

Fatigue management tools: SMS, FRMS and SAFE

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01 Background



Fatigue – What is it?

ICAO (International Civil Aviation Organisation) definition:

‘A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness and/or physical activity that can impair a crew member’s alertness and ability to safely operate an aircraft or perform safety related duties’.

Effects of fatigue

Fatigue is an inevitable consequence of disrupted sleep schedules. For pilots it can mean

- Inaccurate flying
- Missed radio calls
- System warnings missed or slow to pick up
- Routine tasks performed inaccurately or forgotten
- Loss of situational awareness
- Micro sleeps
- Task fixation
- Poor CRM – everyone is on transmit, no one on receive

But fatigue is not exclusive to civil aviation or to pilots.....any member of the team can be affected - managers, rostering staff, maintenance staff

Estimated that fatigue contributes to approx. 15-20% of commercial aviation accidents

Fatigue-related accidents

- 1993 Kalitta International DC-8-61F at Guantanamo Bay
- 1994 Air Algerie 737-200F at Coventry, UK
- 1997 Korean Air 747-300 at Guam
- 1999 American Airlines MD-82 at Little Rock, USA
- 2001 Crossair BAe 146 at Zurich, Switzerland
- 2002 AgcoCorp Challenger 604 at Birmingham, UK
- 2004 MK Airlines 747-200F at Halifax
- 2004 Corporate Airlines BAe Jetstream 31 at Kirksville, USA
- 2004 Med Air Learjet 35A at San Bernadino, California
- 2005 Loganair B-N Islander at Machrihanish, UK
- 2006 Comair CRJ100 at Lexington KY
- 2007 Cathay Pacific 747F ground collision at Stockholm Arlanda
- 2009 ColganDash 8-Q400 at Buffalo, NY



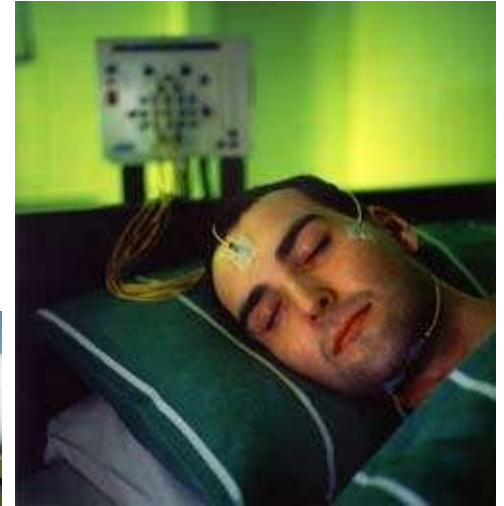
Risk factors for fatigue

There are many factors associated with individual duties and the way in which duties are put together to form a schedule that can contribute to the development of fatigue. For example:

- Extended duty hours
- Reduced rest between duties
- Long commuting times
- Split duties
- Standby duties
- Disrupted sleep pattern
- Time zone transitions
- Consecutive duties
- High workload
- Multiple sectors
- Early starts

02

Current approaches to Fatigue Management



Regulations

Many countries have prescriptive flight time limitation (FTL) regulations

- Limits defined for a range of issues e.g. duty length, duty hours, number of sectors
- UK CAP371 (Civil Air Publication 371: The avoidance of fatigue in aircrews) is probably one of the most detailed regulatory FTL schemes
 - Other guidance available for aircraft maintenance personnel and air traffic controllers

In commercial aviation, these prescriptive regulatory systems are often supplemented by LBA's (labour agreements) and local arrangements

Prescriptive FTLs

Prescriptive FTLs often create the illusion of 'safe' and 'unsafe' boundaries

- If the operator meets the requirements of the regulations the operation is deemed to be 'safe'
- Difficult to design a comprehensive scheme that covers all factors that could contribute to fatigue
 - Personal issues influence levels of alertness
 - Disturbed sleep due to young children
 - Long commute to work

Working outside current regulations

There are situations where it may be necessary to work outside existing regulations

- For example, introduction of new operations, changes to existing schedules
- In the UK this is managed as a ‘variation’, where the operator has to demonstrate to the CAA that the proposed change/s are safe and do not result in high levels of fatigue
 - Generally, this involves the collection of objective data
 - Analysis of FDM data
 - Modelling of proposed route and estimated levels of fatigue
 - In-flight study of aircrew fatigue

Other approaches to managing fatigue

Some operators have taken the data collection process a step further

easyJet UK

- Requirement to work consecutive early and late duties
- Demonstrated to the UK CAA that the approach they proposed was safe
- Continue to use objective data to influence design of schedules



Air New Zealand

- Review fatigue-related issues on an annual basis
 - Setup a scientific advisory committee to provide an independent review
- Routinely, carry out in-flight investigations of specific routes



FRM and Ultra-Long-Range (ULR) operations

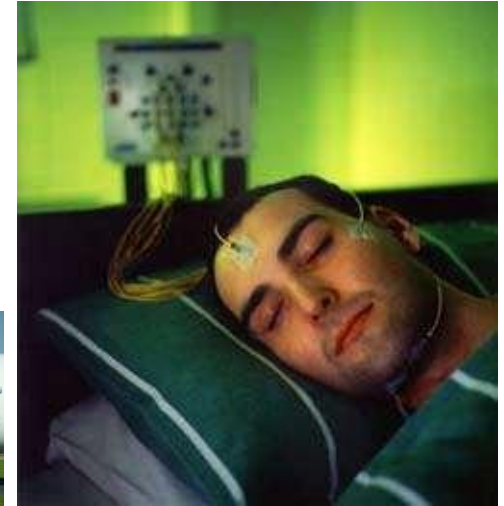
The introduction of a new type of operation, ULR, was associated with the use of FRM techniques

- Workshops used to develop a methodology to managing fatigue
- Modelling of the proposed routes and operational constraints using SAFE (System for Aircrew Fatigue Evaluation)
- Guidance provided to aircrew on fatigue management strategies
- In-flight fatigue monitoring during the first couple of months of the operation and six months after the operation had commenced



03

SMS, FRMS and SAFE



ICAO: Safety Management System (SMS)

Safety Management System

- SMS is 'the systematic management of the operational risks associated with flight, engineering and ground activities in order to achieve as high a level of safety performance as is reasonably practicable'
- Requires an explicit statement of a company's safety policy and corporate responsibility
- ICAO SMS came into force in January 2009
 - In Europe, some member states have mandated it in full and others have deferred implementation until 2012 when the European regulator (EASA) will mandate implementation

Fatigue Risk Management System (FRMS)

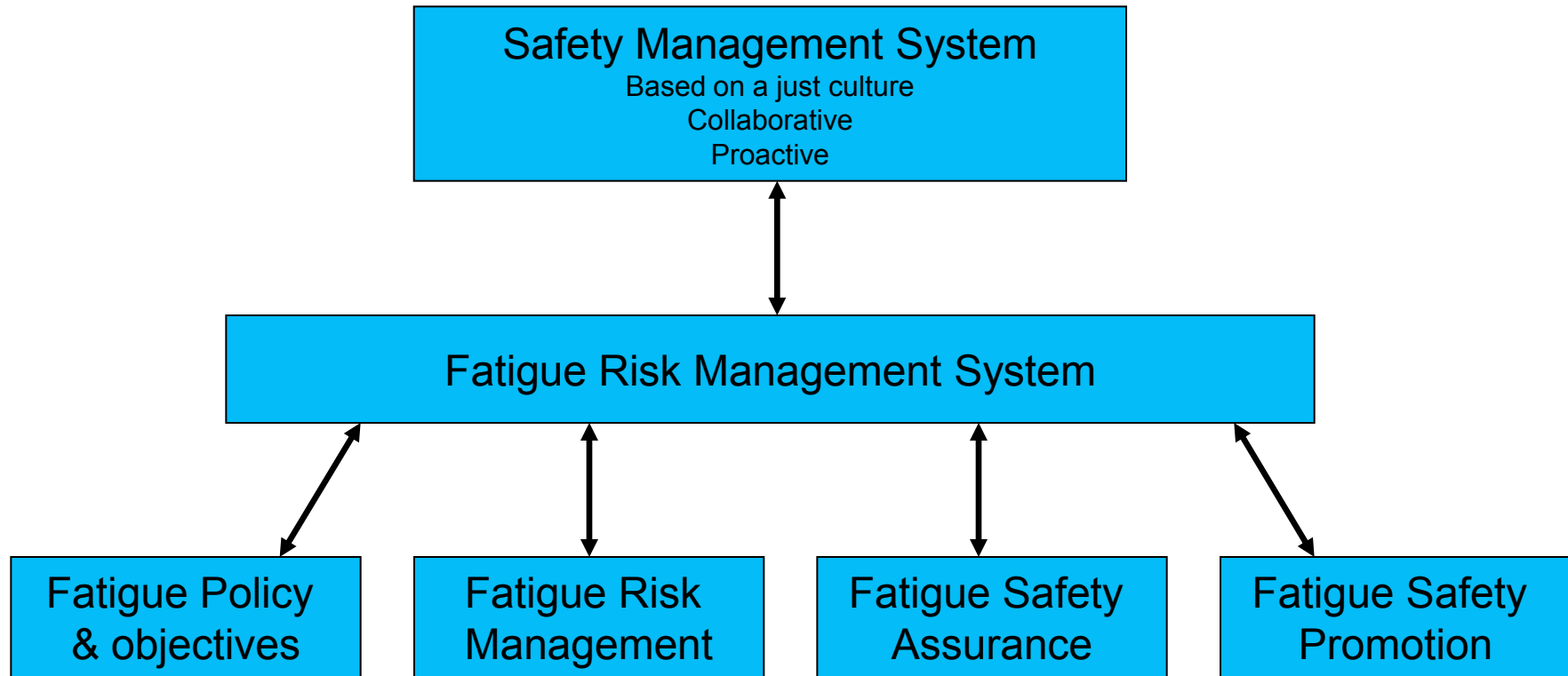
FRMS has been defined as the management of fatigue in a manner appropriate to the level of risk of exposure and the nature of the operation, in order to minimise the adverse effects of fatigue on the safety of operations. It should be:

- Part of the company SMS
- Scientifically driven
- A continuous and adaptive process of monitoring and managing the risk of fatigue
- Aiming to manage fatigue irrespective of the causes

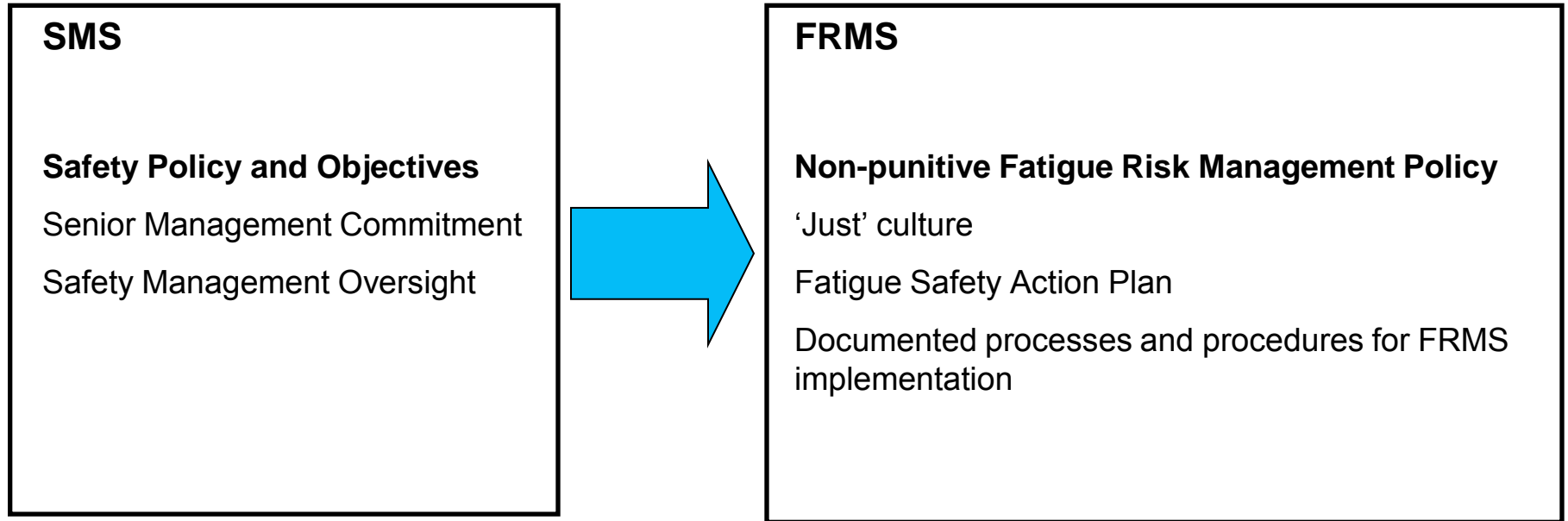
A FRMS should enhance safety through a reduction in errors, incidents and accidents

- It is an holistic risk management approach that includes risk assessments, mitigation strategies, training and education programs, monitoring systems and feedback mechanisms to update and respond to change.
- Operationally it may be viewed from a prevention, prediction, detection and intervention perspective

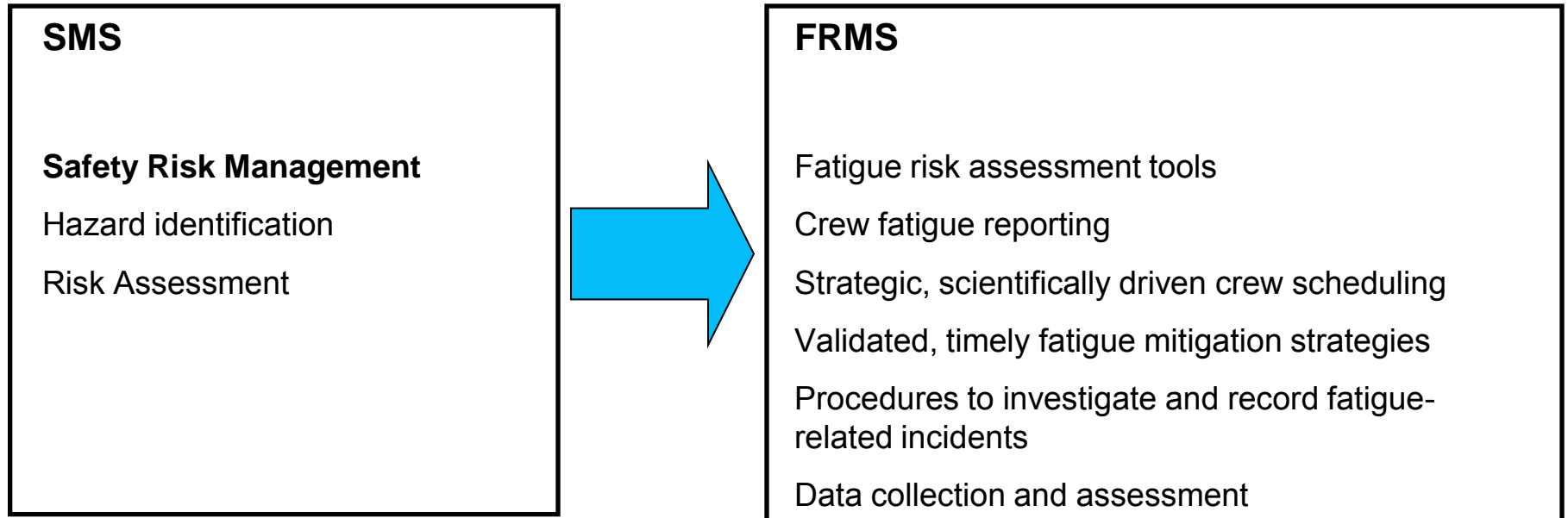
SMS and FRMS



SMS principles and their link to FRMS (1)



SMS principles and their link to FRMS (2)



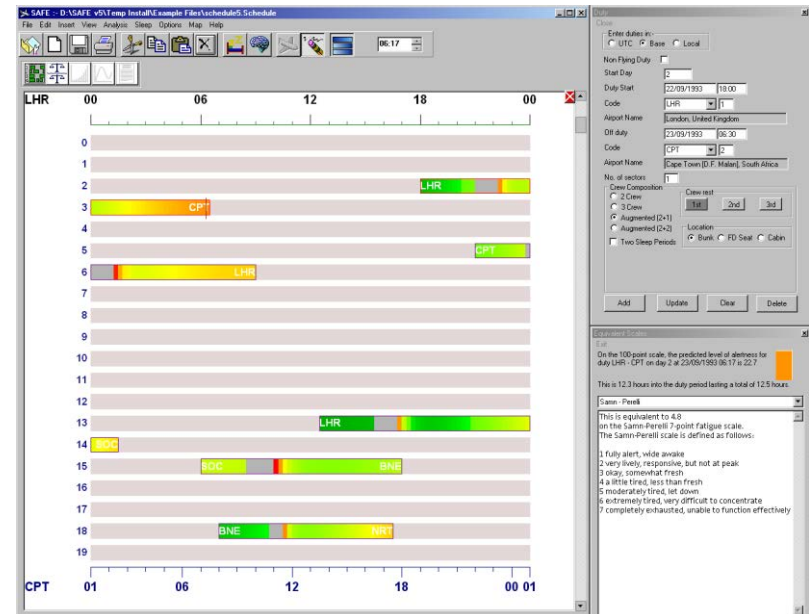
Fatigue assessment tool: SAFE (System for Aircrew Fatigue Evaluation)

Standalone computer program

- Allows the user to obtain an estimate of fatigue during individual duty periods and across successive duties

Incorporates the QinetiQ Alertness Model

- Subsequent refinement of the Model has occurred over a number years and has allowed information to be included that is specific to air operations. For example:
 - Time zone transitions
 - Crew composition
 - Rest in-flight



Why implement a FRMS?

Prescriptive regulations provide only one chance to manage fatigue

FRMS provides more opportunities and greater defences against the risk of fatigue

- More comprehensive
- Should enhance safety (adds defences, additional measures, analysis)
- Provides better understanding of the issues influencing fatigue

FRMS Forum

The FRMS Forum (frmsforum.org) has been setup

- Not for profit organisation
- Run by the aviation industry for the aviation industry
- Membership provides access to documents, advice and meetings
 - Separate areas for operators, unions, regulators and scientists

The screenshot shows the FRMS Forum website. At the top, the logo 'FRMSforum' is displayed next to an airplane icon, with the tagline 'Promoting Occupational Alertness'. A search bar and a shopping cart icon are in the top right. The left sidebar contains a navigation menu with links: Home, About Us, Work Programme, Meetings and Conferences, Members Area, Join the FRMS Forum, Contact Us, Newsletter, Full Name, Email Address, and Sign Me Up. The main content area features a large banner image of an airplane flying over a sunset. Below the banner, there are three columns of text. The first column, 'Welcome to FRMS forum', describes the forum's purpose. The second column, 'Join the FRMS Forum', lists three steps for joining. The third column, 'Benefits of membership', lists several advantages of joining the forum.

Thank you for your attention. Any questions?



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