires the development of integrated transport systems, whereby SSS can be efficiently linked to existing transport chains. This integration should not be restricted to the development of combined systems. On the contrary, SSS should be efficiently connected to all modes by means of multimodal terminals.

The author correctly argues that it is important to change the perception of the decision makers on SSS, both in the private and public sector. SSS should be viewed as a serious part of the transportation chain. In order to develop such a view, the support is required of public policy makers, both at the level of the Union and the individual Member States. The creation of a Bureau Shortsea Shipping was therefore suggested in this paper, an idea which was introduced in 1993 by *Policy Research Corporation N.V. (Belgium)* in its so-called Corridor Study which was commissioned by the European Directorate General for Transport, DGVII. In their policy recommendation no 9, the creation of a EUROPEAN SSS-PROMOTION SERVICE (ESPS) was suggested to stimulate alliances, to improve the co-operation with other modes, to support the introduction of innovative techniques and to provide strategic interaction between the public and private sector.

WATER-BASED MULTIMODAL TERMINALS: AN ECLECTIC SITE EVALUATION MODEL

By L. Clinckers, E. Declercq, C. Peeters, A. Verbeke

Commentary by L. Ojala

The paper presents an 'Eclectic Site Evaluation Model', and discusses its use in assessing sites for multimodal transport terminals in connection with inland waterway transport. More generally, the usefulness of the proposed model is discussed in connection with assessing sites for terminals capable of accommodating environmentally friendlier transport modes such as shortsea shipping (SSS) and inland navigation (IN). A study prepared for the Flemish waterway authorities is used to highlight some aspects of the model and its applicability in such decision making situations.

Some notions on the model structure

The authors have developed a multi-stage approach to be used in evaluating the potential sites/regions suitable or proposed as location for multimodal transport terminals.

The model consist of two more 'traditional' stages which incorporate the identification of attractive areas for the establishment of multimodal terminals based on internal and external decision parameters (see e.g. figure 1), which build upon single parameters approach and are then expanded to profile charts for the potential sites. These are then integrated into a scaled four-boxed matrix indicating the suitability of the sites according to strong/weak internal factors. and high/low opportunities for the external factors, respectively.

The potential sites are here compared with each other, which means that the boundaries in the integrated evaluation matrix (figure 2) are, to a large extent, determined by the number and type of potential sites included in the study. This is not a problem when there is a large number of sites under study, but may cause complications, when the number of potential sites is small.

The authors claim that "the performance of the location on every parameter is measured and ranked according to a scale ... + + to -- ...", but there is no indication *by whom* and *by what means* this measurement (and ranking) should be made, or was made e.g. in the Flemish study. This, I believe, is crucial to the following steps of the model - as I understood the presentation, each stage of the model builds upon the results of the earlier stage. Even though the paper was not entirely clear on that particular point, the reader got the impression that at least the final stage (the application of the 'Eclectic Site Selection Model' described in chapter 4) was (or could be) performed only on those sites which score highly in the initial stages.

Nevertheless, the stage described in chapter 2, could be described as a static exercise, since there were no indications of any time-scales when comparing the various decision parameters. That is, the purpose of this stage was seemingly to rank the sites as they are (or as they are perceived to be).

The following stage of the model was to calculate Centrality Indices (CIs) for the potential sites. This exercise was performed in two steps, firstly from a national perspective, and secondly from an international (European) perspective. This exercise is not difficult to perform as such (and it need not to be more complex than what it is here), but it relies heavily on the input data used in the simple CI formula.

The authors propose that the CI be based on port performance (understood here as the quantities transported to every port [such as ports in France, Germany, the Netherlands etc.].

Furthermore, the authors claim that the CIs of the "various regions did not diverge very much, which indicated the central position of the Flemish region from a European perspective. It also confirmed that the Flemish region could perform a key function in an integrated European 'water-based' system for the transport of goods". This may very well be true, but the way in which this statement was given here as a result of the said CI exercise is somewhat ambiguous. One would expect CI calculations with similar rigor as that for the Flemish region to be performed before one could definitely come to the said conclusion.

The input values for the CI give also rise to one question: if the model is supposed to be used for multimodal terminals, why are the [total] quantities [transported to every port] used as input data. This was said very briefly in a footnote, and as such it may have been too short an explanation. One would, however, expect *the multimodal cargo volumes* (or general cargo volumes for that matter) to be used as a relevant input value for the CI in this case.

In this stage a 'branch and bound' based simulation algorithm is employed to determine and identify the regions of the near-optimality. This method seems to be a very handy one, and judged by the few elegant formulas presented is an easy-to-use approach, as well. the only notion to the use of the simulation model here deals with the input data used in it.

Here, too, the total traffic of [all] ports was used as a basis for the algorithm. One could ask that, subject to availability of data, would the results be different if only multimodal (or unitised or general) cargo be used as input data? This could even affect the choice of ports in the process of minimising the transport costs. It was, however, mentioned that a 'substantial' number of Belgian and foreign ports were included, which has relevance to IN.

The authors mention that among the few other sites, 'Meerhoud' should also be considered as potentially valuable logistical centre, because a number of multinational companies have established their European distribution terminals there. This notion leads to a further question: should all cargo flows (used as input data in the simulation model) be treated equally, i.e. 1 ton is 1 ton, irrespective its origin or shipper. The inclusion of 'Meerhout' with reference to multinational companies presence there suggests that all cargo tonnes are not equal, even if they would all be 'multimodal' and/or international

The authors continue presenting the SWOT - and the integrated analysis, called subsequently the 'dynamic SWOT-matrix'. as a result, a very illustrative matrix is shown in figure 5. which ranks the potential sites in an easy-to perceive fashion. The authors do not, however, give any details how and by whom this assessment is made (or in the case of the Flemish study, was made).

The Eclectic Site Evaluation model

This section of the paper gives a very interesting description of the actual core of the presentation. It is easy to agree with the authors that the traditional financial appraisal methods should be accompanied by a more qualitative analysis of the actual projects under planning. Furthermore, it is easy to share the view that (especially for public policy makes) the Pay Back Method is not as relevant as e.g. the NPV, PI and IRR. all of these methods have their drawbacks, which accentuate with long time scales and difficulties to determine realistic interest rates, especially if commercial and fluctuating interest rates have major impact on the project(s).

It was suggested that the business plan(s) used by investors be used as a basis for this stage of evaluation, and furthermore, that the financial impact of the project(s) should be evaluated after eliminating all subsidies and possible shadow prices. These may, however be difficult to extract from the business plan calculations in a reliable fashion - especially with long time frames which are typical for terminal/port-like investments. This notion does not mean that the *method* presented in this paper is affected as such, but it implies that converting the business plan data to be used in this way should be done very carefully.

It can clearly be seen that the authors have a very ambitious goal to try to compress a vast amount of information eventually into a single matrix, and the way the steps of the eclectic model are described in the paper give a good impression of the difficulty of the task. Many of the criteria touched upon, like "Mobility Impact Studies", and
"Socio-economic Mobility" are also very difficult to treat simultaneously, or in a fashion where they could be put 'on the same line'. the authors briefly mention certain Multi-Criteria Decision Making (MCDM) techniques, and it can be agreed that e.g. Saaty's AHP-method is not very appropriate in this case, partly because of the way how the earlier stages were performed in this case. On top of

that, it may be difficult to agree upon hierarchical levels necessary for the AHP-approach.

The field being not my speciality, one just wonders whether the latest MCDM techniques incorporating fuzzy logic and approximate reasoning (AR) - possibly in connection with some state-of-the-art artificial intelligence (AI) software aid - could prove useful in this type of project evaluation. It is briefly mentioned, that some kind of DSS or Expert system (ES) application exists as a part of the approach, but it is not quite clear whether the software tool(s) is (are) meant to be used by the researchers/consultants or whether they could be used as a decision support system/ES by the actual decision makers.

The final Eclectic site evaluation matrix contains a very concise pack of various kinds of information, and its major advantage is of course, its clarity. As such, its face-validity is high, and as it was mentioned in the paper, it can be used in a very flexible fashion to incorporate the different aspects deemed important e.g. by the investors and public policy decision makers, regardless of the level. The techniques enabling this flexibility is clearly described, the principle of which is also very simple. This is a good feature, of course.

As a final comment, the flexibility of the later stages of this method could paradoxically, be considered as one of the most important limitations of the method. Based on the presentation at hand, one can get the impression, that the method may even be treated with too much flexibility - i.e. basically same input values (which were treated and manipulated in many stages and steps before they could be consumed by final matrix) could result in dramatically different rankings of the alternatives if and when the internal weightings be changed. And when talking about the weightings, the crucial point does not have to be the weigh of the neutral value, but the internal weightings between the + + and the + values - this difference may have a far greater impact on the outcome.

This leads us to the notion of the high face-validity, and the difficulty of an 'outsider' (i.e. outsider to the model structure), decision-maker he or she may be, to determine what is the effect of changing the final weightings on the outcome. And how does the entire picture change, when all of the alternative locations go through the same process described in chapter 4? When qualitative aspects are taken into consideration and difficult-to-measure (not to mention difficult-to-prognose) environmental impacts are integrated into the model the list of top-four or top-three may look quite different than it did after the first two stages.

Nevertheless, the method appears to be a flexible tool in drafting feasible reasoning for alternative terminal sites, where traditional location evaluation methods are complemented by and integrated into a single and very ambitious approach. As a result, a highly versatile and flexible method is being developed, flexibility of which is probably its best feature. Paradoxically an unpremeditated

or concealed way to exploit the flexibility of the method may also be the greater barrier for its users to produce trustworthy results with this ambitious approach.

GROWTH PROSPECTS OF HIGH-SPEED CAR-FERRIES UTILIZATION ON EUROPEAN SHORTSEA ROUTES

By J.P. Dobler

Commentary by K.W. Braun

I agree on the main particulars of the above paper while I would like a more operator/customer oriented view of the fast ferry business. These are the people to convince. I disagree on some important details e.g. the description of the hull forms and the related advantages and disadvantages.

As I understand the peculiarity of the "wave-piercing" catamaran it is not the central Vee-bow adding buoyancy in waves. It is the extreme slender hull form piercing *through* the waves to improve its seakeeping while minimizing vertical accelerations.

Concerning the SWATH it is wrong that this is only an interesting concept for a cruise ship. There are already existing designs on the market which directly compete with other type of high speed ferries. The overall economy is within the range of comparable monohulls and catamarans.

The challenge for the fast ferry designers is to significantly improve the ride quality of their vessels. Much has been achieved by fitting Ride Control Systems to minimize a physical disadvantage of most of the high speed ferry designs. From its basic design idea only the SWATH offers excellent seakeeping *without* the need of fins. The graphs shown in Annex 1. are taken from existing vessel in the United States and eliminate the different methods of data calculation and presentation.

The shown criteria *reliability* in Table I does not belong to a specific fast ferry design. It belongs to the design capabilities and craftsmanship of the yard. A regular service and maintenance is essential for the success of the vessel. Therefore downtime must be reduced to minimum. This has to be taken into consideration by the yard in the design stage of a project. Good craftsmanship reduces the need for later repairs and downtime as well.

Also the shown criteria *strength* of the hull is not vessel type specific. Whatever type of vessel built this must be done in accordance with existing regulations. The regulations for the hull strength are normally given by the relevant classification society. This guarantees enough strength to the hull and is not a criteria related to the type of high speed vessel.

The criteria *limited draft* is varying from vessel type to vessel type considerably. On the other hand the suitable European shortsea routes for passenger/car HSC

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services identified in Table II are not exceptionally shallow. Even the Stena super ferry is not excluded from the listed ports due to its draught of 4,50 m.

If we are talking about fast ferries we should not only look at the speed of the vessel itself but also to its ability of fast loading and unloading. This is essential for a reduced overall voyage time. On a 50 nm route a speed difference of 5 kn is equivalent to 10 minutes in steaming time. This shows that the advantage of high speed can easily be lost if the port turnaround time is not kept to an optimum. In the criteria of fast loading and unloading existing high speed monohulls have a decisive disadvantage against the beamy catamarans offering wider gates for reduced turnaround time in the harbor.

Taking all this into consideration the table I of the presented paper should be well thought about.

It should be taken in consideration that also more conventional type of ferries having the ability to offer higher speed. An order just received from Greek owners having 5240 tdw and a maximum speed of 27 kn.

Coming to paragraph 3 of the paper the author had a close look to the cost advantage of the high speed ferries. But this is only one side of the medal. On the other side there is the income situation of the operator. At the moment the bread and butter business of most of the operator relies very much on the year round transportation of trucks. As an addition there are passengers and their cars with extreme seasonal variations. From these passengers most of the income is given by the onboard sales. Duty free shopping and restaurants. A high speed ferry of today's type can not offer this wide range of transportation abilities and income.

The lookout into the future gives a different picture. Within the EU the duty free sales are more and more restricted and will be stopped in the year 2000. This will change the income situation of the operators. Rough cost estimations show that a cargo spilt might be the answer to these changes. Trucks and heavy cargo will be transported on more conventional trailer-ferries and passengers and cars on the fast ferries. In this case the operator will not lose his best clients, the trucks, and can offer an attractive, flexible and economical high speed service to the passengers and their cars.

Conclusion: There is not the only type of high speed vessel type to meet all requirements best. The operator must carefully evaluate his needs. The vessel must fit in his route profile. Factors e.g. numbers of passengers, cars and trucks as well as route length, weather conditions and harbor facilities have to be taken in account. On some of the listed routes in Table III this might lead to an introduction of a high speed ferry service.

FUTURA - A FAST RO-RO SHIP FOR MEDITERRANEAN COASTAL TRADE

By G. Trincass, C. Closca, R. Nabergoj, J.S. Popovici

Commentary by B. Heynen

The paper deals with the problem of introducing a ro-ro-trailer ship which is commercially attractive and at the other hand in compliance with modern requirements on safety and port-to-port service. Important targets are high speed, reliability in time schedule, major safety with respect to environmental risk, comfortable accommodation and frequent and safe service with reduced variable (operational) costs. The authors believe this element will convince drivers and forwarders to prefer coastal transport.

Different types of ships are discussed in detail from the point of view of an engineer. The paper focuses on the Italian situation and contains essentially engineer-technical arguing about the quality of the ships.

The main hypotheses of the paper is the attraction of speed. "Our basic assumption is that speed attracts cargo in the waterborne transport domain. Service quality is mainly related to a fast transit time." (title 4). This statement is over-simplifying reality because the attraction of shortsea shipping is determined by a combination of factors (of course including speed as one of them), cfr. e.g. the discussion of Horst Linde: "Status and Perspectives of Technological Development in European Shortsea Shipping" at the first Roundtable conference or N. Wijnolst et al. "Innovation in Shortsea Shipping Self-loading and -Unloading Unitload Systems", Delft 1993.

A similar simplification is made when the authors are trying to introduce an economic model. Although every model has to simplify reality to be manageable, in this paper the authors are going too far. They want to prove the economic feasibility by introducing in their calculations economic parameters to describe the commercial exploitation of the new kinds of ship. In the authors' words: "Decisions on geometric design parameters affecting technical factors are based on search for maximum economic benefit". A straight-forward RFR-equation (required freight rate) is introduced as a function of the capital investment (with a profit rate of 13%), the number of RHU's the annual operating costs and the annual voyage costs.

Not included in the model but essential for successful implementation of the idea are the 'transition costs' towards the new situation, which have to be included in the RFR-equation. Operators will only change if a substantial 'value added' can be obtained, which implies a supplementary cost for the maritime operator. Not including this cost in the model implies a substantial underestimation of investment costs and therefore an overestimation of the economic feasibility of the ship.

Another objective with regard to the paper is the underlying assumption of 'corridor-independence' of the ships. This assumption appears more and more clearly not to be true. In general one can say that the attraction of a corridor is determined by the 'speed of the alternative on land', which depends on a lot of circumstances not depending on the corridor. Therefore the Italian situation cannot be generalised as such.

Summarising: the strong point of the paper lies in the technical-engineering approach, the weak point is the economical feasibility study, which needs to be refined to guarantee a successful introduction on the market of the new types of fast ships.

ARE RORO FERRIES SUBSIDIZING LOLOS

By E. Heirung

Commentary by F. Suykens

It cannot be the purpose of my remarks to discuss in detail the figures which Mr. Heirung quotes on port dues in the port of Oslo. I am not aware of the detailed location of the terminals which are described nor of the investments needed in quay walls or road and rail links.

However, take the example of a freight only container terminal and a passenger/a passenger ear/selfdrive RoRo Ferry terminal. It is very difficult to compare a ton of passengers with a ton of containerised cargo certainly when a tariff is calculated as is often the case in shipping. I do know that some ports have lower port dues for RoRo vessels than for LoLo vessels.

1. Recently Mr. Per Jessing from the Swedish Shipowners Association stated at the Seatrade Tanker Industry Convention (September 1983):

"Rule number one for all tariffs must be to find a base free from any possibility to be misunderstood, misinterpreted or cheated with. Gross or net tonnage calculated according to IMO regulations or cargo tons or vessel dimensions can be used."

All port authorities will agree with this statement. Port dues should be easy to calculate and still easier to control. Possibilities to cheat could be avoided.

2. Port tariffs cannot be based on the *direct cost* which a single ship or even a specific regular line occasions to a port authority. All kind of services and overheads have to be paid for.

In part tariffs are also *market oriented*, which shipowners call "what the traffic can bear". Competition with other transport modes or other ports can sometimes play a role.

Very often port tariffs have a long history and cannot be easily be changed. Mr. Jessing in his paper said: "Besides being complex there is an inherent resistance against changes in Tariff structures."

Since the times of sailing ships, there has been in Antwerp a special tariff applied when a vessel called 10, 20, 30 or 40 times in the same year. When we studied the possibility to abolish it, we noticed that it would have been harmful for short sea shipping which would have been penalised. So the tariff has been maintained.

Since time immemorial ships could stay for up to one month in the port of Antwerp after having paid the harbour dues. When we decided to bring it down, we found out that rarely vessels stay longer than 48 hours, not because of port dues but taking into account the value of time for modern vessels. Moreover, if the system had been changed, vessels with Antwerp as home port would sometimes suffer. We decided that we should neither favour, nor punish the national carriers. Nor did we want to penalise vessels with charter problems.

Most ports can show similar experiences which are often market oriented or due to local circumstances and which are difficult to change.

3. It is difficult for a port authority to take into account the earning capacity of vessels. We have no idea if a huge container vessels or a big bulk carrier earns or loses money.

When ship sizes increased some port authorities decided to base their port dues no longer on the gross tonnage alone of vessels but also on the volume of the cargo loaded or unloaded which favours regular lines with part cargoes.

At the same time a solution was found for the problem which Mr. Heirung mentions of deck cargoes which can be bigger for LoLo vessels than for RoRo vessels and for which port dues also based on the volume of cargo handled play a role.

4. The measurement of sea going vessels was always a difficult matter.

When in 1948 the Oslo Convention was signed many countries objected as GRT and NRT did not have a reliable link with the transport capacity. Belgium e.g. introduced the Belgian Net Tonnage which was between 18 and 20% higher than NRT.

It took some 20 years to come up with the 1969 London convention. In contrast to what Mr. Heirung suggested in his paper port tariffs played an important role in the discussion, where some of the major problems were the open shelter deckers and the paragraph vessels.

The 1969 convention came into force 24 months after 25 countries with a minimum of 65% of the world's gross Tonnage had ratified the convention. This was the case on 18th of July 1982.

All new vessels built after this date or those whose ownership changed etc., had to apply the new "universal measurement".

Existing ships could keep their old tonnage and the financial advantages attached to it during a transitional period of 12 years i.e. up to July 1994.

The existing ships who had an advantage in changing to the new measurement (tankers, bulk carriers) changed of course immediately to the new tonnage.

The difference between the old CRT and the new GT (U.M.) could indeed be very big for those vessels where GRT-measurement was in no relation with outside measurements of the vessels.

* E.g. car carriers had a low measurement deck and as a consequence a vessel like the p.c.c. Othello built 1992 had according to the Oslo Convention of 1948 a GRT of 18.242 and according to the London Convention a GT of 52.886 or 2,9 times.

  The Nissan Bluebird (built 1989) measures 12.647 GRT and 39.948 GT or 3,16 times.

  For this reason a transitional period was introduced in some ports like Rotterdam and Antwerp where - by means of a 10% increase per year - the gap between vessels with different tonnage was closed.

* E.g. shelter deckers very often had a twice as high tonnage under GT than with GRT.

* E.g. single decks/general cargo paragraph vessels of 499 GRT saw their deadweight grow from 702 tons in 1961 to some 1.600 dwt or even 2.500 today.

Vessels of 999 GRT had a dwt of 1296 tons in 1970 and as a rule a dwt i.e. carrying capacity of 2.500 dwt today. The same relationship can be found for vessels of 1.599 GRT and 1.999 GRT. They kept their low tonnage, but their length and beam increased as did their carrying capacity. The tax evasion could indeed be very big.

It is clear that:

* Older vessels have benefitted for up to 12 years from port dues which were too low;

* There has been unfair competition between new vessels built since 1982 and which had to pay the higher dues and the older ones which during the transitional period had a competitive lower tonnage;

* There cannot be any windfall profits for the ports who on the contrary will receive from 1994 on what they normally should have been receiving before and they indeed received from the new vessels built over the last 12 years. Moreover ports had windfall losses when bulkers/tankers changed to GT;

* Some countries and ports do no longer believe in tonnage as an expression of the carrying capacity of vessels and they consider the possibility of adopting the French system of volume, i.e. length, beam and maximum draft.

5. The situation is not made any easier now that under the joint efforts of Intertanko and the European Commission an IMO recommendation for SBT tankers might become compulsory in the EEC.

Once again the shipowners try to get "exempted spaces" and the basic principle of GT and "universal measurement" is lost.

SBT tankers fetch as a rule a higher freight rate than non SBT as the oil majors prefer the charter only SBT tankers.
Non-SBT tankers are a vanishing type which will have completely disappeared early in the years 2000.

Not one shipowner will change his ship from non-SBT to SBT because port dues are lower, giving a reduction is an inefficient measure. A real effective measure would require that a higher rate is applied for those tankers which are not environmental friendly instead of lowering the tariff for those vessels who follow the rules. Therefore ESPO always stated that there could be a differential but not a reduction of tariffs.

Does Mr. Heirung realise that instead of having cost based port tariffs he might find the ports obliged to raise their tariffs on other vessels in order to compensate for the 20% reductions which the commission services propose for SBT tankers?

Last but not least Mr. Heirung Jessing insisted that there should not be a possibility to cheat and indeed in the port of Rotterdam they found that some 40% of the SBT tankers used their SBT to transport crude oil.

Port dues are in the competitive environment in which we live already a too complicated matter. We should stick to GT-universal measurement and avoid to have special tariffs, under the influence of different lobby groups.

SAFETY IN A MODERN PERSPECTIVE

By J.A. Stoop

Commentary by K. Giziakis

Dr. Stoop has written a very interesting paper giving a good overview of the current state and future planning considerations regarding safety of the seaways and near port area of Rotterdam.

The author explains the advantages for shortsea shipping in comparison with other modes of transport. To maintain these advantages, he suggested a development of a safety management policy. The safe and sound passage has been kept by Pilotage and VTS. A number of developments will pose problems on the future of existing systems with respect to safety. Experience in aviation and railways has indicated that safety must be taken into account when mainports and transportation corridors are designed..

The author explains the concepts of "Mainport Rotterdam" and "The Netherlands Distributing Country". Both these concepts are needed in order to understand the situation and the policies of transport infrastructure.

Rotterdam, "The door to Europe", is one of the most important entrances to Europe. The author has defined "mainport" characteristics such as: (a) large-scaled activities, (b) tightly coupled logistic chains with a complex interaction, (c) multimodal nature, (d) support by high-tech applications, (e) complex decision making, (f) integration within regional development and planning schemes. This "mainport" concept needs huge investments under conditions of environmental and qualitative demands. The author has suggested that the manager of the infrastructure has to put constraints on both, the customer and the user, in order to optimise the return on the investments. As I understood, this means that our needs for investment determines the pricing policy. This might have some bad effects on the competitiveness of hub in the long run. Instead the market must be the leading force to determine the amount of investments. The government has followed the market approach as the author has described.

In the mainport concept, the author very clearly has defined the developments which have an influence on safety aspects. First is the need to maintain traffic flow under all circumstances, that is poor visibility, strong wind etc. Second, the traffic intensity is increasing and the probability of accidents is bound to increase. Third, tight coupling and the number of stakeholders require a stricter control of dispatching. New co-ordination bodies have to be formed having safety as an integral part up to the highest managerial levels.

The second concept "The Netherlands distributing Country", has concentrated on government policies in the light of the development of the Netherlands as a distributing country in Europe without borders. He tried to identify where safety stands or must stand in the new infrastructure design. The private sector, the state and the private sector again (when?) have interchangeably passed the control of Pilotage and VTS from one to another. Consequently the authority for

safety management has been changed. The author thinks that these changes, especially the right of unpiloted passage, might deteriorate the safety aspect. This seems reasonable from a theoretical point of view, but it would be preferable this to have been proved by some data. The cost-effective method of control could be verified by analysing accident costs data against investment and pilotage fees.

A picture of the current operational practice has been presented by analysing accidents. From the data of Table I the author has concluded that the majority of the vessels involved in accidents belong to smaller vessels. One can argue that it would be better to have the no. of accidents/no. of passages of each category. This could help us to compare category of ship sizes with each other. A second argument for these raw data was that there has been an increase from 24 in 1989 to 34 in 1992. This seems to support the claims of the author. If we consider the no. of accidents/total no. of passages, one could have seen where the safety of the system stands. Suppose there was an increase in traffic flow by 10% followed by an increase to accident by 5%, then the overall probability of accident would have fallen.

In Table II, selected accidents from several places are shown for collisions and strandings with and without pilot. The author has concluded that "to leave smaller vessels unpiloted in waters relatively unknown to them is not without consequence. One could argue that in order to make the above statement he total number of passages with or without pilot must be known and not only the number of accidents.

The author presented results from another analysis on "evaluation of the operational benefits - design and assessment of vessel traffic management systems". The operational benefits summarised as follows: (a) fulfilling horizontal and vertical navigation requirements (b) participation in a simple of complex traffic situation and (c) keeping the uncertainty of the navigation and traffic participation within acceptable limits.

As a conclusion, he has mentioned "the installation of VTS and pilotage have positive effects on the traffic flow safety". Technological improvements to infrastructure and equipment do no automatically bring safety improvements. from passed experience of air traffic control, for instance by the introduction or remote pilotage, he has identified four reasons why this happens. The author explained comprehensively these drawbacks. I think this is a very important part of the paper and anybody who will try to improve safety standards by automation and new investments must take into consideration these drawbacks. The consideration that the slogan is no longer "safety first" but "safety too" was very true. The entrepreneur's view has been always "safety too" instead of "safety first".

One should agree that operational cost-benefit considerations should be carefully made on the weighing of safety aspects against costs. The author has concluded "the most promising gain in safety lies in the design, management and organisation of mainports and transportation corridor concepts including high quality standards and qualified crews.

The author must be congratulated on the thorough and comprehensive theoretical approach to safety. In my opinion, I would rather see some more data supporting the theoretical approach to safety. It is very important for us to understand the successes and failures experience of the leading port of Europe.

THE SINGLE MARKET AND THE REMOVAL OF OBSTACLES TO THE GREATER USE OF SHORTSEA SHIPPING

By F.M. Everard, C.P. Boyle

Commentary by E. Fritzsche

As representatives of the European Shipowners' Association ECSA and the British Chamber of Shipping, the authors are members of the MIF Panel 1 and first-rate authorities on the subject. They have rendered outstanding services in examining the logical connection between numerous European measures, programs and individual actions for a merging single market and assessing their probable effects on Shortsea Shipping.

It must first be assumed that the advantages of the single market will be of equal benefit to all sectors of the European industry, thus also to all carriers. The agreed general conditions are to permit fair competition. In the concept of the Common Market there is no room for preferential treatment of some sectors - such as the shipping sector - by subsidies or other measures as compared to other carriers and vice versa; however, this does not exclude the consideration of important political aspects such as questions of environmental protection.

According to the intentions of its initiators, transportation together with energy and telecommunications is an element within the program of the Transeuropean Networks which is to encourage the merging of Europe. Rightly, however, the authors doubt that this program will have a favourable effect on SSS. It is rather to be expected that the concentration in economic conurbations will increase since the required profitability can be achieved, last but no least, by 'Economy of Scale'.

The authors expect an impetus for SSS neither from the Transeuropean Networks nor from the probability of fair, well-balanced interventions in favour of the shipping sector. Logically, the second part of their paper deals with the remaining possibilities left to the industry and the government to extend the market share of SSS.

Costs at the ship/harbour interface normally amount to more than 50% of the freight costs (waterborne freight), i.e. this is the point where attractiveness and competitiveness of SSS must be increased.

With regard to harbours, the authors define clear requirements which should be complied with - if necessary, with government assistance. This meets with my full approval.

Active marketing is an essential approach to be used by the industry for shifting goods transport from road and rail to the ship. Most certainly, there are further

possibilities to be exhausted in this connection. However, the best marketing efforts will remain ineffective if there is a discrepancy between the profile of services offered and the requirements of the transport market.

There is no doubt that SSS offers advantages in many fields. However, up to now, these advantages were not enough to even only stabilise its relative markets share as compared to road transportation.

I am convinced that this will not change if the industry's efforts are limited, on principle to improving or improved marketing of existing conventional SSS. This trend can only be changed if completely new concepts can be thought up and introduced. In this connection, I am thinking, for example, of studies on a coastal traffic system along the east coast of Sweden.

Finally, I should like to thank the authors for their excellent paper. With their sceptical - or should we better say realistic - view they prevent too high expectations. Much remains to be done and 'staying power' will be required before the aim of shifting an important share in the volume hitherto transported by road to SSS is achieved.

CONTAINER TRAFFICS IN EUROPE - CHANGING PATTERNS AND POLICY OPTIONS

By P. Sutcliffe, M. Garratt

Commentary by P. Marlow

This paper derives from various studies performed at different times over a ten-year period. During this decade [1982-1992] there have been many changes [political, economic, and physical] which have influenced the nature and pattern of container movements in Europe. This paper is therefore a timely contribution to the current scene and has two objectives.
The first is to suggest a methodology for the creation of a relevant database and then to comment on the structure of the market and the nature of the traffic flows. The second is to produce a short case study of the Atlantic Arc market.

The first part summarises various trends in the European Container Market and illustrates some of the contrasts within it. It will be argued elsewhere in this conference that policy recommendations require more reliable market data; the unreliability is generally caused either by gaps in the data or by inconsistent statistics from different sources which then require reconciliation of the different estimates. This paper has attempted to provide part of these data and, furthermore, to establish a methodology by means of which such data can be obtained in the future. The authors suggest in general terms how the data can be applied to policy options.

The second part of the paper examines some of the factors behind the contrasts outlined earlier and discusses whether regional ports have a future in the liner trades. The authors argue that the success of such regional ports relies on the development of a maritime network corresponding to the principles described in EC directives concerning combined transport i.e. a network which would provide a unit load shipping service within 150 kilometres from most origins, and long distance maritime routes to provide for a variety of destinations on a regular basis.

However, this paper has raised several issues or questions in my mind:

* When the authors state that overland routing is more expensive than direct shipping, how are they measuring the costs involved? Are they referring to the direct shipping costs (i.e.. freight charges) or to the more useful (in a logistics context) generalised costs? Efficient supply chain management requires the transport manager to effect trade-offs between the different elements of the supply chain. One such trade-off is between cost and time and it is, of course, possible to pay higher freight charges provided there is compensation, shorter time journeys and lower inventory costs, elsewhere in the supply chain. In multimodal transport operations

the generalised costs of freight transport are often considered more relevant.

* The authors state that port charges vary widely and discriminate against longer shipping routes: while historically this has often been the case must it necessarily continue to be so?

* The Atlantic Arc study suggests that freight forwarders appear to require service frequencies of three times a week but, again, logistics trade-offs and levels of service arguments might allow less rigidity here. Reliability is perhaps more important than frequency and forwarders should aim to provide the service levels needed by their clients.

* The authors claim that maritime systems could offer competitive transit times but it is unclear whether this refers solely to port-to-port times or includes the inland distribution aspects. The volumes of traffic, particularly from Spain and Portugal, are increasing but are very unpredictable and seasonal and are probably not sufficiently attractive to shipping companies. The origins and destinations, particularly in Spain are very dispersed and this adds distance to movements of freight. The increase in total travel (distance and time) is greater for dispersed than for concentrated areas, hence road transport is often chosen. The maritime industry will need to break down this preference if short sea shipping is to be preferred.

Under the heading Network Options the authors then examine four different approaches which they feel could address the issues raised. They suggest:

* Using small ships;
* Adopting a multiport approach;
* Developing new super routes; and
* Trans-shipment of cargo;

but then discount these in turn for reasons of being non-commercial, uneconomic, high port charges and lack of appropriate infrastructure and an inability of the shipping industry to provide the degree of co-operation necessary for trans-shipment to work effectively.

The conclusion from this case study is that existing ship technology can provide a cost effective and rapid level of service and that the problems lie not with the vessels but with the ports (and their charges) and the structure of the maritime industry. The real challenge seems to be to develop a more flexible short sea industry governance.

STRATEGIC PROFILES FOR TRANSPORT COMPANIES: THE CASE FOR DUTCH FOREST PRODUCT CARRIERS

By A.A.C.M. Wierikx, J. van Riet

Commentary by A. Verbeke

The paper by Wierikx and van Riet describes the TOVER-method for the assessment of strategic opportunities for transport companies, especially in the maritime sector. The forest product carriers are taken as an example to demonstrate the relevance of the framework. The TOVER-method is based on Porter's framework of generic strategies (1980) and Ansoff's concept of strategic positioning (1984).

The TOVER-method represents a method to evaluate the competitive environment in terms of identifying and exploiting external opportunities. The approach consists of five sequential steps:

* The definition of the relevant market;
* The determination of the current position within this market in terms of activities and relationships;
* The analysis of the external circumstances;
* The determination of strategic opportunities for improvement of the current position;
* The determination of strategic opportunities for expansion of the current position.

Unfortunately, the identification and exploitation of external opportunities, and a Porter-Ansoff approach to strategic positioning, can hardly be viewed as a tool to improve the competitiveness of shipping companies. In my view, any strategic management analysis should focus first on the internal strengths and weaknesses of those companies. In other words, the first question that needs to be answered is how transport companies can strengthen and further develop core competencies that will allow a favourable competitive positioning in the market, see Rugman and Verbeke (1993).[1]

Hence, if the market is analysed to evaluate the current competitive position of specific shipping companies, the focus should not be on a description of the external environment, but on the match between core competencies and market demand.

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[1]Rugman, A. and A. Verbeke, *"Global Competition Beyond the Three Generics"*, Greenwich, Conn.: JAI-Press, 1993

However, the evaluation of the market in the TOVER-model is limited to an analysis of external conditions without looking at internal capabilities. In my view, competitive advantage will not be obtained by pursuing one of Porter's generic strategies, or by, e.g., operating in a particular geographical market and controlling a complex logistical network, but by the capacity to develop and leverage core competencies that match the requirements of the market.

When the market is viewed from a purely external perspective (as is done in the TOVER-model), the causes and effects of competitiveness get confused. For example, the geographic scope of a firm is a consequence of particular core competencies of that firm. It is obviously not a particular geographic scope that in itself determines the competitive position of a transport company. The geographic scope only indicates the boundaries of a market segment in which a specific company competes. The presence or absence of core competence will determine whether that company can be competitive within these geographic boundaries, and how the geographic scope should be adjusted in the future.

Similarly, the pursuit of a particular position in a network cannot be dissociated from the core competence of the firm involved.

I fundamentally disagree with the cycle of continuing strategic improvements proposed by the authors, because the suggested changes in generic strategy, to be followed by more fundamental changes in geographic scope, network characteristics and logistics, actually seem to occur independently of a firm's capabilities.

For example, as regards logistics, transport companies may approach markets in two ways, depending upon their core competence to meet market demand, see **Figure 1**. Customers for logistical services may require either pure transport services, or more value added services. In the first case, the customer is only interested in a specific transport service, provided independently of other logistical activities. In contrast, in the second case, the customer requires a full door-to-door service, with additional value added activities. Here, the transport company may have to integrate its services into the customer's logistical chain. In both cases, an improvement of the competitive position of the transport firm crucially depends on the availability of core competence. A firm in quadrant 1 will do very well, but a firm in quadrant 4 will perform poorly.

The approach of the logistical chain cannot be dissociated from the internal strengths of the firm, which need to be matched by customer demand. This is very different from the proposal of the authors, who seem to believe that transport firms can freely chose where they will position themselves regarding the provision of logistical services.

To conclude, any proposal to improve the competitive position of companies in the maritime sector requires an in-depth SWOT-analysis (strengths, weaknesses,

Availability of core competences \ Approach of the logistical chain	TRANSPORT SERVICES	VALUE ADDED SERVICES
STRONG	1	3
WEAK	2	4

Figure 1: A strategic analysis of the logistics services provision

opportunities, threats). It does not suffice to perform an analysis of exogenous market opportunities, without a serious analysis of internal core competence. Such a SWOT-analysis approach was adopted in the corridor study Commissioned by the European Union in 1993.[2]

[2]Policy Research, *"Analysis of the Competitive Position of Short Sea Shipping: Development of Policy Measures"*, August 1993.

INTEGRATED TUG-BARGE SYSTEMS FOR SHORTSEA SHIPPING IN EUROPE

By E.G. Frankel

Commentary by J. Igielska

The author has summarised application of the integrated tug-barge system in American coastal shipping as well as in Far East trades. The experience, financial advantages and analysis of technical performance of the systems are valuable and provide good material for consideration of similar system for European shipping.

Short sea shipping is gaining importance as an alternative transport system in Europe. The main reason for this attention is that the road and rail infrastructure will not be able to accommodate the expected 40 - 50 % increase in transport volume from now until the year 2000.

Another important consideration is the increasing concern for the environment.

Within European short sea shipping, 800 million tonnes of cargo has been transported in 1991 as compared with 300 million tonnes of coastal and 500 million tonnes of inland sea transport. European river and canals connect the North Sea with the Black Sea through the Rhine-Danube system. Many other inland seaways provide possibilities for direct shipment of cargo from Scandinavian countries to central Continental Europe.

Low-profile, shallow draught vessels are specially designed for river and coastal water navigation. These vessels have restrictions on their main dimensions and their capacities vary in a range from 1500 to 4000 DWT, depending on inland waterway access.

The push-barge system is also often used for transport of bulk cargo as well as containers, trailers, cars, and other break-bulk cargo. The barges are pushed/towed in sets of two to six units. Barge dimensions vary, but barges of about 76 m x 11.5 m x 4.00 m are representative in the European inland sea ways.

Professor Ernst G. Frankel has written a very interesting paper. His suggestions should be especially considered today when efforts are being made to find suitable transport systems at the lowest possible costs, and bearing environmental requirements in mind.

I definitely agree with the author that within European trade, the tug-barge system would find wider application because of cost advantage over road and rail transport.

Direct transport of cargo by barge system from Scandinavian countries to factories situated close to inland waterways on the European continent would cut total cargo handling time and costs. The barge system should not require handling of cargo from short sea to river transport systems.

The author concentrates on larger barge units than those which could direct trade cargo from coastal terminals to river ports. The system presented has definite advantages, especially for shipping bulk cargoes, which do not require short transit times. Suggested utilisation of bulk barges for empty container

transport in the return direction improves the economy of the system. The only question is whether a sufficient volume of the return cargo would be assured and thus pay back the extra capital cost of this double purpose barge design. I also agree that transit time is very important in short sea shipping and much effort is invested in improving ship scheduling and routing as well as in decreasing port time as much as possible. One possibility for the time being is to offer transit time of maximum two days from a factory in Sweden to a user in central Europe. This would require introduction of fast ships at more than
30 knots speed. It is obvious that cargo which has to be transported in a very limited time is valuable cargo and can not be regarded as suitable for shipment by barge systems. But there will always be a need to transport bulk cargo for which low transport costs have higher priority than short transit time. For this trade return cargo is important and double purpose barges could be considered.
It can be pointed out that about 95 % of exported and imported cargo to and from Sweden is transported by sea. It is not clear how much of this cargo requires fast shipment, but it is obvious that a huge volume would be considered suitable for tug-barge trade.
Considerations of weather conditions, sea state and heavy ice are very important for trade in the Scandinavian area. High ice class requires extra power of main propulsion as well as hull reinforcements. These increase the capital cost of the system. Trade in icy conditions has impact on notch and tug-barge coupling.
I must also mention that a similar system has been used for trade in the Baltic. The system consisted of two pushers and five open type barges, each with a capacity 12650 DWT. The pusher was connected rigidly to the stern of the barge by means of one fixed and two hydraulic hooks. The rigid coupling system meant that pusher and barge could be considered as a single unit.

This system required some ballasting for empty or light-load voyages, and therefore the barge had a ballast water capacity of 12500 cubic meters. The pushers and barges were built to Finish-Swedish ice class 1A Super for year-round operation in the Baltic without the need for ice breaker assistance in level ice conditions.
The pusher unit was of 41.7 m overall length, 15.5 m breadth and a design draught of 6.5 m. The propulsion machinery consisted of two medium speed Sulzer 6Z A1 40 diesels, each rated continuously at 3840 kW drive through reduction gearing to a CP propeller. A 900 kVA diesel generator was driven via a power take-off from the reduction gearing. Power from this generator was supplied to a 680 kW electric motor which drives a CP bow thruster in the barge. The barge had a overall length of 159.1 m, a breadth of 27.2 m and a draught of 6.5 m. The speed at this draught was in the range of 14 knots. The hold was fitted with a high coaming. The barges were also fitted with side ramps for roll-on / roll-off cargo handling.
The main purpose of the system was to transport coal and coke from Polish and Soviet ports, timber from the southern Baltic, limestone from Gotland and iron ore from Luleå (Sweden). The system was introduced into operation in 1987.

Unfortunately, there was an accident a couple of years ago owing to shifting of bulk cargo when sailing in severe weather conditions. One tug-barge set was lost. No further details of the accident are available at the moment.

It is not my intention to point out that this system has any critical disadvantages in Northern European trade, but only emphasise that special attention should be paid to the system performances designed for trading in areas with frequent bad weather conditions and low temperatures.

THE ECONOMIC AND SOCIAL IMPACT ON GREEK PASSENGER COASTAL SHIPPING OF THE FREE MOVEMENT OF MARINE LABOUR IN EUROPEAN UNION

By A.M. Goulielmos, M. Milliaraki

Commentary by K. Köster

The paper discusses the impact of the principles of free movement of workers, i.e. seafarers within the European Union and specially their right to work on-board Greek vessels. Greek Coastal Passenger Shipping is a strong cartel-like formation in Greek coastal shipping, largely endorsed by the government and strongly supported by member shipping comanpies. It is excluded from the free movement of entrepreneurs up to the year 2004 (cabotage) so the question of the paper is whether this sector, too, is excluded from the free movement of seafarers and, if not so, what will be the effects of such a free movement of EU-nationals onboard Greek coastal passenger ships.

The legal background within the EU and Greece is discussed at some length with the main conclusion that seafarers, nationals of a memberstate of the EU, are entitled to seek employment onboard Greek coastal passenger vessels.

The sociological part of the paper discusses the problems of multinational crews, possibly overstressing "the heterogenity of the seamen's social group will create - in our opinion - many problems and difficulties." Multinational crews may be a novelty to Greek coastal passenger shipping as shipowners were obliged by Greek law to employ only Greek nationals, but it is everyday life in international shipping and seafarers learn to cope with it.

The main contribution of the paper is the elaboration of the legal and sociological framework of free mobility of seafareres within the EU. But there are other than legal impediments for the free movements of workers: There is more movement of workers in the US than in the EU due to a common language, uniform recognition of qualifications and a largely common culture. What is not considered at all are the restrictions to the mobility of EU-seafarers (especially officers) resulting from the existence of different manning systems, I.e.:

* Dual purpose (polyvalent) officers in France recently in Germany, too;
* General purpose ratings and dual-purpose officers;
* Conventional manning systems based on department divisions.

Quite apart from national certification requirements, these differences in manning systerms restrict the mobility of EU-seafarers, especially officers from one country and system to another. A drawback of the paper seems to be that it overlooks that there are two parts to recruitment and thus to mobility of

workers, i.e. the occupational choice of the individual and, on the other hand, the selection by the employer. The second part has not been touched upon.

As long as EU-seafarers are paid higher wages in their home countries compared to Greek vessels there will not be much moving of seafarers from the northern Member States into Greek shipping and thus the economic impact on Greek coastal passenger shipping will be very limited. But maybe free labour mobility within the EU will result in Greek seafarers applying for better paid jobs aboard EU Member State vessels other than Greece and thus having a negative impact on the manning situation of Greek coastal passenger shipping?

To come to a conclusion there are many rights existing under EU law which people do not exercise. There is little to indicate that many seafarers have exercised their rights to move to another Member state, except where it is a neighbouring state or one with which they have particular links. The reasons for such a lack of mobility are manifold, but primarily revolve around the difficulty of finding a job, lack of mutual recognition of qualifications and certificates, resistance from unions in the host state and language barriers. This means after all that it is for the capital to go where is labour and not vice versa.

FAST SELFLOADING AND UNLOADING UNITLOAD SHIPSYSTEMS FOR COASTAL AND SHORTSEA SHIPPING: POTENTIAL IN NORTH-WEST EUROPE

By A. Sjöbris/N. Wijnolst/C. Peeters

Commentary by E. Declercq

This paper discusses the potential of innovative techniques for unitload ship-systems in shortsea shipping and their application to the so-called *port hopper network*. I find the approach used very interesting because the viability of the network is considered from an integrated multi-modal transportation perspective.

In the paper, the efficiency of loading and unloading facilities is not only assessed in terms of cargo handling-speed and other (technical) parameters as is frequently done in the relevant literature. On the contrary, the authors evaluate the introduction of new techniques using an integrated approach in which the viability of each new concept is related to the overall viability of the SSS-route. In addition, the potential integration of the new concept into existing multi-modal chains is taken into account by the authors.

Thus, any implementation of new concepts should be considered from an integrated perspective in order to assess their viability. On the one hand, this requires an evaluation of the implementation costs and the willingness of the sector to finance these investments (supply side). On the other hand, an assessment is necessary of the market need for these new techniques and the willingness of customers to use them (demand side). Such an evaluation should be performed using a comprehensive analytical framework. This is required in order to accurately assess the possible consequences of implementing new concepts from four different perspectives:

* *A market perspective*: creation of new markets versus. protection of existing markets;
* *A financial perspective*: effects on both upstream and downstream costs and benefits;
* *An inter-modal perspective*: impact of the new technique on cooperation (multi-modal integration) versus competition (inter-modal rivalry);
* *A policy perspective*: impact at the level of operations and strategy.

The integration of all these aspects in the analysis should allow an in-depth evaluation of both the short and the long term effects on the competitive position of SSS.

Such an integrated approach was initiated by the authors of the study, although an actual integration of all the elements mentioned above was not performed.

Consequently, several important elements (e.g., an in-depth study on the incentive to introduce innovations at the demand side) were only briefly considered.

As the authors correctly argue, in-depth research on the viability of new transportation systems should use integrated evaluation techniques from an inter-modal perspective. These techniques have to consider all relevant elements in the field of management, organization and system operations. The *port hopper system*, which was only briefly discussed in the paper, could be evaluated in a further step from such an inter-modal perspective in order to identify its real economic viability.

COMPETIVENESS OF SHORTSEA SHIPPING PORTS: THE CASE OF ZEEBRUGGE

By L. Maertens

Commentary by J.L.J. Marchal

The paper first summarizes the most important guide lines of the European Union transport policy, pointing out the need for a further development of shortsea shipping (SSS), inland navigation and different Trans-European Networks.

The medium sized port of Zeebrugge is then situated among other relevant ports in the Hamburg-Le Havre range. The importance of the port of Zeebrugge for European SSS and feeder traffic is clearly demonstrated : the port has an average annual growth of 10.5% (which is above the average in the relevant range) and the contribution of SSS represents 76.6% of total maritime traffic in the port of Zeebrugge.

In a next section, the advantages of the port of Zeebrugge are described. It is proposed that future developments for SSS at the strategic level should be oriented to the north, the Iberian Peninsula and the north of the U.K.

The impact of the Channel Tunnel on the port of Zeebrugge is also discussed. The rules to restrict road haulage, which are presently examined by the U.K. government, are one element that could reduce the impact of the tunnel. The author expects that the effects of combined transport will be more important for long-distance traffic than for short-distance traffic. He also claims that the port of Zeebrugge will be less affected by the opening of the Channel Tunnel than other ports, which are located closer to the tunnel.

Other elements that will affect the competitive position of SSS are also defined:

* Public policy makers recognize SSS as a valid alternative for road haulage;
* The introduction of innovative techniques in SSS will increase its competitive position;
* The overall commercial traffic in the E.U. will increase substantially.

Taking into account the elements described above, the port of Zeebrugge has to develop a strategic plan of action to maintain its leadership position. The author thinks that this plan should include the following elements:

* The improvement of infrastructure and superstructure to meet the specific requirements of innovations in SSS and cargo handling;
* The increase of port capacity;
* The decrease of port transit times by improving the port's hinterland connections;

* The prospection of potential markets, e.g., the Mediterranean market.

The paper of L. Maertens is an interesting contribution because it points out the main problems as regards the competitiveness of medium sized SSS-ports in the Hamburg-Le Havre range. The paper also presents some relevant ideas for the development of a strategic plan of action to maintain its competitive position in the relevant range.

THE FUTURE OF EUROPEAN POLICIES FOR SHORTSEA SHIPPING

By C. Peeters, A. Verbeke, E. Declercq,

Commentary by T. Wergeland

The paper falls into two main parts, one listing a series of critical factors that will determine the overall competitiveness of Short Sea Shipping (SSS) and one presenting 10 recommendations for an EU policy for SSS.

The paper is based mainly on work done by two consultant companies for the Commission in 1993 and is thus a paper presenting conclusions, rather than analyses. This makes it difficult to assess the importance of the many factors discussed, and even more difficult to form an opinion as to priorities of policy measures. The paper argues that all recommendations must be seen as a whole and what is really needed is to make a "Masterplan for Shipping in Europe.

Let me say initially that I like the idea of such a masterplan - it is on high time that Europe starts looking at the shipping sector with the same eyes and starts backing it with the same financial and institutional support as other means of transportation have received. Now is the right time for grand concentration on bringing the shipping sector into the total transportation picture of Europe. I could therefore comment on the paper very quickly by saying that basically I do agree with most of the recommendations. My role as a commentator, however, is to be critical and hopefully supplementary, so I hope I will stimulate some discussions with the following

I will first attempt at indicating the logistical perspective in which the future SSS in Europe must be developed. The rationale is to try and identify which logistical parameters that primarily determine the competitiveness of SSS. Then I will comment on the proposed policy measures.

A logistical perspective

In the mid 80s, the consultant company A.T. Kearney did a larger study on the development of logistics in various firms[1] and concluded that logistics rapidly had developed from being a question of reducing transportation costs for outbound goods to become a strategic issue in the more advanced firms. In **Table I** companies have been classified according to their logistical sophistication, with stage 3 companies having integrated their logistics into the overall strategies of the firms.

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[1]The Main findings in [Keurney, 1985] are summarized in [Kvinnsland, 1989]

Stage 1 Companies: Controlling outbound transport and warehousing
* Outbound transportation
* Intra-company transportation
* Finished goods warehousing
* Logistics systems planning
* Logistics control
* Logistics management
Stage 2 Companies: Logistics as an integrated part of the physical distribution proces
* Customer Service
* Order processing
* Finished goods inventory management
* Finished goods plant warehousing
* Inbound transportation
Stage 3 Companies: Logistics as a strategic function
* Sales forecasting
* Production planning
* Sourcing
* Raw Material/work-in-process inventory
* Logistics engineering
* International logistics

Source: [Kearney, 1985]

Table I: Trends in logistics

In **Table II** the likely development of the distribution of firms in the various stages is indicated. The estimates for 1995 are my own and should be treated with the necessary scepticism. The main point is, however, to indicate that the future plans of developing new transportation systems must fit in with the requirements of an increasing number of logistically advanced firms. Around 70% of the customers of tomorrow's transportation systems will require that such systems fit into their logistical strategies. Then it is not just a question of low transportation costs.
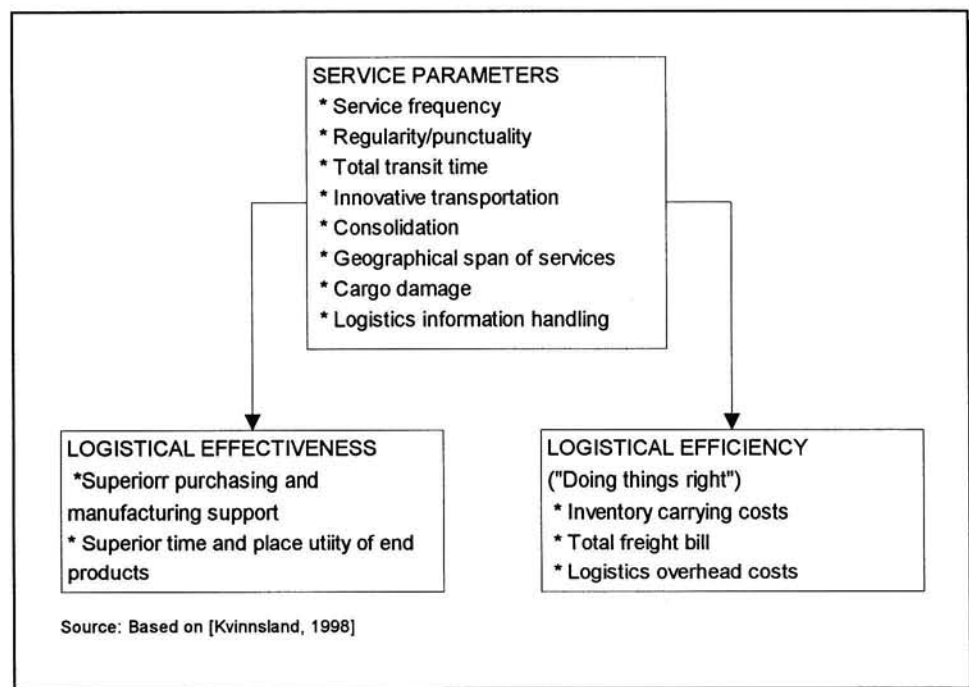
Looking closer at the characteristics of a liner or general cargo shipping service, the service parameters are indicated in **Figure 1.** Together these parameters will

Type of firm	1981	1985	1995
Stage 1 firms	54	42	30
Stage 2 firms	30	38	45
Stage 3 firms	16	20	25

Source: [Kearney, 1985], own estimates

Table II: Development of logistical sophistication

determine the logistical characteristics of the service, and it is instructive to make a distinction between logistical *efficiency* on the one hand (meaning "doing things right", at lowest possible costs) and logistical *effectiveness* on the other (meaning "doing the right things", according to company strategies). To choose a suitable combination of service parameters, one should know more about the customers' priorities.

SERVICE PARAMETERS
* Service frequency
* Regularity/punctuality
* Total transit time
* Innovative transportation
* Consolidation
* Geographical span of services
* Cargo damage
* Logistics information handling

LOGISTICAL EFFECTIVENESS
 *Superiorr purchasing and
manufacturing support
* Superior time and place utiity of end
products

LOGISTICAL EFFICIENCY
("Doing things right")
* Inventory carrying costs
* Total freight bill
* Logistics overhead costs

Source: Based on [Kvinnsland, 1998]

Figure 1: Transportation and logistics

A study made a few years ago [Kvinnsland, 1989], based on detailed interviews with a mix of clients of one of the larger liner/ro-ro operators in Norway, gives

some hints at the direction of the answer. It is of course difficult to compare answers from different people in different organisations. I will not dwell on the technicalities here, but only say that the method employed was the so-called "Analytic Hierarchy Process" (AHP), developed by Saaty[2]. This method allows consistent ranking of qualitative issues and the way AHP was used in this particular study, a number was assigned to each alternative by each person. If all persons agreed that a particular alternative should be ranked at the most important, the number 5 would be the result. The higher the number, the more disagreement among the interviewed. The results are briefly summarised in **Tables III and IV.**

Factor	Ranking*	Factor	Ranking*
Logistical effectiveness	5	Logistical efficiency	9
Logistical effectiveness:		Logistical efficiency:	
Purchasing and manufacturing support	7	Total freight bill	6
Time and place utility	8	Inventory carrying costs	7
		Logistics overhead costs	14

* Minimum number = > higher ranking (5 = absolute minimum)
source: [Kvinnsland, 1989]

Table III: The importance of logistical factors

First it is interesting to see how liner shipping customers value the two different aspects of logistics - the effectiveness vs. the efficiency. All the interviewed agreed that the strategic function of the logistics in offering the right product correctly positioned in time and place) was more important than the direct cost side of logistics. All sub-elements were, however, all ranked as very important, with much emphasis on purchasing and manufacturing support and the total freight bill. For each of these five logistical factors, the main parameters of a liner service were checked. The corresponding results for four of those parameters (frequency, regularity, transit time and cargo damage) are summarised in **Table IV.**

The generally higher numbers in **Table IV** indicate that the various people have different opinions as to the ranking of the various parameters. It is clear, however that service frequency and service regularity are very important. Overall, the issue of the regularity of a liner service is the single most important aspect. This must then be kept in mind when evaluating a new liner service.

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[2] See [Sat, 1986] and [Harket, 1988] for details

Logistics factor	Liner service parameters			
	Service frequency	Regularity	Total transit time	Cargo damage
Total freight bill	19	10	17	16
Inventory carrying cost	10	14	13	18
Logistic overhead cost	24	17	23	12
Purchasing and manufacturing support	11	12	14	18
Time and place utility	18	9	11	13
Average	16	12	16	15

Table IV: The contribution of service parameters to logistical goal fulfilment

The generally higher numbers in **Table IV** indicate that the various people have different opinions as to the ranking of the various parameters. It is clear, however that service frequency and service regularity are very important. Overall, the issue of the regularity of a liner service is the single most important aspect. This must then be kept in mind when evaluating a new liner service.

An obvious conclusion from this study is that shipping companies must in the future seek to offer services that are adapted to continuously increased logistical demands. It is clear that even today SSS can offer cheaper transport solutions on many routes in Europe[3], but still shippers prefer road transport. This is because road transportation generally scores higher on regularity and total transit times and thus secures the possibilities for cargo owners to position themselves more positively along the "time and place utility" dimensions of logistics. The obvious implication for SSS is that unless focus is on the total logistical picture, SSS will never be a really competitive alternative. I will go even one step further and say that unless ship operators can make their services fit into a door-to door concept and thus offer a reliable and just-in-time product[4], SSS could only expand through regulatory measures. This initial perspective has certain implications for the policy recommendations.

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[3]An example is mentioned in [Cheethamd and others, 1993] where a 500 km road transport of animal food at ECU 13 per ton is compared to a 600 km sea route followed by 20 km road leg at ECU 7

[4]A nice example that is indeed pissible , it the car part shuttle traffic run by Ford Europe with 3000 dwt Vessels between Zeebrugge and Dagenham on the Thames, see [Cheetham and others, 1993]

The policies

The paper lists 10 recommendations:

1. Creation of reliable market data on European SSS;
2. Creation of "port-pairs" as "SSS-Traffic Development Champions";
3. Creation of homogeneous EDI-standards through an EDI-Development Package for ports and multimodal operators;
4. Stimulation of diffusion of "Entry Barrier Eliminating" SSS vessel designs;
5. Stimulation of newbuilding and rebuilding of SSS vessels;
6. Stimulation of multimodal inland port terminal expansion;
7. Stimulation of port developments in Cohesion Fund countries and Eastern Europe;
8. Internationalisation of external costs created by the various transport modes;
9. Creation of the "European SSS Promotion Service";
10. Formal inter-EU co-ordination of SSS support measures.

I will not comment each of the recommendations in detail, only make some general comments with validity for several of the recommendations. More specifically, I will focus on:

* The risk of creating "unfair trade practices" through discrimination;
* The risk of basing SSS competitiveness on subsidisation or regulation;
* The risk of creating institutions not matching the industry structure;
* The risk of focusing too much on technological solutions.

The risk of creating "unfair trade practices" through discriminations

I agree fully with the conclusion in the part about avoiding solutions where traffic is concentrated in narrow corridors through selected "super-ports". This will no doubt lead to monopolisation, loss of efficiency, potential non-constructive lobbying activities and even more seriously - to hinterland bottleneck situations actually worsening the logistics of SSS.

I furthermore fully agree with the analysis that neither small shipping companies nor small ports seem to have the capabilities to generate the necessary development of more efficient sea-land interfaces. I am not sure, however, whether the conclusion is that one needs pairs of ports acting as "development champions". A pair is only slightly more general than the selection of an individual part, and again it is a danger that ports with already existing resources for international co-operation, or ports with good connections to active politicians will be the ones benefiting from a support scheme to "port-pairs", and not necessarily the "best" or the most "needed" ports.

Instead what is needed is a policy towards *networks* of ports, where several ports (also two, of course) co-operation in making transportation between the ports more efficient. The prerequisites should be that a consortium is set up around each port that includes the necessary hinterland operators, In this connection it is not at all obvious that the port itself is the natural consortium leader. Many small ports totally lack the kind of expertise necessary to administer international co-operative projects. Sometimes, but not always, research institutions or experienced consultant firms are more capable of running such projects.

To make current ports more efficient or to create new, effective port interface solutions normally involves two elements: investments in new facilities and reorganisation of operational practises. I believe, therefore, that support for international port networks should be directly linked to infrastructure investments. A built-in incentive could be that the more complete the plan is for reorganisation of the port operation and the more complete the consortium behind the plan is, the more investment support could be obtained by national and/or community sources. This means that recommendation 2 should be a part of 6 and 7, or that the three must be seen as a totality.

The risk of basing SSS competitiveness on subsidisation of regulation

Regarding recommendation 8 it is argued that road transportation still does not fully pay for the external costs it generates. Furthermore it is argued that because it is not evident that road transport will be much reduced if higher fuel taxes are implemented, then other regulations as prohibiting road transport during weekends etc. are appropriate measures to be considered.

This is dangerous ground. I cannot possibly see that it will benefit neither SSS nor customers needs in the long run if the only way to increase the share of SSS is to regulate the other means of transport. On the contrary, SSS is totally dependant on the other transport modes to secure a fully door-to-door service for customers and one should, therefore, think in terms of *strategic alliances* between the various modes of transport rather than direct competition to improve on the current situation.

I agree to the formulation of recommendation 8 - and this is also widely accepted politically - but I do not agree to the use of physical regulations to reduce road transport. Market shares of the various transport modes should be the the result of the choices made by independent shippers, based on the total qualities and prices of the various alternatives.

Also regarding recommendations 4 and particularly 5 I am sceptical towards a policy of subsidisation and towards a policy where all the alternatives are given.

The four vessel types mentioned[5] do not necessarily span out the relevant alternatives, although they represent some obvious *new* alternatives. One should not exclude more conventional vessels combined with either improved cargo handling equipment or simply improved logistics. Conventional vessels are often so much cheaper to build that they can compete costwise with technologically more advanced ships if employed wisely.

The point I want to make is this: It will not be the benefit of SSS in the longer run if subsidies and regulations are the only ways of making SSS competitive in the short run.

The risk of creating institutions not matching the industry structure

In recommendation 9 a new organisation is suggested - a non-profit organisation to promote SSS. Although the need is clearly there for someone to put SSS on the agenda both politically and financially, I am really doubtful that a new organisation is what we need. For such an organisation to have some real impact, it needs recipients who can act on its' advises and stimulations, and I just doubt that this is the case today.

Shortsea shipping consists of a large number of vessels, generally old and generally owned by small, often single ship companies. The European shortsea fleet (by ownership) consists of 10,132 vessels[6], with an average age of more than 21 years and where 88% is carrying a European flag[7]. The age structure and the average size of firms are main problems for the industry. The *average* firm of this industry will not be able to use an organisation as the one suggested in recommendation 9, and this organisation will thus mainly be a tool only for the larger, more advanced firms. National and international bureaucracy might also result as well as conflicts with both national and community shipowners' associations. My suggestion would be to set up a large "SSS Promotion Fund" instead and to let it be administered by DGVII or perhaps ECSA, or simply a separate committee, but not a formal organisation. The money from this fund could go to any activity improving on the marketing of SSS or the dissemination of research results in the field of SSS, where the focus is on the *active firms* of the industry.

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[5]Fast cargo ships, sea river ships, selfunloading bulk carriers and selfloading and -unloading unit load ships

[6]In the size range between 100 and 5000 GT at the end of 1991 according to [Crilley and Dean, 1993]

[7]Based on [Crilley and Dean, 1993], table A2.6

The risk of focusing too much on technological solutions

Generally I feel the recommendations (recommendations 4, 5 and 6) over-emphasise the focus for more *technological* research. At a distance I have observed a Norwegian technological research programme for high speed vessels. Several man-years and millions of NOK have been devoted to technological research on hull construction, propulsion systems, etc., but next to nothing was spent on analysing the market prospects for such vessels. The result has been the construction of vessels for which there is no market. Today there are many designs available in the European markets, but to much too little attention has been devoted to the suitability of these designs for the various markets[8]. More market research is definitely both necessary and should be encouraged. I do agree with the emphasis put on the diffusion process and the need for support in the implementation phase of technological programmes, but I would like to see more emphasis of doing technological research based on solid market analyses.

The need for better market statistics and standardisation

Let me end on a positive note. I fully agree with the need for improved statistics as to cargo flows and the relation to the means of transportation. I have participated in several meetings in the International Advisory Committee on Shipping Statistics, where this point has been raised repeatedly. Mr. Han Son Chu travelled for years around the world arguing for the so-called Uniform System[9], where the idea was to link the documents forming the basis for trade statistics with freight movement data on the most basic level. Linking the ship's cargo manifest with customs declaration forms would enable later studies of cargo movement by vessel type. The system was primarily developed for developing countries and many of them have adopted the system, but the UN Statistical Office never managed to persuade the statistical offices of developed countries to change their practices. Today we can only regret that.

The advantage of the EU is that one can enforce changes across member countries. I strongly support any change in the direction of improved cargo movement statistics. This is an issue becoming increasingly important in the age of EDI. Where it is so easy to loose more and more of the statistical base for analyses because one wishes to simplify procedures. I would finally argue, therefore, that recommendations 1 and 3 must be seen in connection with each other.

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[8]This was also discussed in the first Roundtable Conference, see [Wergeland, 1993]

[9]The first ideas of this system was discussed in a meeting in Bangkok in 195 and in 193 the UN Statistical OFfice issued a document called "guidelines for implementing the Uniform System of maritime transport Statistics"

Endnote

I strongly support the idea of a Masterplan for SSS, but if that is not happening fast, a word on priorities will end my comment. I would personally focus on the four elements below and the listing indicates my priorities:

* Steps to improve European cargo movement statistics and implement European-wide standards for both statistics and EDI;
* Stimulate research in the area of new logistical solutions to current transport problems;
* Stimulate the investment and reorganisation of networks of European ports and their hinterland structure;
* Create a European Short Sea Shipping Promotion Fund to improve on the marketability of SSS.

I hope by this to stimulate some discussion around a very interesting and important paper.

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UK ROADS TO WATER INITIATIVE: A FOCUSING STUDY

By J.J.L. Packer

Commentary by R. Fenyoe

In offering a commentary on Mr Packer's paper I would like to:

* Reiterate some of its principal conclusions for the UK;
* Consider their implications for roads-to-water in a European context;
* Put forward some policy recommendations for discussion.

Approach

The study was intended to examine the entire freight market before focusing on segments which might justify further more detailed evaluation. It therefore covered the whole range of potential short sea shipping alternatives to road freight, and all types and modes of commodity from dry and liquid bulk to unitised lo-lo and ro-ro, in both internal and external trade. The top-down approach enabled the study team to very quickly focus attention on key issues, such as whether there is any scope at all for short-sea shipping, and then to quantify the volume potential in different market segments.

The approach involved three main techniques: quantitative estimation, cost modelling, and market research. Quantitative data was required to assess volumes available. Cost modelling contributed to the identification of potential target markets by identifying the circumstances in which short-sea shipping could compete on price, or the change required in the through road or shipping cost structures to allow it to become competitive. Market research was required to assess non-price factors and their differing influences within the various market sectors.

Limitations

The study was developed jointly with the UK Department of Transport Shipping Directorate. This has restricted the scope of the study, in that it did not examine the whole of the relevant EU coastal area. Ideally the study should also have evaluated Irish land bridge and seabridge traffic within the geographical area of the British Isles in more detail, because this traffic is complementary to some of the trades examined.

A second limitation, again determined by the nature of the original commission, is the restriction of the study to short-sea shipping. One of the study conclusions is that in some markets rail would be more appropriate, and the approach could have been extended to evaluate all three modes. This would then

have identified the most competitive environmentally friendly alternative to long-distance road haulage.

Potential identified

The main potential identified in the study is the modal shift of north/south international, unitised freight, with some transfer of unitised and semi-bulk east/west trade also possible. Potential road haulage savings could also be obtained through the innovation of a "coastal highway" for unitised traffic between Scotland and South East England, but such a service would not be viable in terms of either price or quality of service on current costs unless it could be linked in to international or container feeder movements. A strength of the top-down approach is that analysis of the relationships between different segments can suggest linked services of this type.

Similar savings in road tonne-miles could be achieved by reversing the drift from coastal shipping to the distribution of petroleum by road. Petroleum is the last remaining significant coastal flow, and the volume shipped has declined by 25% over the past ten years. As well as examining new potential markets we need to protect the trades which still exist, and the businesses which operate them.

The overall result is, not unexpectedly, disappointing. The potential for shifting traffic from roads to water in the UK is extremely small. Let us look at the figures again.

* Of a road total of 1.5 billion tonnes, only 83 million tonnes of freight travels over 300 km. This is about five per cent. Over 450 km the figure is reduced to 20 million tonnes.

* The potential for transfer is estimated at perhaps 15 million tonnes, or 1% of the tonnage. This is less than the annual long-term growth rate for road freight. It is true, however, that the tonne mile saving would be a little more significant, at 3.5%

We cannot realistically look to shortsea shipping to solve the problem of road freight growth in the UK. The reason for this is that distances between economically active regions of the country are rather short, and that coastal movement represents a diversion away from a straight line between them.

European implications

This result does not necessarily apply also on the continental mainland, where the relationships between the key socio-economic and geographic determinants may be quite different to those in the UK. In particular, distances can be longer, and there is more scope for inland waterway movement.

It could therefore be valuable to examine the freight transport hinterlands of other European coastal regions to identify the scope and relative magnitude of potential for water using the same top-down approach and the same combination of volume estimation, cost modelling, and market research. The same extent of original work is unlikely to be necessary because the results of existing studies can be synthesised to similar effect.

Volume estimation could prove difficult in some cases. Certainly in the UK, 1991-1992 are the last years for which a detailed quantification of international traffic flows can be attempted. As a result of changes consequent upon the Single Market we have lost the invaluable port and mode statistical classifications for EU trade, while the very existence of current inland origin/destination data has depended on financing by a private company, Eurotunnel.

It is surely essential that commercial entities seeking to identify new markets and governments monitoring the impact of their transport policies should have sufficient statistical information to support their judgements. The minimum requirement is for origin/destination data for rail and sea corridors, showing annual volumes by service type and rail terminal or port.

Rail/sea competition

Rail and sea are both environmentally friendly alternatives to road and should be examined together.

* The wrong question is how can short-sea shipping (or combined transport, or pipelines, or whatever) reduce the growth in road traffic.

* The right question is: how can the growth in road traffic be reduced, without economic damage, and where this is judged necessary for congestion or other environmental reasons.

A purely modal approach is the result of the way responsibilities are organised in government and parastatal organisations, and is reflected in the way studies are organised and their results implemented. Because of a false division into competing rail and water interest groups, governments may impose policies they believe to be environmentally friendly in support of one mode while ignoring its effect on the other, while research funds may easily be inappropriately apportioned between modes. I shall give recent UK examples of both of these, which happen to favour the rail mode.

The first is the 44 tonne concession. The road limit in the UK will be raised from 38 tonnes to 44 tonnes for traffic which will proceed for the main part of its journey by rail. There is no doubt that this concession will encourage the use of intermodalism through the Channel Tunnel and therefore reduce the volume of road tonne miles.

However, the unaccompanied modes more associated with full load, weight cargo, could be affected more than accompanied trailer through Dover. The damage to east coast ports as a result, and as a result of Shuttle competition, would be ameliorated if the concession had also been granted to container and unaccompanied trailer operations, and/or a selected range of northern ports. This option has been rejected by the UK Government in not applying the EU definition of combined transport to these movements.

It is true that individual through movements could use less road haulage as a result, because road/sea/road is replaced by rail with short terminal movements by road, but overall cargo will be lost to sea carriers who desperately need volume to maintain their existing services. Services could be lost or their quality reduced, resulting in a further increase in road haulage.

The second example is the study, recently commissioned by the British and Irish governments with PACT funding, intended to "identify the scope for commercially viable rail/sea combined transport services between Ireland, the UK, and other EC member states". This allegedly "combined transport" study is concerned with trade with the continental mainland only via the Channel Tunnel. Neither the improvement of existing direct short-sea links nor the impact on them of a rail landbridge is considered worthy of attention.

Both sea and rail, separately or together, can contribute to the limitation of road freight. There is a real need for administrators in these areas to work together towards our common objective.

One area in which the shortsea option could benefit from separate attention is in publicity. The present and potential contribution made by shortsea shipping to freight movement in Europe should be more widely known. Road and rail have their Trans-European Networks, and there needs to be an equivalent short-sea concept, even if this forces us to decide whether pressure on roads would be most reduced by strong sea corridors linked into the major road and rail nodal points or a rich patchwork of flexible low-volume links.

Land use, planning, and location of industry

The report draws attention to the changes in the structures of distribution in the UK, which has involved much faster through movement of goods from manufacturer to retailer and consumer, a decrease in the size of individual product consignments, and an increase in the number of lines carried at retail outlets. The distribution centre network has been designed around the use of road, and its existence makes conversion of traffic from road to rail or water much harder.

In Europe as a whole, cheap, fast, road transport has been a major factor in industrial location, allowing multinationals to concentrate production and gain economies of scale at the cost of increased freight vehicle mileage.

These are very powerful pressures. We need to be aware that our efforts to stimulate environmentally friendly transport may be insufficient and that if we really feel that the growth of road haulage is a threat to our environment we may need either take Swiss measures, increase all transport costs to influence industrial location policies and distribution strategies, or wait for the market to do the job through congestion and eventual gridlock.

Defence of water transport

As the study demonstrates, short-sea shipping is under intense competitive pressure from road, and now from the proponents of rail combined transport. Container and unaccompanied trailer short-sea shipping has lost share in UK trades, as has coastal oil transport. Other dry bulk cargoes have all but disappeared except for low-valued stone and residual coal.

We should, perhaps, be urgently considering how we are to save the industry we have before we dream about its expansion.

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