

Safety Assurance Process for FRMS eJcase Implementation

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EARLY DRAFT of HILAS Book Chapter

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1 Fatigue Safety Assurance

1.1 Background

The function of an airline safety management system can be broken into two principle domains of safety assurance and safety risk management (Stolzer et al, 2008, p186). Safety risk management activity is associated with the identification of hazards, assessment of risk and the development of risk control strategies. Operational evaluation of these strategies determines whether they in effectively control the identified risk and can then form part of the airline Safety Assurance function. The Safety Assurance process continuously monitors operational activity ensuring that applied risk controls are consistent and robust in that they continue to achieve intended objectives (supported by systemic safety performance indicators). These two core operational activities take place within the SMS umbrella provided by a safety policy and safety objectives and are supported by safety promotion and feedback.

The FRMS structure follows the same principles of SMS (Figure 1) and performs a safety risk management and safety assurance function for the easyJet operation. The approach to FRMS Safety Assurance comprises elements of both Risk Management System (RMS) and a Safety Assurance processes developed by the HILAS SMS working group and adhered to the principles of Organisational Learning (Argyris & Schön (1974), Koornneef (2004)) and Resilient Safety Culture (Reason (1997; 2008), Weick & Suttcliffe (2007), Akselsson et al (2009)). The Fatigue Safety Assurance function is integrated into the Operations Risk Group and functions as part of the company Safety Management System. It delivers coherent fatigue management practice between easyJet operational departments. The functions include interface with the network development team for commercial scenario evaluation and risk assessment; fatigue risk network monitoring through the Safety Management System and rostering quality assurance through the sampling and assessment of planned and achieved rosters for quality, standardisation and compliance. The FRMS is responsible for the fatigue risk oversight of the easyJet operation in accordance with the provisions of the FRMS policy and the functional oversight requirements of the CAA variation (derogation from FTL supported by an acceptable means of compliance oversights by the FRMS).

The easyJet FRMS functions in accordance with the recommended capability contained within ICAO Annex 6 guidance and EASA draft FRMS regulation requirements. The FRMS team is part of the Safety department and the day to day running of the FRMS is delegated to the Fatigue Safety Risk Manager and the Fatigue Safety Assurance Manager (necessity for this structure depends on the size, nature and complexity of the operators FTL scheme (EASA NPA- OR.OPS 325.FTL) (Figure 1). The purpose of the assurance role is to provide a formal oversight of the roster planning and implementation function in regard to legal, industrial, systems and process compliance. This oversight further recognises that legal compliance in itself does not necessarily guarantee achieving the levels of fatigue alleviation commensurate with safety being our number one priority.

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Effective oversight of the crew planning cycle necessitates the independence and empowerment to follow events, processes, rule sets and standards across internal and external departmental boundaries and handover points. This allows the full identification of structural factors related to consistency and standardisation as well as performance. In essence the department is tasked to enhance safety effectiveness and operational efficiency through the enforcement of FRMS principles and appropriate rostering standards.

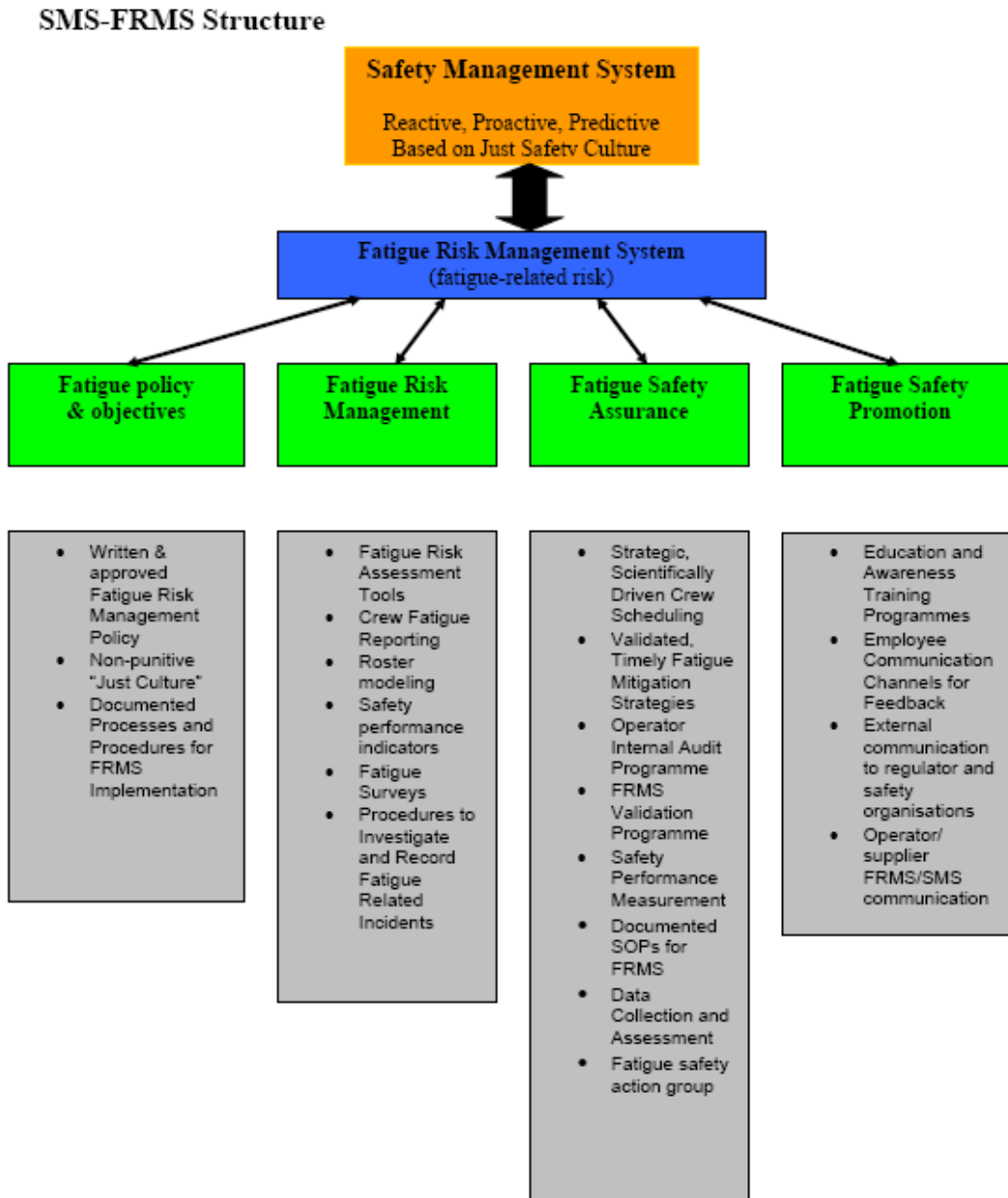


Figure 1. FRMS Structure within SMS (adapted from EASA NPA 2009c & ICAO doc 9859, 2008)

1.2 Core functions of the FRMS (adapted from EASA OR.OPS.025.FTL and HILAS RMS process)

1. Developing corporate and company fatigue safety policy ensuring a clear definition of safety objectives, safety performance metrics and operational standards
2. Detecting, measuring, categorising, investigating and analysing operational fatigue hazards in order to provide the interface between safety risk assessment and rostering processes.
3. Prioritising strategic and tactical fatigue risks so as to develop and implement appropriate controls and rule sets.
4. Communicating change and risk management activity to the organisation
5. Tracking and monitoring the performance of implemented controls thereby assessing any residual risk.
6. Providing feedback to stakeholders and regulator as part of a continuous improvement cycle

The FRMS team interfaces with the commercial function through the Roster Evaluation Group (REG). The REG functions as an inter department (inter-silo) learning agency focussing on safe rostering practices supported by evidenced based rule sets. This group is the focal point for input from the FRMS (risk assessments and incident reports, roster compliance and standards), CRPG (roster planning and delivery teams) and the strategic safety and business input from the Airline Management Board (AMB), Safety Review Board (SRB) and Network Development Team.

This chapter outlines the role and function of the REG, the development and implementation of evidenced based rostering rulesets (interface between safety risk management and assurance), a new concept for audit and compliance to FRMS rulesets, an interface process for communicating fatigue rostering risk to line managers, a concept for the engagement of FRMS into strategic schedule development and a derogation from certification process to support rostering flexibility and economic opportunity for an airline.

1.3 FRMS & prescriptive FTL

The traditional prescriptive regulatory approach for addressing the safety risk of crew fatigue is based on defining quantitative limits in respect of flight and duty times. This approach does not fully take into account the qualitative issues surrounding factors such as the human circadian cycle of work and sleep, irregular and unpredictable duty patterns, and the substantial individual differences that can exist in relation to a crew member's ability to operate safely across a complex and wide ranging set of specific circumstances.

Consequently while prescriptive guidance, such as that contained in Civil Aeronautical Publication (CAP) 371 “The Avoidance of Fatigue in Aircrews”, will continue to form the basic framework for fatigue risk management it is recognised that this will only offer limited and static control. Mitigation of fatigue risk can only adequately be achieved through the responsible and informed implementation of FRMS. This is because FRMS is a multi layered, scientifically based and data driven ongoing adaptive process that can identify fatigue risks and develop and evaluate mitigation strategies to manage any emerging operational risks. As such it will dynamically maintain a required level of safety whilst allowing increased flexibility appropriate to the specific operational environment and context.

An FRMS is required to include a comprehensive system of policies, training, methods, processes, and data collection and analysis all of which are monitored by internal audits within the context of the company Safety Management System (SMS) (EASA NPA 2009c). This system relies on the related concepts of Quality Assurance and Quality Control.

The FRMS safety risk management team must establish a full and robust safety case, supported by scientific research, incident investigations, metrics, and reporting in order to identify risk, prior to implementing each and every roster constraint to the business.

After identifying the risk, that safety case is put before the Roster Evaluation Group (REG) made up of the relevant postholders and risk stakeholders. It is these postholders who own the risk and it is they who make the decision to implement mitigating strategies in the form of roster constraints in order to maintain an acceptable level of safety. The rostering constraints need to be encoded into rostering rule sets (rostering optimisation software) and guidance generated to rostering staff on how to implement the changes.

A fully fledged FRMS provides a systematic and objective process of managing fatigue risk and can add significant value to the business model. For this to happen it needs to be firmly embedded in the operational philosophy of the operator, have the full support and the visibility of the most senior management in the company, and will work only if it is continually nurtured through a “just and open” culture.

The FRMS does not represent a ‘bolt on’ compliance system that acts as a barrier to commercial viability. It represents operational flexibility and opportunity. It facilitates optimal performance and protection within evidenced safety criteria in pursuit of commercial opportunity.

1.4 The role of QA and QC in FRMS

An airline operator should be aware of the expectations arising from CAA FODCOM 10/2009, EASA NPA/FRMS and ICAO Annex 6. The operator is required to have a basic understanding of Quality principles associated with the rostering process and Operator FRMS responsibilities (EASA NPA 2009 c).

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The safety department is responsible for the development and implementation of the airline SMS and, by extension, FRMS.

The FRMS Identifies safety hazards, ensures that the remedial action necessary to maintain an acceptable level of safety is implemented; provides for continuous monitoring and regular assessment of the safety and compliance level achieved and aims to make continuous improvement to the overall level of safety.

Therefore, FRMS assumes responsibility for safety Quality Assurance (QA) and the oversight components of the crew planning cycle while the relevant CRPG/OCC departments perform Quality Control (QC) functions and report to agreed metrics. This reflects the following systemic expectations:

QC: Determines that quality work and deliverables occur during construction and implementation.

QA: Provides oversight and reviews that QC is being performed effectively identifying appropriate trends and risks to inform QA and formal audit.

This conceptually reflects the principles of EASA NPA 2009-02c GM OR.OPS.025/325.FTL relating to FRMS.

Fatigue Safety Assurance Team (FSAT) ensures that processes and rules linked to fatigue-related risk (FRMS Risk Register) are defined and appropriate and this team performs audit and oversight of the Rostering Quality Control (QC) function.

QC is owned by the production department and focuses on evaluating a work product and the practical integrity of the construction methodology – testing and inspecting to ensure the defined rules, standards and processes are observed.

Broadly roosting Quality Assurance (QA) ensures that legal and compliance targets are set, understood and delivered by QC. The method of delivery and its effectiveness is the remit of QC.

Benchmarking is vital when considering changes to process and can be achieved using the defined metrics. Trending is an especially useful QA tool facilitated by the review of QC data.

The following are recommended core roster components that need to be considered by QC. They are not necessarily in order of priority as they are dynamic and often interdependent:

- 1: Legality (adherence to FTL and Working Time Directive -WTD)
- 2: Industrial compliance (adherence to Rostering and Crewing agreements)

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- 3: Contractual compliance (adherence to contractual provisions - e.g. French; part time; seasonal)
- 4: Qualification compliance (adherence to type and categorisation requirements)
- 5: Productivity (Measure of work output e.g. block hours; duty hours)
- 6: Efficiency (The efficiency with which the work is output e.g. out of base duties; positioning)
- 7: Cost (Cost associated with work output)
- 8: Fatigue resistance (adherence to FRMS guidelines such as transitions, elongated duties)
- 9: Sustainability (Work distribution and sequencing relevant to longer term fatigue)
- 10: Crew acceptability (Lifestyle considerations; preferences)
- 11: Robustness (stability - standby and buffers)
- 12: Fairness (work shared out equitably)
- 13: Consistency (comparable output related to comparable input)
- 14: Completeness (coverage and crew complements.)

QC must demonstrate the product is functioning in accordance with the assurances we have given the CAA in relation to the above components (FODCOM 10/2009). The list is neither a finite nor static listing although the more metrics that are reported the more confidence can be generated in the desired quality being delivered. The range of metrics employed similarly helps inform QA trending.

Roles and responsibility of the FSAT in FRMS

FTL Alleviation design, amendment and compliance

- Design & development of the company FTL scheme
- In compliance with CAP 768 ensuring that the company FTL scheme for the prevention of fatigue of all crew is approved by the CAA, incorporated in the operations manual and interpreted correctly
- Lobbying and liaising with the Civil Aviation Authority on all matters surrounding the FTL scheme
- Maintaining a strong personal understanding of company and regulatory policy & procedure
- Reviewing training procedures for FTL compliance and monitoring standards to ensure all relevant staff apply rostering rules and processes correctly within the Flight Operations Department.
- Supporting the achievement of standards and compliance across Flight Operations by ensuring common approaches throughout all departments.

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- Ensuring that all applicable rules and regulations are correctly embodied in rostering and associated planning systems

Crew Fatigue

- Supporting the Company FRMS to enable greater flexibility in our crew thereby providing higher levels of safety and crew utilisation
- In liaison with the FRMS Safety Risk Manager (FSRM) addressing any issues surrounding aircrew fatigue concerns and working to achieve the embodiment of fatigue risk management within Flight Operations
- Monitoring of aircrew fatigue levels through review of FRFs and liaison with the FSRM thereby developing methods of mitigation of fatigue during aircrew roster construction and maintenance
- Providing an ORG representative within an easyJet centre of excellence for advice on FTL and FRMS

1.5 Rostering Quality Assurance

This aims to assure that quality work and deliverables are built into the product **before** the work is done. It ensures that processes, rules and metrics are appropriate, defined, consistent and documented. It performs audit and oversight of the Quality Control function validating the product as “fit for purpose”. QA is a preventative and process driven function extending across the complete life cycle of the product. Recommended components of QA include:

- a) Definition and management of rule sets
- b) Definition and management of key performance metrics
- c) Validation of production and implementation processes to ensure continuity, compatibility and standardisation.
- d) Staff training
- e) Analysis of key performance metrics to identify underlying trends which may inform QA .
- f) Assimilation of customer feedback and industry research.
- g) Oversight of Quality Control to ensure the function is being performed effectively.
- h) Exception reporting and the ratification of corrective and preventative actions within a concept of continuous QA assessment.

1.6 Rostering Quality Control

This aims to determine **during and after** production that quality work and deliverables are being, and have been, incorporated. QC is owned by the production department and focuses on evaluating a developed work product, testing and inspecting to ensure the defined rules and standards are observed. QC is a corrective and product orientated function within a specific area of responsibility.

QC in its basic form takes place over the three components of a build cycle:

- a) The mining of the raw material by compiling the necessary information and ensuring its sufficiency, validity, accuracy and relevance.
- b) The production process which entails assembly of the raw data into the end product either manually or automatically.
- c) Inspection of the finished article to validate it conforms to the rules and standards set by QA

2 Encoding of FRMS Fatigue knowledge for Roster Construction.

Background

The interface between the safety risk management and the safety assurance functions is where risk assessment and management activity is encoded as best rostering practice and evidenced based rule sets to support an acceptable means of compliance. The table provided (Table 1) documents best practice principles in the form of rostering strategies to minimise fatigue levels. This information has been drawn from the findings of FRMS risk assessment, external scientific research and FRF reporting (references are annotated where applicable).

The list is not exhaustive or definitive but has been prepared as an example guide to facilitate subjective review of manual and optimised rosters around fatigue risk criteria. Fatigue is a complex interaction between many variables and a simple check-list is no guarantee of fatigue resilience and operational safety performance. However, it has been produced in order to provide assistance to CRPG staff implementing the internal quality control process in measuring the output of the roster produced by manual and or optimized processes.

The application of fatigue mitigation strategies within the rostering process has been recommended by Caldwell & Caldwell (2003); Caldwell et al (2009), Folkard (2002) and Fletcher & Dawson (2001), Stewart & Abboud (2005) inclusive of:

- Operators should implement best practice guidelines to mitigate fatigue related risk inclusive of maximizing rest time, minimizing circadian disruptions and optimize on-duty performance (balance workload across the schedule),
- The modification of schedules (safety, optimization and productivity) supported by operational science (risk assessments) and balanced by effective manpower planning to develop evidenced based controls for operational fatigue risk (avoidance of single days off, multiple night shifts, forward rotation duties, minimise backward duty rotations, sufficient standby coverage for disruptions)
- Management (interdepartment: safety and rostering) and employees should be trained in fatigue awareness and countermeasures to facilitate working together reviewing practicable and implementable solutions to fatigue related problems (excessive crew positioning, legal is safe management approach, crew duty discretion, elongated shift hours, consecutive long duty days)

These principles can be documented to guide the development of fatigue resistant rosters and should be provided to the operators Rostering Management team by the FRMS. This controlled document will order to integrate and encode FRMS feedback provided from the FRMS review of the published rosters.

2.1 Fatigue Principles

Table 1. Fatigue rostering guidelines based on risk assessments (internal and external scientific studies)

No	Fatigue Mitigation Roster Guidance	Reference
1.	Elongated duties should be avoided on D1 early due to short-term acute sleep loss over the prior 24 hour period. (For the purposes of this criterion, elongated duties are defined as a duty period of 10 hours or more).	Stewart, 2006 CAA Review of Aircrew Fatigue Research, 2005/04 Ref. 5.2.5/6 Knauth, 1996 Cruz et al, 2003
2.	Elongated duties should be avoided on D5 early due to cumulative sleep loss as the result of operating consecutive early start duties. (For the purposes of this criterion, elongated duties are defined as a duty period of 10 hours or more).	Stewart, 2006 CAA Review of Aircrew Fatigue Research, 2005/04 Ref. 5.2.5/6 Knauth, 1996 Belenky et al, 2003 Fletcher and Dawson, 2001 Van Dongen, 2003
3.	Elongated duties should be avoided on D5 late when cumulative fatigue is greatest at the end of the duty block. (For the purposes of this criterion, elongated duties are defined as a duty period of 10 hours or more).	Belenky et al, 2003 Fletcher and Dawson, 2001 Van Dongen, 2003
4.	Duty blocks should contain a mix of 2 and 4 sector duties and more than three consecutive 4 or more sector days should be avoided.	CAA Review of Aircrew Fatigue Research, 2005/04 Ref. 5.2.6 Powell, 2007
5.	Consecutive elongated duties should be avoided. (For the purposes of this criterion, elongated duties are defined as a duty period of 10 hours or more).	Baker, 1999 ref. 2.2.7 Knauth, 1996 Powell, 2007
6.	The rostering of successive periods of minimum rest should be avoided.	
7.	Stable sleep patterns should be maintained through rostering blocks of consecutive early or late duties. Transitions should be avoided wherever possible.	Baker, 1999 ref. 2.3.1 Stewart & Abboud, 2005

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8.	Parity between on and off duty times facilitate improved sleep management. However, when there are differences in off duty times throughout the duty block they should be rostered so that duties become progressively later rather than earlier.	Baker, 1999 ref. 2.3.1 Stewart & Abboud, 2005
9.	Backwards rotational shift changes should not be planned (i.e. Late/Night to Early duty)	Knauth, 1996 Sallinen et al, 2003
10.	Where forward transitions are rostered the late duty should terminate by 2300hrs local in order to avoid a sustained period of wakefulness at the end of the late duty as a result of acclimatisation to the prior early duties operated.	2008 HFMP Results
11.	Where transitions are rostered, the early duty preceding the late duty should not exceed 14 hours.	
12.	Transitions should not exceed more than one per duty block. Although this is a legal requirement of the ALLV rule-set, it is clear that for other crew operating under rule-sets with no current protections around transitions, that operating more than one transition in the duty block will lead to significant circadian disruption and the undesirable backwards rotation.	Baker, 1999 ref. 2.3.1
13.	Where a night duty is planned, this should be preceded by a prior late duty preferably terminating post 2300hrs local in order to enable the crew member to adjust to the change in sleep cycle.	Rajaratnam & Arendt, 2001
14.	Night duties should not be planned within the same duty block as early start reports.	Baker, 1999 ref. 2.3.1 Sallinen et al, 2003

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15.	<p>The alleviation rule-set permits one night report (between 0300-0459local hrs) to be rostered in a duty block of four or five consecutive early starts. This report time is likely to result in higher levels of sleep loss than later early starts as the waking time will occur well within the window of circadian low. It is recommended that these starts are not operated on D1. While in most cases this would not be legally possible where a prior day off existed, the planning of a rest period and then a deep early report of this nature on D1 would cause short term acute sleep loss. Equally cumulative sleep loss incurred throughout the duty block will be greatest on D5 and so this day should be avoided.</p> <p>Optimal placement is on days 3-4 where acclimatisation to the prior early starts has occurred and a good sleep period is likely to be achieved. Rostering on day 2 though less preferable to days 3-4 should facilitate an adequate sleep opportunity.</p>	<p>CAA Review of Aircrew Fatigue Research, 2005/04 Ref. 5.2.5/6 Knauth, 1996</p>
16.	<p>Single days off should be avoided wherever possible.</p>	<p>Knauth, 1996 Hildenbrandt, Rohmert, & Rutenfranz, (1975) Johnson & Naitoh, (1974) Malette, (1994) Wylie et al, (1997)</p>
17.	<p>Where single days off are unavoidable – maximum hours free from duty should be provided. (i.e early duty prior to day off and late duty following)</p>	<p>Malette, (1994) Hildenbrandt, Rohmert, & Rutenfranz, (1975) Johnson & Naitoh, (1974) Wylie et al, (1997)</p>
18.	<p>Paired days off should not be preceded by a late duty and followed by an early report as this will result in only 1 quality nights rest.</p>	<p>Malette, (1994) Hildenbrandt, Rohmert, & Rutenfranz, (1975) Johnson & Naitoh, (1974) Wylie et al, (1997)</p>
19.	<p>Duty periods should not exceed 14 hours total duration.</p>	<p>Bader Report Appendix 3 - 2.1.2 Caldwell, 2005</p>
20.	<p>Rostering the same route for 3 or more consecutive days should be avoided. Familiarisation is likely to result in complacency and increased tiredness associated with operating repetitive cycles of the same rotations.</p>	<p>2008 FRMS network wide base visits - crew feedback</p>

21.	<p>Poor levels of roster stability are likely to contribute to high fatigue levels through stress as crew struggle to manage their domestic commitments with their work schedules. In addition, short notification changes may cause difficulties in managing sleep patterns and achieving adequate pre-flight rest. Schedules should then be constructed in such a way that realistic buffers are provided and that changes caused by standby call-out do not cause disruption to most or all of the remaining work sequence.</p>	<p>Baker, 1999 ref. 2.2.4 & 2.3.1</p>
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2.2 An example of intra- and inter-organisational Learning agencies supporting operator rostering operational readiness and system viability

Any system (airline rostering) exists within certain constraints (FTL) that might shift over time, within an environment in coexistence with other systems that provide threats and challenges for the system's functioning (operator requirement and accountability for the management of fatigue risks with its own FTL scheme). The system needs to learn from two different sources:

- a) internally about maintaining its operations stable
- b) externally - through its outside world radar function - about market position, regulatory development, technological advancements and opportunities and needs for strategic choices.

Typically, learning from its own operations is often associated with learning from accidents or incidents (fatigue reports), but exploratory risk investigations (HFMP) inspection and audits (Threat and Error Management) may also reveal instability trigger sources before the operational disturbance actually occurs. Likewise, learning from developments in the outside world is typically associated with business development, e.g. expansion, state-of-the-art technological advancements (data-mining tools for SPI's detecting weak signals), forthcoming regulations (EASA NPA 2009C) and future perspectives. In order continue in the long run, it is crucial that interaction between learning from the outside world and the existing daily operations takes place in order to inform decision makers about feasibility and risks.

Thus, learning from operations and its operational surprises is essential for fostering learning from the outside world about threats and challenges for the organisation in order to adapt to and survive in the changing world.

The System of Organisational Learning (SOL) model (Koornneef & Hale, 2004), depicts key elements and interactions in organisational learning processes which are incorporated into the SIRA process.. By adapting the elements of the SOL model and applying them to the learning agencies that support managers responsible for the oversight, development and managing of rostering rule sets (working process) sustained by evidenced based risk

assessments the process of intra- and inter-organisational learning and memory can be represented between operators, regulators, and scientific bodies.

2.3 Rostering Evaluation Group (REG)

The SIRA Sensory Network from the risk management system assigns the REG learning agency (support system to the Fatigue Safety Action Group FSAG) to assess safety or business trigger signals with the aim of generating evidenced based rostering rule sets (lessons learned by the work process units) that support risk mitigation activity or commercial drivers with an acceptable level of risk. lessons. The better the members of the learning agency are informed about the daily contexts of work processes, the more easily and effectively the lessons can be formulated and adopted by work process management. In this case the REG learning agency that consists of members who come from the rostering and FRMS teams who are in a good position to assess whether and how a potential operational risk can be managed supporting acceptable safe operation and process efficiency. These 'lessons' as new rostering rule sets are implemented into the work process (roster development and construction) and are stored in the controlled rules register within FSAT (supported by risk assessment documentation) as a form of organisational memory. This process supports the REG and FSAG function such that time is not spent on learning the same lesson twice. Equally important is that lessons learned by the one organisation need to be accessed by other people and this process is exemplified by the interaction between operator and regulator in the petition for derogation from certification standards. Examples of organisational memory are written procedures and protocols, but liaison with the regulator and the promulgation of operator contextual based risk assessments (post expert group validation) as evidence to support future rulemaking process and best practice guidance for industry. The implementation of the International FRMS Forum acts as an inter-organisation community practice network supported by accessible domain knowledge and inter organisational contacts to be consulted and reused.

The interactions between the elements in the SOL-model have a concrete form in development of this system, which can be identified and assessed (Figure 2a). These include trigger signals (internal and external), context information and lessons to be implemented that flow between the work process and learning agencies (rostering to REG, International FRMS forum and FSAG). In principle, the learning agency verifies data in, performs inquiry, proposes process changes and fills the organisational memory with case data, lessons learned by implementation and classifying data, e.g. root causes, whilst the work process offers notification data to the organisational memory and consults it for lessons that might be reused.

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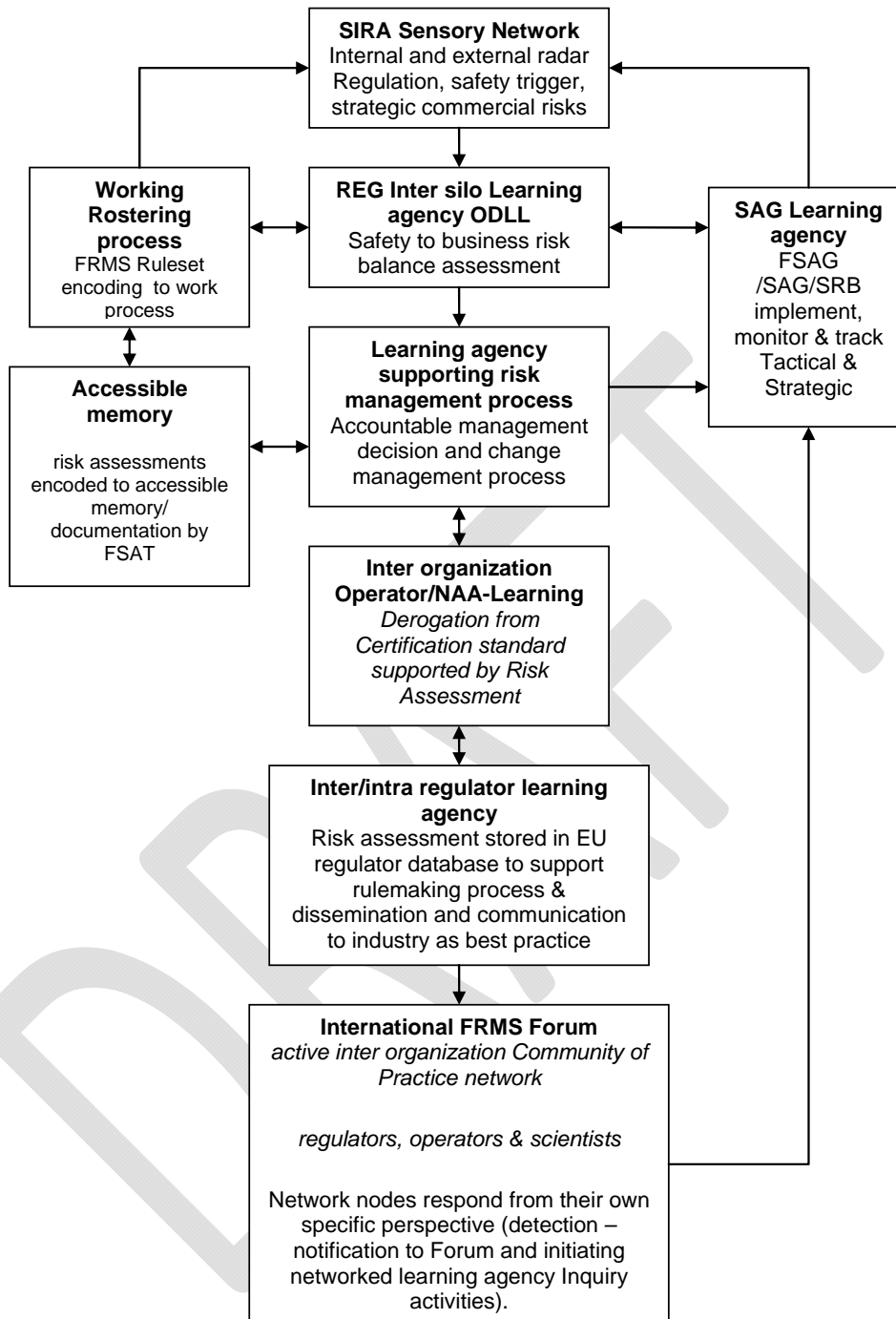


Figure 2a. Intra- and Inter-Organisational Learning and the SOL Model

2.4 Scientific evidenced based rule sets: Acceptable Means of Compliance (AMC)

The role of the REG as Learning Agency for the Rostering Management Team and operational feedback mechanism for the regulator

The REG function is principally associated with Organisational Double Loop Learning as roster standards are defined through the activities of this group. The REG is an interdepartmental forum for balancing commercial opportunity and operational risk so to deliver optimum financial and shareholder benefit. As such it defines expectations in respect of the roster quality to be achieved which not only assume full legal compliance but the delivery of FRMS requirements both of which are achieved through robust Quality Assurance and Quality Control.

It is consequently evident that QC relies heavily on the identification of appropriate metrics as applicable to each component. Where there is an implementation phase testing and inspection is a dynamic ongoing process that will generate additional metrics. Best practice guidelines help achieve compliance with legal, industrial, contractual and FRMS requirements most noticeably during the implementation phase where buffering provides the necessary margin to facilitate operational integrity. Metrics should accordingly reflect best practice where appropriate. Whereas compliance elements of the roster will be determined by the FSAT the discretionary elements which constitute “best rostering practice” and are the means by which such compliance is achieved, is owned by the accountable department and is an integral part of their QC.

At each stage, or sub stage, of the production cycle there is a requirement for the product to be signed off against the relevant metrics before entering the next phase of construction. This entails delegation of authority and responsibility. Comparison of process against metric is a means of reviewing the method of production and this is equally applicable where automated solutions are employed. While QA may define the rules required to achieve the end product is “fit for purpose” QC can define the system rules and parameters encapsulated in the production process that are designed to achieve that outcome. Where production is undertaken remotely, or by a third party, this aspect of QC assumes greater significance.

All processes and rules should be summarised or referenced in an appropriate procedures manual which may be held electronically but will be subject to notice amendment and revision. Where production and implementation are split over a number of departments QA ensures compatibility, continuity and standardisation.

It is evident that the effective management of rule sets is fundamental to the achievement of the requisite compliance and quality. FSAT manages the administration of rule sets supporting AMC in accordance with the following process:

The process for the development of new FRMS rule sets is outlined in Figure 2b. The requirement for new rule sets, as a safety control, can be sourced from new regulation, ineffective existing controls, un-managed/new fatigue hazards or in response to a new

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business direction that would require new system processes. The requests are presented to the REG in the form of initial business and safety cases. If an initial decision is to proceed then a detailed risk assessment (as part of the Safety Risk Management process) must be undertaken. Decision options are generated that balance safety and business case arguments for the accountable postholder. The decision maker reviews the risk versus revenue opportunity and business costs to implement and monitor. From the FRMS perspective the risk assessment forms the basis of a derogation request from to the National Aviation Authority (NAA) against FTL or as part of oversight of the company FTL scheme (OR.OPS.025.FTL). Changes are tested through IT and existing supplier systems before full implementation and encoding into the rule set register maintained by the FSAT. The implemented control is monitored through the safety risk management system and reported at the Fatigue Safety Action Group. Once the testing phase is complete and the control performance is acceptable with specified parameters, then the control forms part of the operational system and monitored through fatigue safety assurance.

Task OPS.055 of the Agency rulemaking programme shall conduct an "Evaluation of the provisions on the Flight and Duty Time Limitation and rest requirements laid down in subpart Q of Annex III of EU-OPS"

This evaluation will include a review of the well known "Moebus" report. However, the EU Commission expressed the view that it was "*preferable that all studies and scientific evidence which might have been developed recently should be taken into account*". To this effect 'operational science' risk assessments conducted in support of the company FTL scheme or variations from FTL certification standard can be utilised by EASA to support the rule making process as a form of continuous improvement. The knowledge gained from company risk assessments validated by EASA will be disseminated to wider industry to raise awareness and to act as guidance material to support best industry practice.

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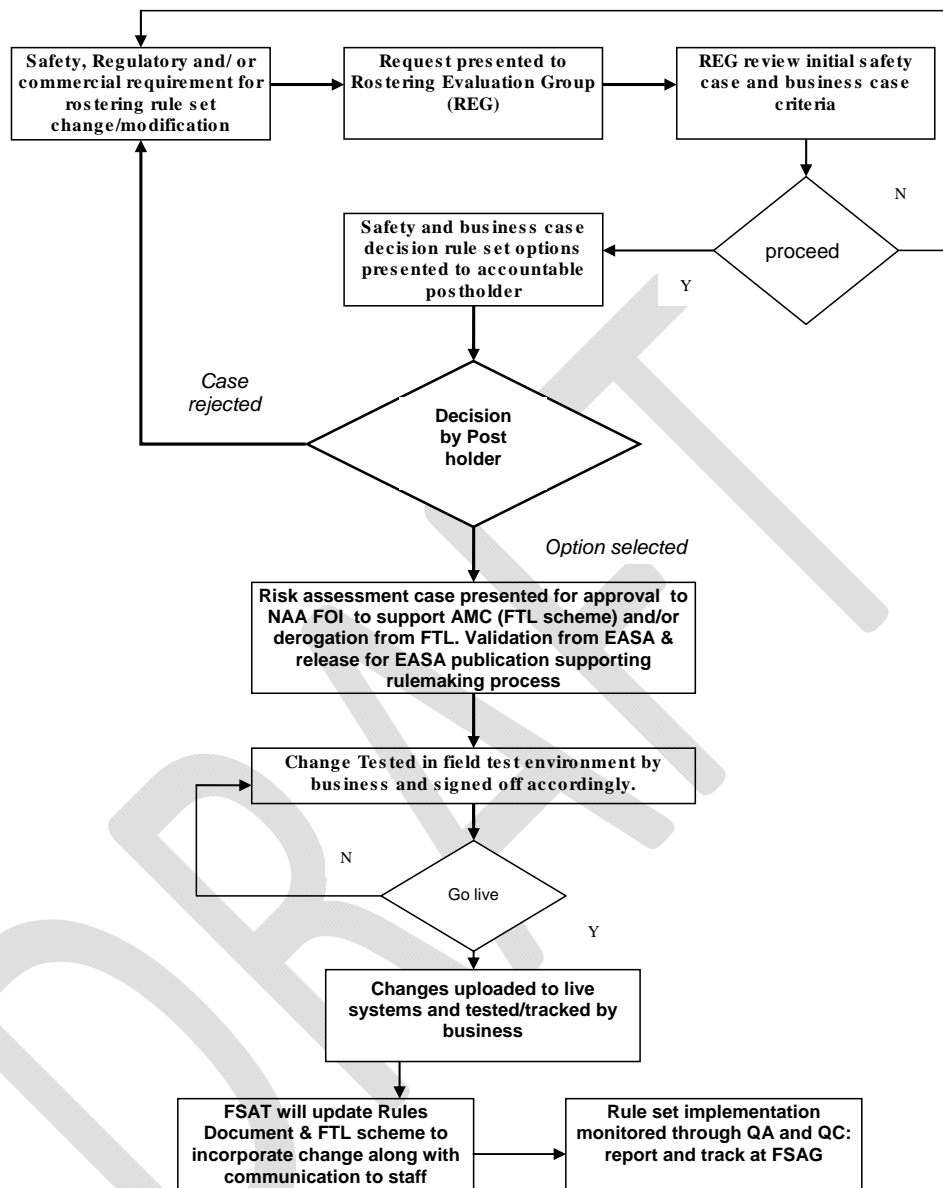


Figure 2b. Simplified FRMS rule set implementation process: REG functioning

2.5 Concept for the approval of operator risk assessments supporting derogations from FTL

In accordance with the provisions of the rule set approval process already outlined we have already mentioned where an operator may wish to seek a derogation from FTL to support business flexibility and efficiency. The operator must conduct an operational risk assessment based on evidenced based scientific process (the easyJet HFMP process is an example of this requirement) show at least an equivalent level of safety as that provided under the FTL.

AMC.OR.OPS.330.FTL (c) Flight time specification schemes

- a) Individual scheme submission to the competent authority to contain a risk assessment inclusive of hazard analysis and risk management log.*
- b) Details regarding consultation with affected groups “as appropriate.”*

It is expected that the operator will have a comprehensive or ‘gold standard’ FRMS implemented to support the initial risk assessment (safety risk management) and subsequent monitoring requirements for the new risk controls as part of the assurance process.

The request for an FTL derogation and the supporting risk assessment is first submitted to the NAA. They would review the application against acceptability criteria and can be supported by an expert panel group (consist of regulatory, scientific and operational FRMS experienced individuals).

The NAA can provisionally approve the application and forward the application to EASA or reject the application with guidance to the operator to support a resubmit.

EASA will go through a validation process supported by an expert approved body of similar capability to that employed by the NAA. The process of approval and rejection is the same as the NAA however EASA may formally request that the operational risk assessment be included as a form of organizational learning supporting the rulemaking process. This will require a confidentiality release by the operator. EASA would disseminate the risk assessment to the wider industry through forums such as the International FRMS Forum, EASA website and NAA website.

This conceptual process is outlined in Figure 2c.

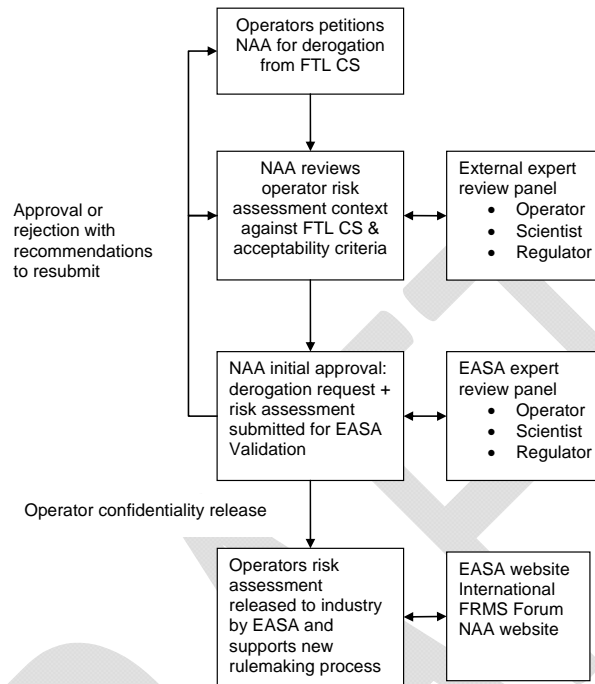


Figure 2c. NAA/EASA derogation approval process

2.6 What happens when FRMS guidance is not followed: FRMS Ruleset violations/corrective action

The suggested process is based on the concept of progressing FRMS as a business tool that gives an operator increased flexibility within the context of managing fatigue-related risk adaptive to operational need.

FRMS risk assessment guidance is translated into evidenced based rule sets in the rostering process after ratification by the accountable postholder through the REG forum (and where necessary to support an alleviation or derogation from FTL through the NAA and EASA). They appear as hard rules (never to be broken) and soft rules (breaking these rules incurs a penalty that restricts rostering process against risk level). Any hard-rule legal or FRMS company violations that are discovered that were not signed off at the

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publication stage with rostering management and FRMS approval must be corrected. These can come in three forms that follow the standard audit findings process.

FRMS guidelines form part of a three tier system:

- 1: Level 1: Mandatory. Must be observed. Red violation. Comparable to a legal exceedance
- 2: Level 2: Controlled; Violations must be reported. Amber violation. Comparable to an industrial exceedance.
- 3: Level 3: Advisory. Best Practice. Green violation. Comparable to the present soft (green) rules.

Guidelines could be raised or lowered between levels in response to identified risk through the REG process.

This process is embedded in an operators FTL scheme such that: "Approval of the company FTL scheme and associated Variations is dependent on compliance with FRMS mandatory Level One guidelines. These guidelines are to be notified to, and approved by, the Authority on the recommendation of the company FRMS."

Observations of a self audit will be categorised by the reviewing manager as follows:

Level 1: **Immediate action required via CRPG Notice to Staff to immediately supersede current published procedure.** Amendment to procedure to be incorporated at next procedures manual revision cycle.

This would include any findings having Company FTL implications; any findings relating to legislative or safety requirements. An example might be an Aircrew Information Management System (AIMS) failure that has allowed undesirable or illegal activity to go unnoticed.

Optimisation software: If the finding is as result of the Roster Optimiser not applying a rule correctly this should be immediately escalated to the Roster Manager for coorrective action with the supplier.

Level 2: Considered non-urgent – no legislative/safety implications. Amendment to procedure to be incorporated at next revision cycle or update to the Roster Production team via e-mail and/or team meeting.

Example: increase in observations of elongated duties of day1 of an early block, OR consistent placement of Level 2 flights often in an undesirable position.¹

¹ Undesirable in quality could be placement in an inefficient manner and/or in a position likely to increase the likelihood of sickness or fatigue.

Level 3: Observation raised – no fault found with procedure or process, however may be suggestions to improve procedure/process. Best endeavours will be made to incorporate in the subsequent roster run.

The advantage is that an operator could change Level One guidelines at any time without having to await an FTL manual revision cycle. The business could add or subtract rules as operationally necessary making the guidelines specific to bases, groups or even seasonal crew resource. Advantages are a process that is:

- 1: Flexible.
- 2: Adaptive
- 3: Dynamic

The FRMS is then able to impose rules with more authority and adjust to opportunity and threat with greater speed than the business could probably handle. This process is inline with the intent of EASA NPA draft regulation enabling suitably FRMS qualified operators to gain increasing self governance. They may wish to consider a system of licensing FRMS within an operation to reflect the attained standard (Gold, Silver, Bronze) with each standard bestowing additional authority in keeping with internal status and maturity.

2.7 Example Process for managing operational Fatigue Mitigation Requests: safety risk management to safety assurance interface

The following outlines an example process for the management of fatigue concerns (proactive and retrospective) between the FRMS team and the Rostering Management. The process outlines the fatigue concern, whether any fatigue rostering guidelines are not followed and recommends a mitigation action. The line manager is then required to acknowledge this safety signal and then manage the issue. The manager must outline reasons for the acceptance or rejection of the FRMS recommendations. Communication is then made to the crew member and the mitigation request logged within AQD.

Example process steps:

1. In accordance with the provisions of the fatigue reporting process and as annotated on the fatigue report form crew have the right to request an FRMS assessment for a forthcoming roster sequence or request a retrospective investigation of a flown duty sequence should they have a concern regarding fatigue. These requests may be received via phone, email, Air Safety Report or Fatigue Safety Report (FRF).
2. Upon receiving a request immediate FRMS feedback is initiated through the template '*Your Fatigue Concern has been received*' category is completed with the relevant details and sent to the crew member via email from FRMS inbox.

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The purpose of this email is to inform the crew member that their request has been received and is in the process of being investigated.

3. A standard fatigue investigation is conducted as is the procedure for all fatigue reports (FRFs), however requests for reviews of future roster changes should be prioritised as there may be a limited window to implement a change if the future roster sequence is upcoming. It is also preferable for Intermediate Rostering & Crewing teams to be provided with maximum notice.
4. Where no roster change is considered necessary, the email template '*Your Roster has been reviewed*' is completed with the relevant details and emailed to the crew member explaining the reasons why the roster is considered to represent a low fatigue risk. All relevant emails are filed in the FRMS database, subfolder '*Fatigue Mitigation Requests*'
5. Where a roster change on fatigue grounds is considered necessary then the Fatigue Mitigation Request Form (FMRF) shall be opened and saved.
6. Section 1 of the FMRF is completed by the FRMS team. This section requires that the specific fatigue issue and suggested mitigating strategies to lower the fatigue risk are detailed. Once this section is completed it is forwarded using the Rostering & Crewing Management Team
7. Section 2 of the form is completed by the Intermediate/Crewing Manager logging whether a change has been implemented and the details. Where a change is considered operationally unviable then the reason for the declined change and the negative operational/financial implications of implementing the change are also logged in this section. The completed form will be emailed to the FRMS team.
8. The FRMS team will forward all completed forms to the FSAT.
9. All completed forms received from Intermediate/Crewing are saved to the original saved FMRF.
10. Where a roster change has been implemented then the template '*Your Roster has been changed*' email is completed with the relevant details and sent to the crew member providing notification of the rostered changes. All relevant emails are filed in the FRMS inbox, subfolder '*Fatigue Mitigation Requests*'
11. Where a roster change has not been implemented then the template '*Your Roster has been reviewed*' email will be completed with the relevant details and sent to the crew member providing advice of policy in these circumstances. All relevant emails are filed in the FRMS inbox, subfolder '*Fatigue Mitigation Requests*'
12. The Discussion Log is updated with all requested details for trending purposes.
13. The report is entered into AQD as follows:
 - a. Enter email from crew as an FRF and open investigation,
 - b. 'Go To Investigation',
 - c. Change state to 'Findings Issued',

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- d. In 'Investigation Synopsis', enter response from Intermediate, and email to crew member,
- e. Change State to 'Closed'.

14. A corresponding entry is made in the Tracking Sheet.

Fatigue Mitigation Request Form		
<i>Instructions:</i> FRMS to complete Section 1 Intermediate Rostering/Crewing to complete Section 2; A & either B or C.		
Section 1: FRMS	FRMS	
	Crewmember & Duty:	
	Name Surname (####) duty on dd/mm/yy	
	Fatigue Issue:	
	Sleep loss is likely prior to D1 early, however this is a non-elongated 2-sector duty and the rest period following is adequate for recovery and pre-flight rest. D2 & D3 are early standbys and D4 is a late standby. There is a possibility that this will result in a sub-optimal E-L transition, however without information on the final duties, the fatigue risk is unable to be assessed. The crew member has been rostered a late, elongated 4-sector duty on D5 when cumulative fatigue risk is highest.	
Suggested Mitigation:		
Change the D5 duty to less than 10h duty and preferably 2-sectors.		
Section 2: Intermediate	Intermediate Rostering & Crewing Department	
	Action taken:	
	A: By Authority of (Departmental Manager or nominated authority):	
	B: Yes, the roster has been changed to:	
	C i) No the roster has not been changed due to:	
	Shortage of standby cover	Y/N
	Roster disruption	Y/N
	Pax/HOTAC costs	Y/N
Other (please provide detail):		

Figure 3. Example FMAF form

2.8 Roster Evaluation Group (REG) Operation

The REG represents a practical forum with FRMS & CRPG teams working together to manage fatigue and commercial risk related to roster strategy. The REG bridges interdepartmental silos to facilitate the balance between revenue generation, risk and acceptable cost.

The role of the Roster Evaluation Group and the Fatigue Safety Action Groups is to report and review significant strategic and tactical safety risks within their sphere of responsibility. The integrated functioning of the REG and FSAG therefore represent proactive teams that support business targets by enhancing an appropriate safety and reporting culture. The REG enhances line management accountability through defining clear expectations and assumptions. It facilitates robust discussions around identified corporate business opportunities and safety risks in order to generate risk management solutions for the review and approval of the Postholders and Accountable Manager.

The team's prime function, as part of the risk management process, is to develop consensual strategies mitigating the safety risks contained within the company risk register as reported at the SRB and AMB. These strategies are designed to safely reduce cost by optimising rostering efficiency and manpower planning within the context of a risk controlled environment. In addition, the REG is the sole review board for any crew rule-set changes. The REG is consequently an interdepartmental forum for balancing commercial opportunity and operational risk so to deliver optimum financial and shareholder benefit. The REG meets as required with minutes and documentation maintained by the FRMS.

The REG Terms of Reference (TOR) include:

- Providing a business and safety review of current rostering rules, regulations and parameters as interpreted within a manual assignment process
- Providing a business review of the effects of rule changes and alleviations to include pre-implementation modelling and cost benefit analysis. It is intended that a consultative approach will be undertaken with crew representatives prior to any changes being implemented, thereby promoting crew safety, efficiency and lifestyle factors through consensus and cooperation
- Reporting to management a prioritised review of commercial team initiatives together with, SRB and AMB risk and policy implications and associated FRMS assessments.
- Maintaining and improving feedback loops from the FRMS into the schedule creation, pairings, rostering and crewing processes.
- Facilitating the opportunity for FRMS to proactively undertake rostering design scenario & modelling analysis for consideration by the business..

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- The interpretation of risk treatment option analysis and the prioritisation of optimiser and staff resource capacity for such evaluations
- The ranking of risk treatments options against agreed criteria to facilitate evidenced based decision making by the Accountable Manager;
- Reviewing and monitoring of fatigue management policies in CRPG and FRMS so as to provide a coherent and complimentary strategy for documentation and audit.

In order to illustrate the cross-functional nature of the REG this document first provides an overview of the operational structure of the participant teams. The REG is constituted from the operational business side by the establishment planning and roster production and development teams.

Establishment Planning

This group produces an establishment plan from defined demand and creates monthly tactical pairing solutions against resource levels. The plan includes optimal crew training plan for initial, recurrent and command training and includes defined training resource requirements (TRE, SIM, CT etc) and interface with training management.

This team provides a handover to rostering on crew resources including guidance to training on annual and monthly training activity and also creates strategic pairings as an input into the optimised network development planning

Roster production and development

The Crew Resource Planning Group owns Quality Control for the roster planning and production process from inception to roster publication. Consequently this encompasses both Establishment Planning and Rostering departments. The Operations Control Centre (OCC) owns Quality Control during roster implementation. This encompasses both Intermediate Rostering and Crewing.

Interoperability of Fatigue Safety Action Group & risk stakeholders

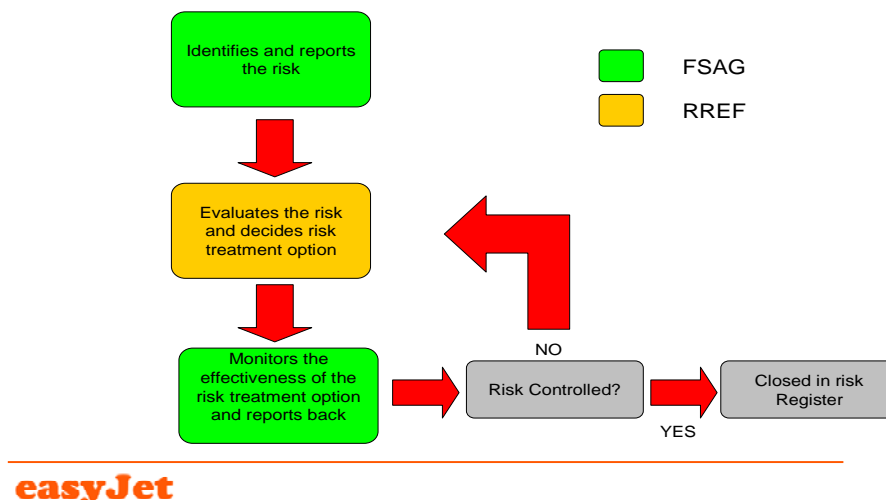


Figure 4 REG inter-functionality with FSAG

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The REG acts as a specialised Learning Agency (LA) for the FSAG where the tacit knowledge of the business and safety stakeholders are integrated to achieve a demonstrable change to operations. The FSAG also acts as a LA for the Airline SAG and then the SRB as both are gates to higher management. The REG postholder acts as the manager for all rostering operations and reports to the accountable manager. The interrelation between the FRMS team, rostering and commercial teams is outlined diagrammatically in Figure 5. The strategic process reviews new regulation such as the EASA NPA and commercial direction of the business (3-5 year plan) that may require proactive development of new fatigue controls (e.g. longer duration or deep night commercial flights) that are not currently employed with the FTL scheme. The role of the FRMS sub-teams is shown where safety assurance and safety risk management functions interact with rostering planning, internal QC and delivery teams around the REG business agenda. All meetings of this group follow a baseline agenda, are minuted and actions points disseminated to relevant stakeholders.

Proposed rule set changes requiring investigation are conducted in accordance with company project management process (Figure 6). The REG forms a balancing function between the development of the business and safety cases around the trigger signal scope. Progress is tracked through project management updates to the REG. This method is clearly understood by the business owner and facilitates clarity around scope, objectives, resource requirements and risk issues recorded via project briefs, Initiation documents and updates. The business case and safety cases are prepared in cooperation to support the generation of viable alternatives to be presented to the accountable manager for the decision process. The steps outlined have been adapted from the DOE-76-45/39 SSDC-39 (1987) & DOE (1999) investigation process but a six-sigma (define, measure, analyse, improve, control) process is equally applicable. The working groups for both the safety and business case need to test and critique the decision options (Cohen, 1996 metacognition model) before final agreement and presentation through the REG to the decision maker. This allows clarity where the decision maker can balance risk, revenue and cost issues for each viable business option. The accountable manager then makes the decision to implement or not and then initiate the change management process.

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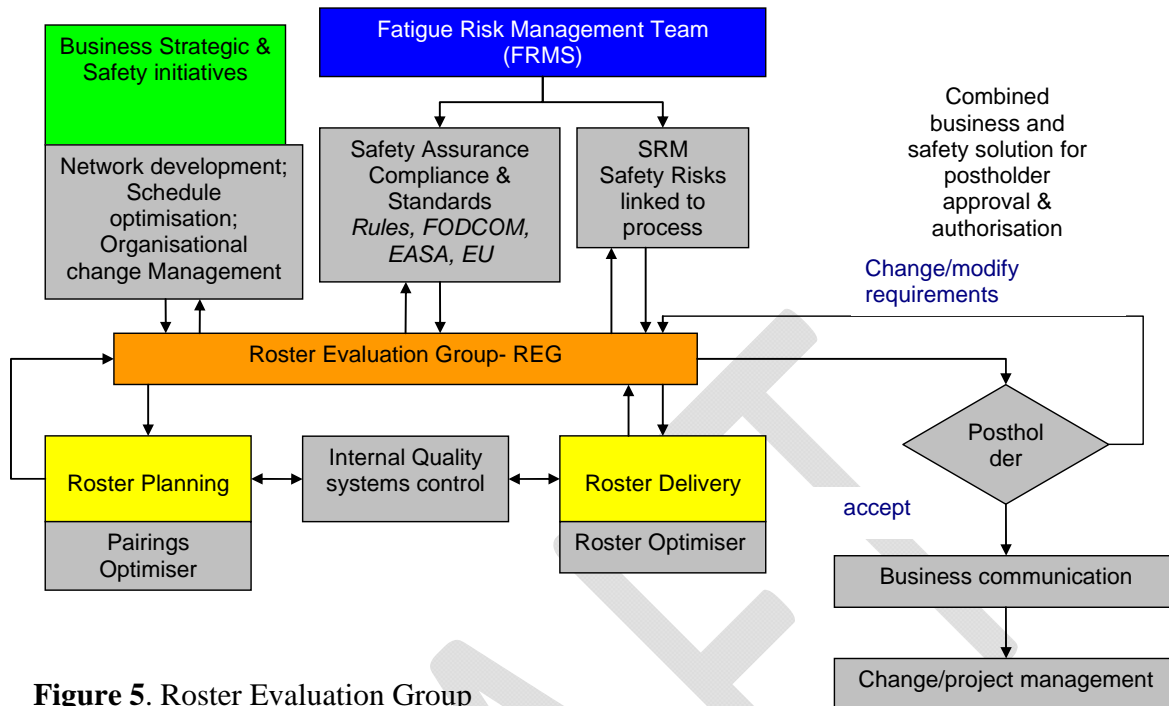
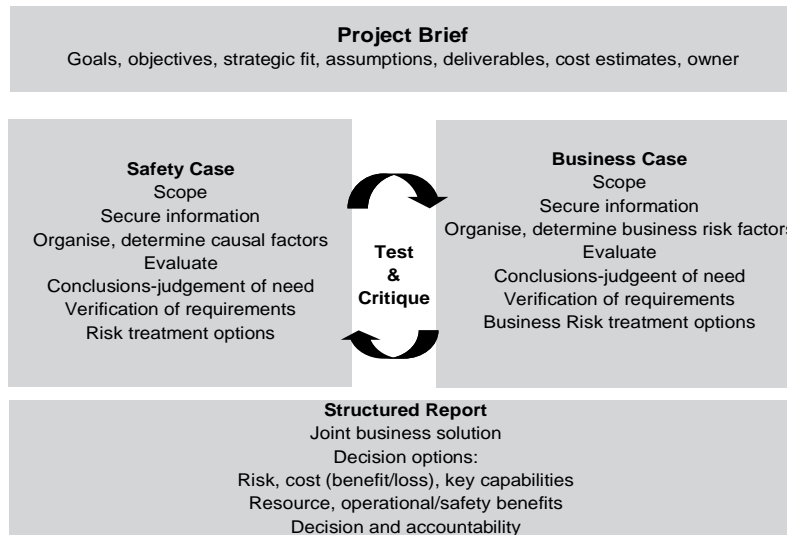


Figure 5. Roster Evaluation Group

Strategic risk investigation



easyJet

Figure 6. The interface between Safety case and Business case from the REG facilitating management decision process

2.9 Fatigue Safety Review Processes

A formal process to monitor and review all safety and security issues is achieved through a committee process of the Safety Review Board, and department Safety Action Groups, covering specified functional areas. This top-down and bottom-up approach and provides a medium for regular consultation, assessment and review (Figure 7). We will now discuss the function and scope of a Fatigue Safety Action Group (FSAG). Thus, SAG's act as hierarchical learning agencies (tactical to strategic issues) that facilitate learning from operational incidents and safety trigger signals and is essential for fostering learning from the outside world about threats and challenges for the organisation in order to adapt to and survive in the changing world.

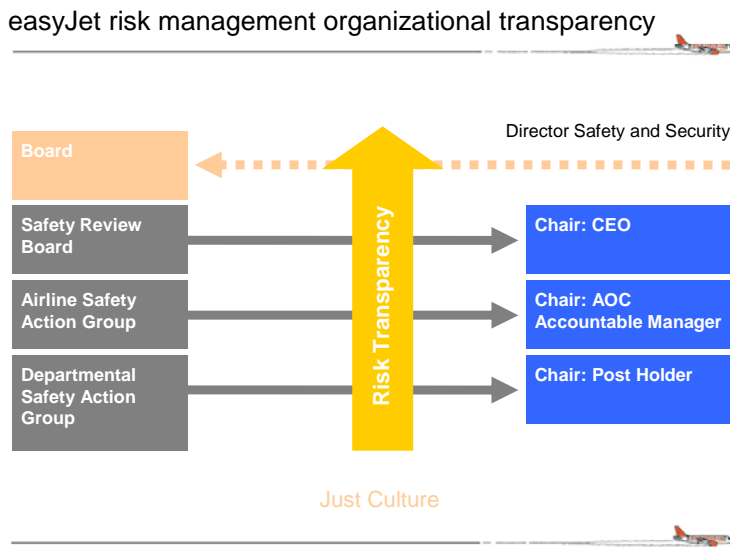


Figure 7. Safety Action Group Process

2.10 Fatigue Risk Management SAG (FSAG) or Fatigue Management Steering Group (FMSG)

The Airline SAG recommended that non-technical safety related issues pertaining to fatigue should be addressed through a new SAG, with key issues being elevated to the Airline SAG in accordance with the current SMS.

The FSAG has been formed as a reporting and communication forum to manage the company's responsibilities regarding fatigue related risk and its functional has been adapted from Fatigue Management Steering Group concept (Gander, 2005). This includes

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responding to crew reports of fatigue. The group meets on a monthly basis and reports to the main airline SAG, the SRB and the CAA. Fatigue is also reported as a key risk at board level. This meeting is minuted with records maintained by the FSRM.

Its principal functions include:

- Discussion of key fatigue-related incidents / events;
- Discussion of industry fatigue performance trends from external databases and industry contacts;
- Overview of existing monitoring protocols and fatigue management processes;
- Creating a forum for the discussion of areas of concern;
- Review of crew fatigue reports – trends and anomalous findings;
- Review of crew surveys; Predictive model roster sample analysis; HFMP study findings and rostering metrics (discretion, stability, violation occurrence reports-VOR's);
- Consideration of cross-sectional / inter-departmental influences;
- Context-dependant discussions of both network and local issues;
- Discussion of implementation, accountability, resources and timeframes of appropriate corrective actions.
- The review and monitoring of selected risk treatment options discussed at the Roster Evaluation Group (REG).
 - Requesting internal audit of specific issues;
 - Providing transparent and timely feedback to the workforce and to higher management;
 - Co-operating with internal and regulatory audits;
 - Overseeing the quality assurance of fatigue risk management training (initial and on-going) across the organisation.

Example FSAG Standing Agenda

1. Safety Objectives and KPI's
2. FSAG Terms of Reference
3. Action Points
4. Generic and Concurrent risk charts
5. Current Safety Investigations
6. Aero-medical examiner issues
7. Summary Safety Performance Indicator Statistics from FAID/SAFE; HFMP studies; Surveys; investigations
8. Development Calendar - Forthcoming Deadlines
9. Regulatory progress and industry FRMS Risk assessment/scientific studies: Updates
10. Departmental Fatigue Safety Issues - Flight Ops, Cabin Ops, Ground Ops, Engineering
11. AOB

The FSAG is the focal point for the FRMS, is supported by the FRMS risk register and reports into the main airline SAG.

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Fatigue is a key strategic business risk and performance monitoring is reported at the monthly Safety Review Board (SRB) (chaired by the CEO and attended by Departmental Postholders) and monthly Safety Action Group (SAG) Meetings (Chaired by the Chief Operating Officer and Postholders and Quality & Safety Managers). The role of the Safety Review Board is to act as a proactive strategic body which owns the safety philosophy, and is responsible in transmitting it through the organisation.

The agenda of the Safety Review Board (SRB) includes (easyJet Accident Prevention Plan, APP):

- High level review of progress to reach targets set.
- Review of external or company wide issues that may impact ability to reach targets – such as expansion plans, new regulations etc. and take appropriate action.
- Give direction to and receive feedback from Safety Action Groups on their progress, challenge thinking as appropriate through personal experience acquired from Safety Walks or Human Factors Feedback.
- Chart and receive feedback from cross-company working teams to address specific risk issues.
- Review Key Risks (fatigue) and examine the operations for emerging issues.
- Receive feedback and progress actions from Quality audits.

3 Strategic FRMS: Oversight of Schedule Development

Principles of Schedule Development

The concept of strategic FRMS supports a rostering operational readiness configuration for the operation. That in effect means that crew resource is managed (management controls) so that they are available in the right place and right time to optimise efficiencies and exploit commercial opportunity at an acceptable level of risk.

The Commercial department are responsible for schedule development and consequently assume the status of process owners. Nevertheless it is recognised that as well as generating revenue the schedule has to take into account the cost of implementation and the associated operational risk entailed by delivery.

Therefore in order to make schedule development informed and efficient all stakeholders should define their requirements and parameters in terms of generic and seasonal specific network characteristics. Key stakeholders are the Commercial, Operations, Fleet Planning and FRMS departments although it is recognised that this list is not exclusive.

The primary objective of schedule development is to produce maximum profitability within a risk controlled environment (Figure 8).

Organisational Structure and Timelines

The schedule development process is enacted through a Network Development Forum and its timelines run for 2 years in advance of the final implemented product schedule. Representatives from all key stakeholders should be nominated to attend the NDF meetings taking into account the varying scope of each NDF forum which is, in turn, related to chronology.

NDF 1: 18 months and greater in advance of schedule release.

NDF 2: 12- 15 months in advance of schedule release

NDF 3: At 12 months or less sanctions formal release to sale of the active schedule.

Thereafter the development process passes to the Schedule Working Group (SWG) and Tactical Change Group (TCG) that refine and maintain the schedule as it approaches day of operation.

Throughout the process FRMS oversight is undertaken by the Roster Evaluation Group (REG)

NDF Scope and Output

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a) NDF stage 1 > 18 months to 2 years

Provides high level commercial direction and scenarios centred on proposed new routes, bases or fleet and identifies historical or future issues to be addressed by stakeholders as part of development. Releases a limited number of full or sub schedules to NDF 2 as the framework for focused analysis.

b) NDF stage 2: 12-15 months

This stage provides initial commercial, operational and FRMS assessment of the schedules submitted by NDF 1 taking into account the previously defined generic and specific requirements. Concurrently it identifies dependencies. Following sign off it releases an approved single active schedule, with options as appropriate, for development.

c) NDF stage 3: < 12 months.

This stage provides detailed commercial, operational and FRMS assessment in order to refine the NDF 2 offering into a single coherent schedule. As part of this function it actions or progresses dependencies. Following sign off it releases a schedule for sale and therefore simultaneously to the SWG for change management.

SWG and TWG Scope and Output.

Schedule Working Group

This group meets bi-monthly to refine the active schedule in the light of further direction identified as necessary by the NDF structure or required by external constraints such as slot availability. It fully delivers dependencies and reports back to the NDF structure to inform future schedule development. It releases the active schedule to the TWG once the roster production process commences.

Tactical Working Group.

Meets bi-weekly to evaluate the impact of change requests and to action them if deemed practical and acceptable taking into account input from the SWG and NDF structure. It can propose alterations to the active schedule necessitated by operational experience and disseminates the instructions to relevant staff intended to mitigate identified network related issues.

Role of the REG in Schedule Development Oversight.

The REG provides the means by which FRMS input into the schedule development process is achieved. The REG balances business and safety objectives to provide evidenced guidance, advice and direction on schedule construction that is intended to

minimise the fatigue risk that could result from operating the resulting pairings and sequences. The REG has comprehensive access to fatigue and compliance data including crew reporting and discretion analyses. Accordingly it is empowered to recommend fatigue mitigating improvements at every stage of the schedule development process.

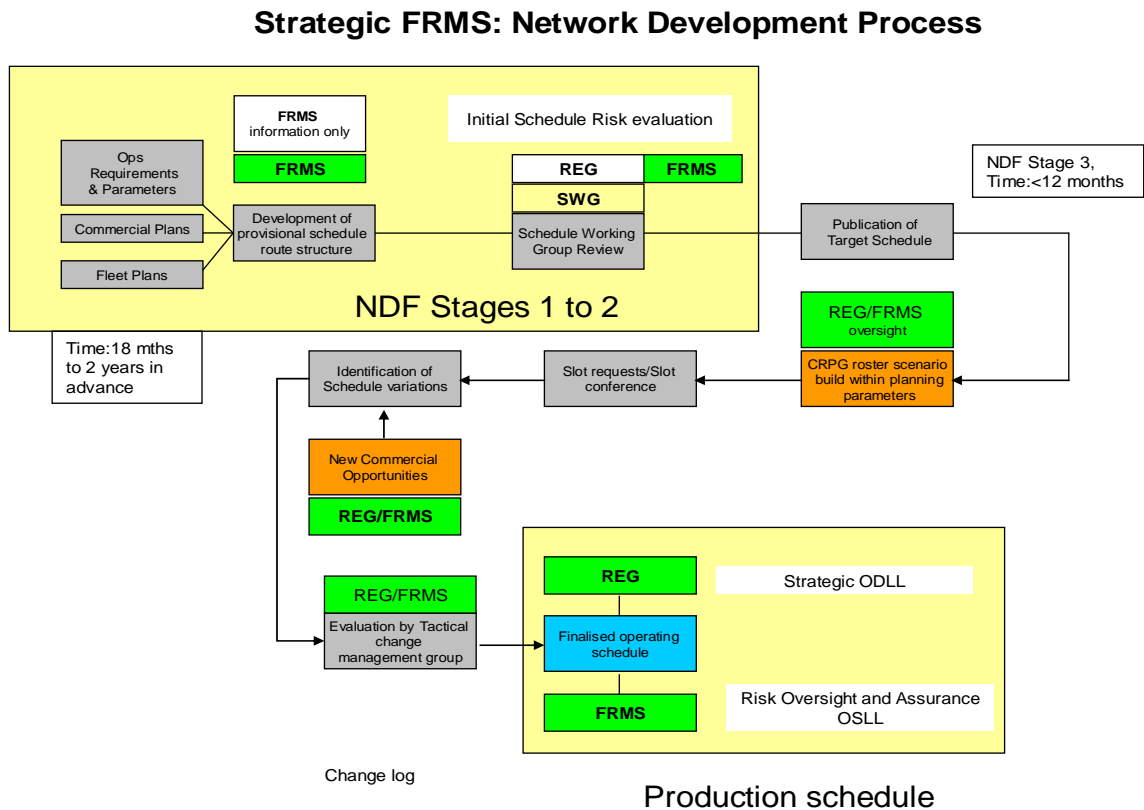


Figure 8. Strategic FRMS in schedule development

3.1 Company FTL Scheme and FRMS: Acceptable means of compliance

An operator is responsible for managing operational safety risks including crew fatigue. One of the appropriate mitigations for crew fatigue is an approved Flight Time Limitations (FTL) scheme which works in conjunction with an FRMS to ensure that crew members are sufficiently alert to operate to a satisfactory level of performance and safety in all normal and abnormal situations. An FTL scheme defines parameters and rules, based on generic fatigue principles that act as boundaries for roster construction and implementation within an individual operator. The purpose is to provide a context or envelope within which FRMS and best practice can provide refinement specific to the differing components, characteristics and circumstances of the operation. The

prescriptive rules within an FTL scheme consequently provides a structure which complements the more dynamic elements of FRMS by imposing a discipline on the exercise of flexibility. It simultaneously provides an NAA with the framework within which to vary the prescriptive element of FTL control in relation and proportion to the maturity and capability of an operator's FRMS.

Flight Time Limitations (FTL)

Airlines can schedule in accordance with the limits laid down through the certification standard FTL guidelines. Each operators commercial scheduling model is different and as such it is the responsibility of the operator (OR.OPS.015.FTL Operator responsibilities) to ensure that fatigue related risk (and incidents related to fatigue) have processes of:

- Detection
- reporting
- investigation and management
- feedback and
- adjustment mechanism

These processes within the FRMS are managed through the SIRA Risk Management System.

The approved FTL scheme shall be properly owned, implemented and monitored by the operator and promulgated in the Operations Manual.

Extract elements supporting FRMS AND PRESCRIPTIVE REGULATION

(a) An FRMS can be used within the envelope of prescriptive flight and duty time limitations or as an alternative to such prescriptive rules where an equivalent or enhanced level of safety can be demonstrated.

(b) Consequently the scope and rigidity of an operator's Flight Time Specification Scheme will be related to the competence, maturity, authority and capability of its associated FRMS.

(c) In that context the continuing CAA approval of the easy Jet FTL scheme, together with variations, is contingent on demonstrating the effectiveness of the company FRMS to the appropriate level of proficiency and governance.

(d) Variations subject to formal and specific FRMS endorsement, actively reportable to the CAA, shall either be dated for renewal or contained within this scheme.

(e) Appropriate mitigations for fatigue risk shall include an approved FTL scheme with provision for good rostering practice that takes into account the applicable FRMS principles and guidance.

(f) Appropriate internal audits of fatigue risk management shall be carried out as part of easyJet's Quality System. This includes validation of the effectiveness and integrity of Quality Control and Quality Assurance processes. All oversight shall have the aim of confirming that easyJet is adequately managing fatigue risk.

(g) easyJet shall take mitigating safety measures when the FRMS process shows that the required safety performance is not maintained.
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