Presentation Sequence:

1. Thesis in Relation to the Design Project

2. Introduction to the Concept, Skyport

3. Global Scale (Quick Summary of P3)
   a. Analysis and problems in current freight distribution modes
   b. Proposal of *Skycraft Global Distribution Network*

4. Design Concept (Building Scale)
   a. Research on automation in container ports, automated docking systems
   b. Design concept of *Skyport*
With every tool man is perfecting his own organs, whether motor or sensory, or is removing the limits to their functioning....Man has, as it were, become a kind of prosthetic God. When he puts on all his auxiliary organs, he is truly magnificent, but these organs have not grown on to him, and they still give him trouble at times.....Future ages will bring with them new and probably unimaginable great advances in this field of civilization and will increase man’s likeness to God still more.

Sigmund Freud

**Theme - Technological Prosthesis**

Emerging technologies, namely robotics, communication technologies, biotechnology and nanotechnology have concentrated and channelled their powers upon the human body in order to augment its capacity for better speed and precision in terms of production. These technologies have provided us with an increasing level of comfort, speed of activities, safety and well-being. However they have in turn made the body’s rhythms and activities clockwork and layed it down on a barren plane, illuminated by an all seeing and searing gaze. The labile, becoming body dries and withers away under the intense gaze of forces.

Emergent technologies will further augment and expand the inward and outward scale of the fabrication and colonization of the human body by technology. My essay accepts the power of spatio-temporal technologies in the past but also expands, recognizes a similar trajectory in emergent technologies. Therefore this essay is a counter force proposing to divert and redirect the relentless stream of technological innovations towards an unpredictable, open future of becoming.
“We are passing through a stage in a long process towards interpenetration, simultaneity, and fusion, on which humanity has been engaged for thousands of years.”

Umberto Boccioni

AVATAR

An architectural construct becomes a pure interface, an augmentation of bodily senses, a void without a function other than to reveal the unseen, the outside. A body integrated into our flesh and mind intensifying our senses in subtlety, sensitivity and articulateness. An extensive spiderweb to catch the intensive fly to recover what is lost. An Avatar to ride towards an unpredictable, unforeseen future...
GLOBAL SCALE

*Skycraft Distribution System*

is a fully automated, aerial, freight distribution network based on robotic and airship technologies.

BUILDING SCALE (Design Project)

*Skyport*

Skyport is one of the distribution nodes in the global network serving as an aerial port for the import and export activities of containerized freight.
Analysis of Current Freight Distribution Modes
Current Freight Modes

Air Freight Modes
- Civil Cargo Plane
- Military Cargo Plane
- Helicopter
- Aeroscraft

Water Freight Modes
- Container Ship
- Cruise Ferry
- Ocean Liner
- Bulk Ship

Land Freight Modes
- Lorry
- Tractor Trailer
- Truck
- Truck Chassis
- Freight Train
- Pipeline
Percentage of Greenhouse Gas Emissions per Sector

- Electric Utilities: 34%
- Industry: 19%
- Agriculture: 8%
- Commercial: 6%
- Residential: 5%
- Transportation: 25%
- Noncommercial Aviation: 1%
- Commercial Aviation: 2%

Climate Impact of Current Transportation Modes
Problems in Current Freight Transportation Modes

<table>
<thead>
<tr>
<th>Freight Mode</th>
<th>Climate Impact Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger Vehicle</td>
<td>40%</td>
</tr>
<tr>
<td>Heavy Freight Truck</td>
<td>27%</td>
</tr>
<tr>
<td>Aviation</td>
<td>5%</td>
</tr>
<tr>
<td>Rail Freight</td>
<td>4%</td>
</tr>
<tr>
<td>Marine Freight</td>
<td>3%</td>
</tr>
</tbody>
</table>

Fuel Consumption Rates according to Freight modes:
- Air
- LTL (Truck)
- Truck
- Domestic Water
- Rail
- Ocean Water
FREIGHT TRANSPORT GROWS AT AN EXPOSIONAL AND ALARMING RATE !!!

![Graph showing freight transport growth in EU from 1985 to 2003](image-url)
Major Global Air Freight Routes

Map showing major cities and their connections, such as:
- Ted Stevens Anchorage, Alaska
- Vancouver
- Minneapolis-Saint Paul
- Indianapolis
- John F. Kennedy, New York
- Detroit Metropolitan
- O'Hare, Chicago
- Denver
- Minneapolis-Saint Paul
- Hartsfield-Jackson Atlanta
- Fort Lauderdale-Hollywood
- Miami
- Orlando International
- London Gatwick
- Brussels
- London Heathrow
- Amsterdam Schiphol
- Frankfurt
- Luxembourg-Findel
- Munich
- Charles De Gaulle
- Paris
- Leonardo da Vinci-Fiumicino
- Athens
- Bahrain
- Tehran
- Delhi
- Katmandu
- Hong Kong
- Guangzhou Baiyun
- Beijing Capital
- Incheon, Seoul
- Kansai
- Shanghai Pudong

Other cities include:
- Tokyo
- Narita
- Singapore Changi
- Jakarta
- Parth
- Melbourne
- Sydney
Proposal of Aerial Distribution Network
Skycraft

Manned Cloud by French designer Jean-Marie Massaud
ADVENTAGES OF HYBRID AIRSHIPS

LARGE PAYLOAD 500 tons (22 tons in cargo planes)

LONG RANGE - HIGH ENDURANCE 22,000 km - 7 days

LOW MAINTENANCE - OPERATING COSTS

HIGH FUEL EFFICIENCY

LOW INFRASTRUCTURAL REQUIREMENT
No Airport requirement - Simplicity and efficiency of ground maintenance

ENVIRONMENTAL BENEFITS
Low noise, no hazardous fuel emission

CAPABILITY TO FLY AT LOW SPEEDS AND LOW ALTITUDES

NOVEL WAY TO TRAVEL

CURRENT POTENTIALS AND APPLICATIONS

LOGISTICS - CARGO TRANSPORT - WARFARE SUPPORT

ENVIRONMENTAL PROTECTION

EXPLORATION OF REMOTE AND INACCESSIBLE AREAS

SURVEILLANCE & INTERDICTION

TOURISM, ADVERTISING (HOTEL)

HUMANITARIAN AID - EMERGENCY HOUSING - RESCUE - SUPPORT
Comparison of max. Distance Travelled between Freight Modes

- Container Ship: 9,300 km
- Cargo Plane: 14,400 km
- Skycraft: 22,000 km
- Freight Truck: 7,000 km
<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Cargo Capacity</th>
<th>Truck Equivalency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freight Truck</td>
<td>26 tons = 1 unit</td>
<td>1</td>
</tr>
<tr>
<td>Freight Train</td>
<td>130 tons</td>
<td>5</td>
</tr>
<tr>
<td>Cargo Plane</td>
<td>1300 tons</td>
<td>50</td>
</tr>
<tr>
<td>Container Ship</td>
<td>10,000 tons</td>
<td>300</td>
</tr>
<tr>
<td>Skycraft</td>
<td>130,000 tons</td>
<td>2000</td>
</tr>
</tbody>
</table>

Comparison of Current Freight Modes with Skycrafts
Comparison of Freight Modes with Skycraft Network
What Does Skycraft Network Replace in the Logistic Chain???
Primary Terminals: on existing major ports and metropolitan areas
Secondary Terminals: on existing major ports
3rd Level Terminals: metropolitan areas without adequate ports
4th Level Terminals: cities on major air freight traffic routes
5th Level Terminals: on disaster zones
**Primary Terminals**
Number: 20
Location: existing major ports and metropolitan areas
Capacity: 1000 containers
Volume: 10 milyon m³
Length: 400 meters

**Secondary Terminals**
Number: 18
Location: metropolitan areas without adequate ports
Capacity: 800 containers
Volume: 9 milyon m³
Length: 350 meters

**3rd Level Terminals**
Number: 19
Location: existing major ports
Capacity: 750 containers
Volume: 8.5 milyon m³
Length: 320 meters

**4th Level Terminals**
Number: 56
Location: Cities on major air traffic routes.
Capacity: 600 containers
Volume: 8 milyon m³
Length: 280 meters

**5th Level Terminals**
Number: 12
Location: Disaster Zones
Capacity: 500 containers
Volume: 7 milyon m³
Length: 250 meters

**SKYCRAFT 1**
Number: 56
Route: international Freight
Capacity: 240 containers
Volume: 0.6 milyon m³
Length: 120 meters

**SKYCRAFT 2**
Number: 56
Route: Domestic Freight to distribution centers
Capacity: 150 containers
Volume: 0.4 milyon m³
Length: 90 meters

**SKYCRAFT 3**
Number: 56
Route: Harvesters from other modes of freight.
Capacity: 80 containers
Volume: 0.3 milyon m³
Length: 60 meters
Research for the Design, Skyport
Automated, Robotic Ports and Warehouses
Automated Docking Systems
The Evolution of Airships
Research on Automated, Robotic Ports and Warehouses
Automation in Air Cargo Terminals - Spaces

**AIRSIDE HANDLING**
Identification - Sorting - Checking

**AUTOMATED WAREHOUSE**
Storage - Retrieval - Conveyer Systems

**LANDSIDE HANDLING**
Delivery

**Airport Apron:** area where aircraft are parked, unloaded or loaded, refueled or boarded

**Workstations:** for sorting and consolidating freight according to time zone, destination...

**AS/RS:** (Automated Storage and Retrieval System) - ETV and stacks

**Transfer Vehicles and Conveyor Belts**

**Nose Docks**

**Truck Docks**
Air Cargo Terminals - Flow of Goods

ULD Identification

- Inbound ULDs - Airside Interface
- Identification of ULDs

ULD Storage

- Transport to Storage
- Automated ULD Storage

ULD Delivery

- Transport to Dock
- Outbound ULDs - Landside Interface
Identification (sorting) - storage - delivery

**AS/RS (Automated Storage and Retrieval System)**
Automatic storage and retrieval for import cargo. AS/RS maximizes floor space, improves throughput and adds routing flexibility by providing out-of-the-way storage space.

**AEM (Automated Electrified Monorail)**
This system links the AS/RS to the ULD handling system using an overhead transport line. 18 trolleys move the boxbins back and forth between the break down workstations, the AS/RS and the truck docks.

**ETV (Elevating Transfer Vehicle)**
The three-story ETV stores and retrieves air cargo containers smoothly and quickly.

**TV (Transfer Vehicle)**
TV provides the direct high speed conveyor/transport connection from the landside to the ETV on the airside.
Abstract Model of Air-Freight Terminals

- **Landside Handling**
  - Truck Interface
  - Truck Dock

- **Container Storage**
  - Work Stations
  - Automated Storage - Retrieval Systems
  - ETV Stores
  - Cold rooms, warm rooms, dangerous storage rooms
  - Valuable storage rooms, freezer rooms
  - Conveying and Transportation Systems

- **Airside Handling**
  - Apron Plane Interface
  - NoseDock

Interface systems
Workstations
Automation in Container Terminals (ports)

WATERSIDE HANDLING
Gottwald AGVs
are unmanned, software-guided container transporters forming an efficient link between the quay crane and the stackyard.

CONTAINER YARD
ASC Automated Stacking Cranes
are automated storage and retrieval systems on the quay side. For landside storage and removal in conjunction with a railway link or road trucks.

LANDSIDE HANDLING
Thanks to the innovative camera system, the container can be accurately deposited semi-automatically on the road truck.
Abstract Model of Container Ports

WATERSIDE HANDLING
- Apron
- Ship Interface

CONTAINER YARD
- Buffer Zone
- IMPORT
- Dry Cargo Storage
- Reefer Container Storage (temp. sensitive)
- Empty Container Storage

LANDSIDE HANDLING
- Buffer Zone
- Truck-Train Interface
- Administration Building
- Maintenance Shop
- Container Repair - Cleaning Facility
Automated - Robotic Car Parking Systems

Advantages:
- flexible and efficient use of space
- minimum foot-print
- very fast access time
- no ramps and driving lanes
- no costly illumination
- environment-friendly in terms of its compact construction, and in addition it reduce emissions
- offers security against theft and vandalism
- saves the need for costly building engineering compared with conventional garage buildings
Automated - Robotic Car Parking Systems

Volkswagen Autostadt (Autocity)

The car towers work like giant vending machines: As a new car arrives from the factory, it's transported by robot to an empty storage slot in one of the towers; when a customer shows up to collect the car, the same robotic picking system fetches the vehicle, brings it down to ground level, and transfers it to the KundenCenter in the next building.
Research on Docking Systems
Mooring masts were equipped with lifts and other machinery necessary to bring fuel, crew, passengers and cargo to the airship moored at the top of the tower.
Space Shuttle Mooring Systems
Docking with international space station

1. 110 m.
   Orbital Maneuvering System
   to thrust the Space Shuttle from one orbit to another.

2. 50 m.
   Reaction Control System
   is used to change speed, orbit, and attitude.

3. 9 m.
   Reaction Control System
   fine-tune the alignment of the Space Shuttle with the docking target.

4. 0 m.
   Reaction Control System
   makes contact with the docking ring. Once a series of hooks is engaged, the Space Shuttle is then successfully docked.
Quay cranes are used to load and unload containers. Emma Maersk can use 11 cranes at the same time.

11 Cranes can load or unload the Ship at the same Time.

The first Trip was with 13 Crew. The cost was $145,000,000 US.
Automated Mooring Systems

Automated Mooring Systems improves efficiency and productivity greatly and enhances the speed of the overall logistic chain.

NO ROPES...... NO PEOPLE......NO ACCIDENTS

By using vacuum and hydraulic based technology instead of ropes the whole operation of mooring a ship is reduced to within 12 seconds.

**INFRASTRUCTURE**
- Improved pier utilization
- Absorption of vessel motion

**SAFETY**
- Reduced risk of mooring accidents
- Real-time monitoring of mooring status

**EFFICIENCY**
- Improved turn-around time
- Improved continuity of work processes
- Improved cargo transfer rates

**ENVIRONMENT**
- Reduced emissions due to faster mooring process
- Less pier and breakwater structures required
Container Ship Mooring Systems

**QUICK RELEASE HOOKS**
The units are designed to withstand static and dynamic forces exerted by the vessel, often from wind or current load.

**REMOTE RELEASE SYSTEMS**
Purpose is to release the mooring lines, which may be under tension, in a safe and controlled manner.

**ENVIRONMENTAL AND OCEAN MONITORING**
Environmental and oceanographic sensors provide data during docking and mooring.

**CENTRAL MONITORING SYSTEM**
The data from load cells, docking lasers and environmental sensors is relayed to a central PC system usually located in the Jetty Control Room.

**DOCKING AID SYSTEM**
A tool used to assist in manoeuvring the vessel during the last 300 m of approach. The docking system measures vessel distance, angle and speed of approach using lasers.

**MOORING LINE LOAD MONITORING**
Once the mooring ropes secured, line tensions and their distribution must be monitored effectively.
- Wind and current, speed and direction of waves
- Surge effects from passing vessels
- Tidal changes
- Vessel draft changes due to loading or discharge of product
The Evolution of Airship Technology
**Balloon** (first manned flight - 1783)

**Type:** Balloon

**Description:** Balloons are simple ‘bags’ holding gas or hot air, without a framework.

A balloon is a type of aircraft that remains aloft due to its buoyancy. A balloon travels by moving with the wind. It is distinct from an airship, which is a buoyant aircraft that can be propelled through the air in a controlled manner.
Blimps (non-rigid airship - early 20th century)

Type: Airship

Description: Use a shaped bag without a framework or supporting structure.

Non-rigid airships, also known as Blimps, are the most common form nowadays. They are basically large gas balloons. Their shape is maintained by their internal gas pressure. The only solid parts are the passenger gondola slung beneath the ship, and the tail fins. All the airships currently flying for publicity use are of that type.
Semi-Rigid Airship (early 20th century)

Type: Airship

Description: airships with a partial framework.

Semi-rigid airships are airships with a partial framework. These often consist of a rigid, occasionally flexible, keel frame along the long axis under the aerodynamic hull envelope. The partial framework can also be inside the hull.
Rigid Airship
(Zeppelin early 20th century - Hindenburg explosion in 1937)

Type: Airship

Description: complete internal structural framework

A rigid airship was a type of airship in which the envelope retained its shape by the use of an internal structural framework rather than by being forced into shape by the pressure of the lifting gas within the envelope as used in blimps and semi-rigid airships.
AEROSCRAFT - ML866 (2010)

**Type:** Hybrid Airship  
**Description:** The Aeroscraft ML866 is a buoyancy assisted air vehicle with a rigid structure and gas cells.  
**Lift:** Helium - buoyancy (70 percent), aerodynamics, turbofan jet engines for vertical takeoff  
**Energy:** Hydrogen Fuel Cells

**Function:**  
- luxury private yacht,  
- sightseeing and long-distance cruise  
- to reach isolated communities, such as remote islands in the Atlantic and Pacific oceans  
- transport military vehicles or supplies to difficult terrain

**SPECIFICATIONS**  
**Volume:** 19,000 meters cube  
**Dimensions:** 64 x 36 x 17 meters  
**Range:** 9,656 km  
**Max. Endurance:** 90 hours  
**Cruising Speed:** 222 km/h  
**Altitude Range:** 0 to 3600 m  
**Payload:** 400 tons or 250 passengers  
**Helium Volume:**  
**Cabin Area:** 500 square meters
**Strato Cruiser (Design Phase)**
by art director Tino Schaedler and Michael J Brown

**Type:** Hybrid Airship

**Function:** The luxury helium-filled airship contains a gourmet restaurant, a spa, a swimming pool, a resident DJ and so on.

**Key-features: Structure:**
With its carbon fiber skin, sectional helium chamber design and photovoltaic cells, the Stratocruiser’s construction brings new levels of safety, speed and ecology to travel. Its “doughnut hole” atrium reinvents the zeppelin concept with a sky lounge on top, the earthward viewing restaurant on the underside and a recreational climbing wall in between. Private suites are sheltered away from public spaces on the ship’s belly, while an advanced propulsion system more than doubles the cruising speed of conventional blimps.

1. Rigid Airship Frame with Helium Chambers
2. Photovoltaic Cell Network
3. Retractable Polycarbonate Roof
4. Terraced Deck with Lap pool
5. SkyView Lounge
6. Main Atrium with Climbing Wall
7. EarthView Restaurant & Bar
8. Spa Treatment & Library
9. Private Suites
10. Kitchen & Staff Rooms
11. Captain’s Bridge
12. Gantryway
13. Propulsion
14. Bungee Jumping Platform
Manned Cloud (Design Phase)
by Jean-Marie Massaud

Type: Hybrid Airship

Description: Flying Hotel

Function: Emergency - housing

Key-features - Program:
Two two-deck cabin will contain amenities including a restaurant, a library, a fitness suite and a spa. There will also be a sun deck on top of the double helium-filled envelopes.

SPECIFICATIONS
Volume: 520,000 meters cube
Dimensions: 210 x 82 x 52 meters
40 passengers - 15 crew
Range: 5000 km / 72 h
Cruising Speed: 170 km/h
Altitude Range: 0 to 3600 m
Payload: 400 tons or 250 passengers
Helium Volume:
Cabin Area: 1100 m²
First deck (500 m²): Restaurant, lounge, library, fitness
Second deck (600 m²): 20 rooms, terraces, spa, bar
Air_ray (Research Phase)  
by by FESTO

Type: Hybrid Airship
A remote-controlled hybrid construction with flappingwing mechanism.

Air_ray is a remote-controlled hybrid construction comprising a helium-filled ballonett and a flapping-wing drive mechanism. The propulsion is effected by a flapping-wing mechanism. The wing module, which can be moved up and down by a servo drive unit, has a structure like that of the tail fins of many fish.

http://www.festo.com
**IONIC Airfish (Research Phase)**
by by FESTO

**Type:** Ionic Airship

The flow-optimised pneumatic structure is derived from the penguin.

The new bionic plasma undulating drive in the stubby wings is a simplified copy of the mechanical beating wing drive of birds, without the moving parts. The classical principle of the ion beam drive, that functions using air-ionising high DC voltage fields, is at work in the tail. The accelerated air ions thus produce an ion wind with a speed of up to 10 m/s.

http://www.festo.com
Skyport Design Parameters
Design Parameters

The Evolution of Airship & Design Stages of Skyport

1. **Balloons**: The envelope and the gondola are far apart and structurally separated.

2. **Blimp (Non-Rigid Airship)**: The envelope and the gondola are structurally separated. The envelope takes an aerodynamic shape.

3. **Semi-Rigid Airship**: The envelope and the gondola become closer and by the construction of a truss, they are structurally bound. The envelope is still without a framework.

4. **Zeppelin (Rigid Airship)**: The envelope and the gondola become unified through a complete internal structural framework. The rigid envelope houses living spaces as well as helium.

5. **Hybrid Airship**: The envelope and the gondola become completely unified inside a structural frame and an aerodynamic envelope. The lift is partially produced from the shape of the envelope as well as the helium.

6. **Skyport**: The envelope and the gondola are vertically expanded to accommodate the freight cargo and social spaces, keeping the overall aerodynamic shape of the envelope.

7. **Skyport**: The envelope and the gondola are further vertically expanded to compensate for the increase in weight and a protected cavity is formed at the rear to serve as the import-export zone.

8. **Skyport**: The envelope and the gondola are ing structurally and spatially separated by a buffer zone dividing the social and freight spaces. The blowing air through the buffer zone further generates lift force.

9. **Skyport**: Central distribution spine is tilted diagonally to generate enough distribution space for the flow of goods in the lower freight rings and also to give the design a kinetic and dynamic shape.

• **Design Concept**: During the evolution of the airships, the envelope and the gondola become more integrated and structurally bound to one another. Skyport continues this evolution process by infusing the envelope and penetrating it with social spaces, connecting it with the gondola, thus merging the two elements spatially under an aerodynamic shroud while at the same time structurally separates them. Therefore, the design has both the features of early semi-rigid and also hybrid airships in it.
Design Parameters

Flat - Linear Shape
- extensive - scattered land use
- large foot-print

Vertical Shape
- compact form - min. footprint
- efficient use of space
- fast distribution via multiple levels access points.

Planer - 2d flow of goods
Limited - one level Interface (exchange points) Zones

3d flow of goods
multiple levels of exchange nodes interface zones

3d storage of goods
but planer circulation and exchange of goods
consumption of space
inefficient distribution system
Design Parameters

Container Types &
Distribution of Payload
Container Specifications and Distribution of Payload

<table>
<thead>
<tr>
<th>Shipping Container</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5 x 2.5 x 12 meters</td>
<td>Volume: 68 m³</td>
</tr>
<tr>
<td>Max. Gross Weight: 20 tons</td>
<td></td>
</tr>
<tr>
<td>Empty Weight: 2 tons</td>
<td></td>
</tr>
</tbody>
</table>

Fitted inside TEU
Compatibility with existing logistic modes

<table>
<thead>
<tr>
<th>Air Freight ULD</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 x 1.5 x 3 meters</td>
<td>Volume: 15 m³</td>
</tr>
<tr>
<td>Max. Gross Weight: 3 tons</td>
<td></td>
</tr>
<tr>
<td>Empty Weight: 169 kg</td>
<td></td>
</tr>
</tbody>
</table>

Containers will be able to interlock to each other becoming a single container increasing the system's speed and efficiency.

<table>
<thead>
<tr>
<th>Skyport Container</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 x 3 x 3 meters</td>
<td>Volume: 27 m³</td>
</tr>
<tr>
<td>Max. Gross Weight: 6 tons</td>
<td></td>
</tr>
<tr>
<td>Empty Weight: 100 kg</td>
<td></td>
</tr>
</tbody>
</table>

Different translucent containers will differ in color according to their cargo and weight.

During storage containers will separate and move through the system individually via conveyor rails.
Container Specifications and Distribution of Payload

Placing heavier containers close and around the central axis, lighter ones on the periphery and empty ones on the edges, reduces moment forces exerted on the structure due to shifting payloads and helps to maintain overall balance of the skyport.

Heavy Container
Weight: 3≤x≤6 tons
Around central axis

Light Container
Weight: 0≤x<3 tons
Close to central axis

Empty Container
Weight: 100 kg
On the periphery

Volume of Helium: 20 milyon cubic m.

**Skyport Payload Capacity:** 3000 containers

Container ship Payload Capacity: 9000 containers
Design Parameters

Stability & Balance

during crusing and loading and unloading of cargo
Systems used for Weight balance and stability of Conventional Carriers

1. Ballast Tanks
   Separate ballast tanks are used to stabilize a ship by filling or emptying the tanks with water.

2. Ant-Heeling System
   Designed for quick acting in response to fast and heavy cargo loading processes.
Weight balance and stability of skyport during ascent - descent and weight differentiation.
Weight balance and stability of skyport during loading - unloading

Anti - Heeling System (Redistribution of Weight)
Designed for balancing vessels for fast - heavy cargo loading and loading processes.

Stability is maintained by pumping water around the vessel’s ballast tanks.

- Immediate response to weight
- Rapid loading - unloading
- Safe

Direction of Water Flow through ballast tanks

Unloading  Loading  Loading  Unloading
Design Parameters

Aerodynamics & Orientation
CONVENTIONAL AIR-FOIL SHAPES

- Low chamber - low drag - high speed suitable for race planes, fighters...

- Deep chamber - high lift - low speed - thick section suitable for transports, bombers...

- Deep chamber - high lift - low speed - thin section suitable for transports, bombers...

- Low lift - high drag - reflex trailing edge
  Good stability

- Symmetrical sections
  Good stability

- Thicker for better structure and lower weight
  Increased lift capacity and decreased drag

AIR-FOIL SHAPED HELIUM ENVELOPE

- Minimizes wind loads
- Increases lift capacity
- Creates better stability

LIFT FORCE IS CREATED

Wind cavity
Separating helium envelope and freight towers

Wind shield
ORIENTATION OF SKYPORT

1 STABILITY
Skyport will align its short side towards the prevailing wind in order to minimize wind loads on the surface for better stability.

2 LIFT FORCE
Turning its airfoil shaped envelope towards the prevailing wind will create additional lift force.

3 LOADING - UNLOADING ZONE
Import and export activities will take place in the protected zone unaffected by turbulent winds. All ships during docking will orient their short side towards the prevailing wind.
References on Construction Technology
- Aircraft Carrier -
- Passenger Plane -
- Airship -

Construction Phases of Skyport
Key Features:

- Modular Construction

- Efficiency in Time and Money by building the modules as large and as finished as possible.

-A carrier is made up of up to 200 superlifts - modules constructed in separate shipyards and later transported to the final shipyard where they are assembled together.
<table>
<thead>
<tr>
<th>Systems Enhancement - Design Integration</th>
<th>Engineering</th>
<th>Construction - Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract Awarded</td>
<td></td>
<td></td>
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<tr>
<td>Major Components Procurement</td>
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<tr>
<td>Steel Fabrication</td>
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<td></td>
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<tr>
<td>Equipment Outfitting</td>
<td></td>
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<tr>
<td>Keel - Module Assembly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module Erection</td>
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<td></td>
</tr>
</tbody>
</table>

- **0 Years**: 1, 2, 3, 4, 5, 6, 7, 8

1. **2 Superlifts**, made of multiple decks and compartments up to 900 tons are constructed and transported to the shipyard.
2. Superlifts are adjusted on site and connected to the adjacent module.
3. Superlifts are lifted by goliath gantry crane towards the ship.
4. The last superlift module is connected and inside installations are finished.
5. The construction is finished and the dry dock is flooded with water.
Construction Phases of a Passenger Airplane

1. Various components of the plane are constructed around factories in Europe.

2. Later major A380 assemblies are transported to Toulouse by ship, barge and road.

3. A380 final assembly is taking place in Toulouse, France, with interior fitment in Hamburg, Germany.

Construction Phases of a Rigid Airship

1. Primary structure, the composite rings are completed in different construction sites.

2. Assembled parts are shipped to the construction site.

3. A temporary base is constructed to support the airship during construction.

4. Primary structure, aluminium girders are joined.

5. Secondary structure, stringers are added, binding the ribs and completing the frame of the airship.

6. Aluminium outer skin is connected to the structure.

7. Gas cells, fuel tanks, water ballast, pipes, wires and engines are installed.

8. The envelope is inflated with helium and support base is removed, leaving the airship floating.

9. Airship leaves the hangar to begin its first flight.
Construction Phases of a Rigid Airship

Construction of aluminium rings
Laying down the base.
Connecting the rings with horizontal stripes.
Completing the airframe.

Connecting the aluminium skin to the structure.
Installing the fuel and gas tanks...
Opening of hangar doors for initial flight.
Construction Phases of Skyport
Construction Phases of Skyport

1. Procurement of major components to begin construction. Steel

2. Primary composite rings are constructed at various construction yards spanning up to 400 meters in length.

Framework of superlift structures is composed of triangular lattice girders.

Materials: Duraluminum (light, strong alloy), carbon fibre-reinforced plastic, aluminium glass fibre reinforced laminate.

3. Airframe of the superlift structure is completed by joining the aluminum ribs and connecting them with stringers, metal beams.
Construction Phases of Skyport

4. Aluminum skin is joined to the airframe and the construction of internal decks and compartments are finished. Construction of the massive superlift structure is completed ready to be transported.

5. Superlifts are transported to main construction yards via freight ships.

6. A temporary base is constructed in order to support the structure during construction.
The first superlift module is lifted by goliath gantry crane and transported to its designated place on the base where it is secured and adjusted.

Final superlift module is attached to the structure, completing the hull. Then internally, gas and fuel cells, water tanks, pipes and wiring is installed.
Construction Phases of Skyport

9. After the internal installations of engines and gas cells are complete, the envelope will be filled with helium. The base structure will be removed and skyport will begin to float.

10. While the skyport is floating close to the ground, the gantry crane will be installed at the bottom of the vessel. It will begin lifting and securing the freight rings one by one until they are all joined to the main structure.

11. Completion of the skyport. Skyport begins its maiden voyage.
Once Skyport is Constructed.......and transported to the Port of Roterdam

**Initial Phase**
Total Container Port Capacity: 15,000 TEU.

**Phase - 1**
1 SkyPort Capacity: 1,200 TEU.
- Increased Capacity
- Better Efficiency, Speed of exchange
- Lower Cost

**Phase - 2**
1 SkyPort Capacity: 1,200 TEU.
- Increased Capacity
- Better Efficiency, Speed of exchange
- Lower Cost

**Phase - 3**
15 SkyPort Capacity: 18,000 TEU.
- Using freed port areas for recreation.
- No need for connection to land transportation infrastructure

Totally replacing the container ports by Skyports and staging them near coasts.
Section Through the Container Port

1. Long - Distance SkyCraft - International Import
2. Middle - Distance SkyCraft - to Distribution Center
3. Short - Distance SkyCraft - harvester from other freight modes

Large size Skycraft - between Skyports
Middle size Skycraft - to distribution centers
Small size Skycraft - to other ports, container ships
Skyport - Clusters According to Altitude and Types of Goods

Central Storage Port
- Storage of long term freight containers.
- Delivery of freight to short term ports for export.

Fast storage and retrieval system for heavy freight
- Non-perishable goods: Machinery components, Auto parts, Electronics.

Fast storage and retrieval system for light freight
- Non-perishable goods: Toys, shoes...
- Perishable goods: Frozen meat, sea food....
Skyport Design

Concept Drawings
3D Renders
Sections - Elevations
Facade Detail
Renders in Context
Sky-Craft, mobile, aerial, hypothetical, elusive.

For the idea of being offers security, identity, fidelity, all the military comportments of the controlled, the known in advance the predicted, the designed.

But the domain of the skies is too complex in its currents and counter-currents, too transitory in its invisible fluidity, too uncertain in its potentials.

Leibniz Words (translated)

Airial nancys, holding their sky-crafts, in an intense, deep, and intimate synthesis.

The crafts are like sky-birds flying through the ocean of space in infinite current (time?), records our love.

They are territories, like spider-web, to catch the attentive gaze, the aspiring agent, in order for indefinite auto-fulfillment through our finite existence.
Storyboard for Skyport for Final Rendering

1. 000 (close-up)

The captain arrives at the Skyport. The port's lights are turned off. The ship is about to lift off. The captain is on the bridge. The ship is ready for takeoff.

2. 050

Captain checks the ship's exterior. The ship's exterior is检查。The captain walks to the control room. The ship ascends into the sky. The captain is on the bridge. The ship is about to lift off. The ship's exterior is checked. The ship ascends into the sky.

3. 060

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

4. 080

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

5. 090

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

6. 100

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

7. 110

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

8. 120

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

9. 130

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

10. 140

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

11. 150

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

12. 160

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

13. 170

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

14. 180

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

15. 190

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

16. 200

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

17. 210

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

18. 220

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19. 230

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20. 240

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21. 250

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22. 260

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24. 280

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25. 290

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26. 300

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27. 310

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28. 320

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

29. 330

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

30. 340

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

31. 350

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

32. 360

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

33. 370

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

34. 380

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

35. 390

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.

36. 400

The ship's exterior is checked. The ship ascends into the sky. The ship's exterior is checked. The ship ascends into the sky.
Skyport Envelope:
The envelope structure is composed of vertical ribs and horizontal beams strengthened by tension cables. The airframe is composite aluminum alloys. The large truss beams carrying the ring, also contains all the mechanical installations, emergency evacuation capsules and environmental sensors. Furthermore on the top surface of the envelope are heat and pressure sensors to detect fluctuations in the climate.

Skyport Envelope:
The upper envelope contains the lifting gas, helium as well as air ballonets. A social ring is attached to the envelope which houses the social spaces above and the office spaces for port authorities below. These spaces are entered through the side decks on the broad side of the ship and are pressurized and heated by a climate control system. The lower spaces are also naturally lighted by indirect sunlight bouncing from the clouds below. All the social spaces are linked by a express shuttle system at the periphery of the envelope.

The upper parts of the envelope is penetrated by social decks and observation platforms, ending with the skydeck at its apex. The vertical circulation spine which connects the freight towers with the envelope connects all the social spaces together.
Skyport Gondola:
The gondola section of the port is an automated robotic storage facility for containers. However, this facility is penetrated by observation and viewing platforms for technitions as well as common people so that the kinetic energy and motion in the design, the flow of containers, unmanned, docking skycrafts and the relentless labour of robots are perceived by the eye both from the inside and outside of the port.

Skyport Gondola:
Gondola of the skyport is basically an automated storage and retrieval facility for the containers. This section of the port is composed of the vertical circulation spine (which connects the gondola with the envelope), the import and export interfaces, the container rings and the protective wind shield facing always towards the prevailing wind.
Skyport Aerial and Exploded Perspective

Major Components

Helium Envelope
Goliath Crane
Protective Canopy
Automated Container Towers

Automated Container Towers
The towers via robotic arms and conveyor belts provide a fully automated storage - retrieval system.

Stacking Rings
Central Spine
Vertical Distribution
Export Apron Interface
Import Interface
Skyport Import - Export Systems

Central Spine
Vertical distribution shaft connecting import and export aprons and moving goods and people among different floors.

Import - Export Aprons
The alignment of import and export aprons that are attached to the central spine.

Automated Container Tower
The layout of central spine, import - export interfaces and container rings together with the installation of windshield to the front of the structure.
Skyport Import - Export Systems

A section of the Container Tower
Skyport Docking Systems

Technologies incorporated:

Ship Docking systems
- remote release system
- mooring line load monitoring
- docking aid system
- environmental monitoring systems
- central monitoring interface
- quay gantry cranes

Airship Docking sys.
- mast probe cables

Orbital Docking sys.
- reaction control sys.
Skyport Docking Systems

Skyport docking system serving three skycrafts simultaneously.

Section through Skyport Docking System  Flow of container freight through skyport interface
Skyport Docking Systems - EXPORT

Skyport export interface showing three skycrafts docking at the same time and exchanging cargo.

Gantry crane and mooring details of skycraft.

Container ring and open export apron in view.
Skyport Social Spaces - Unautomated

Above the automated towers and around the helium envelope, supported by the main truss ring will be the recreational ring housing the public spaces.

- Recreational Spaces
  - Viewing Platforms
  - Eating Drinking Spaces
  - Shopping Spaces
  - Aviation Museum

The automated, robotic, structure will not be secluded from the public. On the contrary the flow of containers, moving robots and unmanned sky crafts will be perceivable via observation decks, circulation shafts and express shuttles.
Skyport - Social Ring - Facade Detail

High Altitude
Cabin Pressure > Air Pressure = Aluminum Skin Expands.
Outside Pressure
Skin

Low Altitude
Cabin Pressure = Air Pressure = Aluminum Skin Compress.
Outside Pressure
Skin

Mechanical Space
Environmental control system
Indirect Lighting
High-Impact Glass
Multi-Layered Perspex
Insulation Between
Pressurized Space
Recreation Areas

Express Shuttle

Environmental Sensors

Structural Rib-Aluminum Alloy
Solar Cell Arrays
Weather Protection Layer
Adhesive Layer
Polyester Film
Synthetic Fibre-Fabric
Helium

Helium Envelope
Air Balloonet
Tension Cables
Main Truss
Aluminum Alloy
Anti-heeling System
Water Ballast Tanks
Pressurized Space
Office Areas-Port Authorities
Indirect Lighting