FATIGUE RISK MANAGEMENT

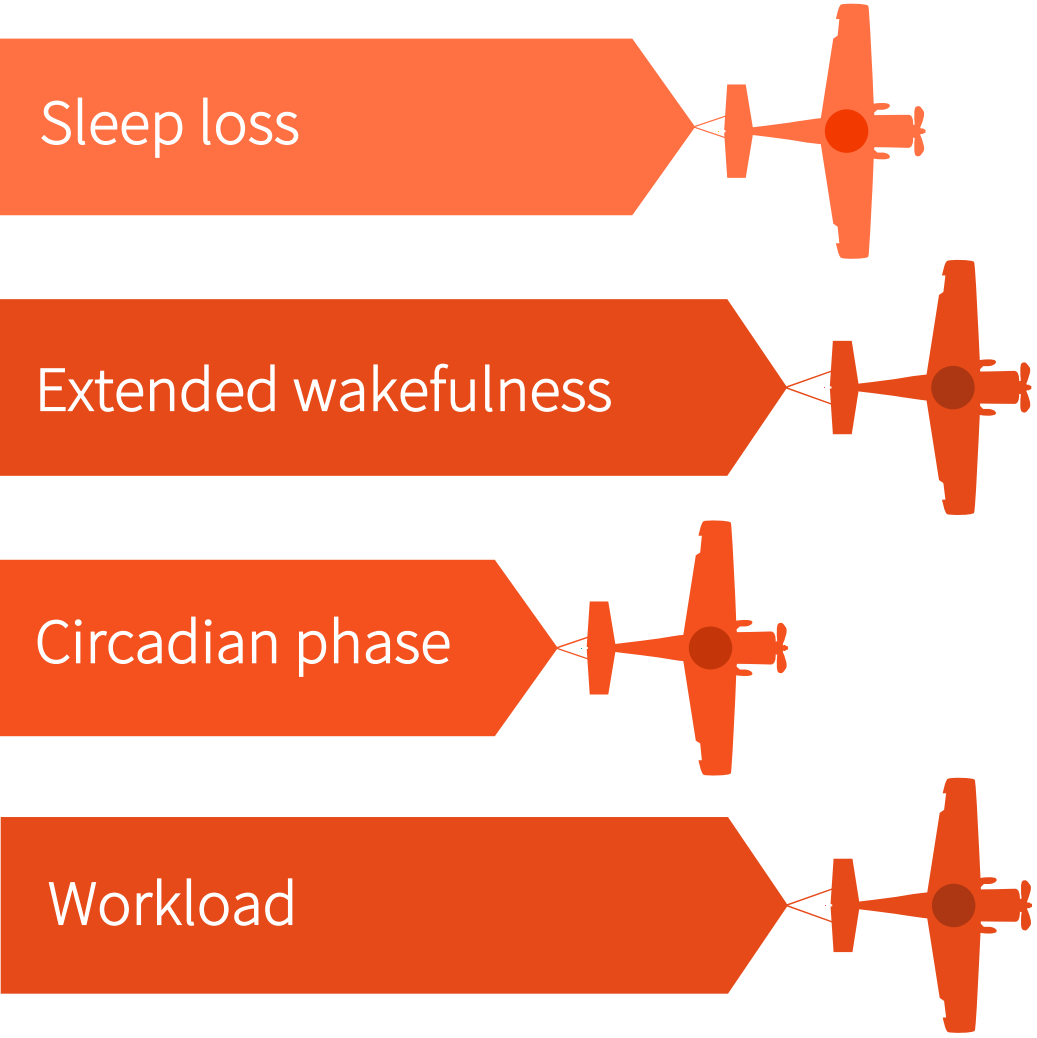
An Airline Perspective

CAPTAIN NILESH PATIL

IATA FATIGUE MANAGEMENT
TECHNICAL GROUP

IATA

Understanding Fatigue



A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety-related duties.

Risks to Aviation

Fatigue can contribute to accidents and incidents in several ways due to its direct impact on human performance.

- *Higher propensity of making errors*
- *Reduction in situational awareness*
- *Slower reaction time*
- *Difficulty in decision making*
- *Reduced communication*
- *Misperception of risk*

ICAO SARPs

Two distinct approaches

Prescriptive	Performance-based (FRMS)
• *Requires the Service Provider to comply with duty time limits defined by the State;* • *while managing fatigue hazards using the SMS processes that are in place for managing safety hazards in general*	• *that requires the Service Provider to implement a Fatigue Risk Management System (FRMS) that is approved by the State*

ICAO SARPs

Prescriptive approach

- ✓ Flight Time and Duty rules and the SMS

Fatigue Risk Management System

- ✓ FRMS Policy and Documentation
- ✓ Fatigue Risk Management Process
- ✓ FRMS Safety Assurance Process
- ✓ FRMS Promotion Process

OR a mix of the two

Some operations under Prescriptive & some under an approved FRMS.

Prescriptive Approach

The Regulator must develop regulatory limits and guidance on:

- Flight times
- Flight duty periods
- Duty periods
- These limits over daily, weekly, monthly and annually
- Rest periods to recover from acute and accumulative effects of fatigue
- Definitions relative to managing fatigue
- Acclimatization / Re-acclimatization
- Commanders Discretion to extend duty period
- Other related areas such as Controlled Napping in Cockpit if applicable.

Flight Duty Timetable - EASA

* Illustration only

Maximum daily FDP — Acclimatised crew members

Start of FDP at reference time	1–2 Sectors	3 Sectors	4 Sectors	5 Sectors	6 Sectors	7 Sectors	8 Sectors	9 Sectors	10 Sectors
0600–1329	13:00	12:30	12:00	11:30	11:00	10:30	10:00	09:30	09:00
1330–1359	12:45	12:15	11:45	11:15	10:45	10:15	09:45	09:15	09:00
1400–1429	12:30	12:00	11:30	11:00	10:30	10:00	09:30	09:00	09:00
1430–1459	12:15	11:45	11:15	10:45	10:15	09:45	09:15	09:00	09:00
1500–1529	12:00	11:30	11:00	10:30	10:00	09:30	09:00	09:00	09:00
1530–1559	11:45	11:15	10:45	10:15	09:45	09:15	09:00	09:00	09:00
1600–1629	11:30	11:00	10:30	10:00	09:30	09:00	09:00	09:00	09:00
1630–1659	11:15	10:45	10:15	09:45	09:15	09:00	09:00	09:00	09:00
1700–0459	11:00	10:30	10:00	09:30	09:00	09:00	09:00	09:00	09:00
0500–0514	12:00	11:30	11:00	10:30	10:00	09:30	09:00	09:00	09:00
0515–0529	12:15	11:45	11:15	10:45	10:15	09:45	09:15	09:00	09:00
0530–0544	12:30	12:00	11:30	11:00	10:30	10:00	09:30	09:00	09:00
0545–0559	12:45	12:15	11:45	11:15	10:45	10:15	09:45	09:15	09:00

Flight Duty Period Table - Singapore

* Illustration only

Table A: Maximum Permitted FDP for Flight Crew (Acclimated to local time)

Maximum FDP (hours)	Local time of start	Total sectors to be flown							
		1	2	3	4	5	6	7	8 or more
	0600-0759	13	12 ¼	11 ½	10 ¾	10	9 ¼	9	9
	0800-1459	14	13 ¼	12 ½	11 ¾	11	10 ¼	9 ½	9
	1500-2159	13	12 ¼	11 ½	10 ¾	10	9 ¼	9	9
	2200-0559	11	10 ¼	9 ½	9	9	9	9	9

Table B: Maximum Permitted FDP for Flight Crew (Not acclimated to local time)

Total sectors to be flown	1	2	3	4	5	6 or more
Maximum FDP (hours)	12 ½	12	11	10 ½	10	9

Flight Duty Period Table - India

* Illustration only

Maximum Daily Flight Duty period for two pilot operation shall be as per the following table:

Maximum Daily Flight Duty Period (FDP) Limitation**	Maximum Number of landings	Maximum Flight Time Limitation
12.5 hours	2 for night operations	9 hours
	3 for day operations	
12 hours	4	8 hours
11.5 hours	5	
11 hours	6	

***** Reduction of Flight duty period due to operation in WOCL***

When the FDP starts in the WOCL, the maximum FDP stated in above table shall be reduced by 100 % of its encroachment up to a maximum of two hours.

When the FDP ends in or fully encompasses the WOCL, the maximum FDP stated in above points shall be reduced by 50 % of its encroachment.

Prescriptive approach requirements

- Regulator must base their Prescriptive limits on scientific principles
- FTL rules in the Operations Manual may be more stringent
- Operators should use the Scientific principles in pairing and roster design
- Operators SMS should include crew member fatigue as a hazard it manages
- Typically, reactive management of fatigue is allowed
- There should be an appropriate level of Fatigue management training.

Shift Towards a Performance-Based Approach

Why move from a fixed set of rules that are generally well understood by all to a performance-based approach?

- Operator may need more flexibility in conducting operations
- More enhanced framework for monitoring of fatigue
- Same or better level of safety as compared to Prescriptive approach
- Allows new types of operations e.g. Ultra Long Range (ULR)

FRMS

- FRMS processes are very similar to SMS ones
- Main difference is that SMS address all kinds of risks, and FRMS processes are specifically designed to manage FATIGUE RISKS
- FRMS must also
  - Identify and assess potential risk (predictive) prior to conducting operations under FRMS
  - Identify and Assess actual fatigue risk proactively during operations
- Attempts to achieve a balance between Safety & Productivity Cost

FRMS: Commonality with SMS

FRMS POLICY & OBJECTIVES

Key accountabilities
FRMS documentation

FRMS PROMOTION

Training and education
Safety communication

FRMS RISK MANAGEMENT

Fatigue Hazard identification
Risk assessment and Mitigation

FRMS ASSURANCE

FRMS performance monitoring and measurement
Use of Fatigue SPIs
Continuous improvement

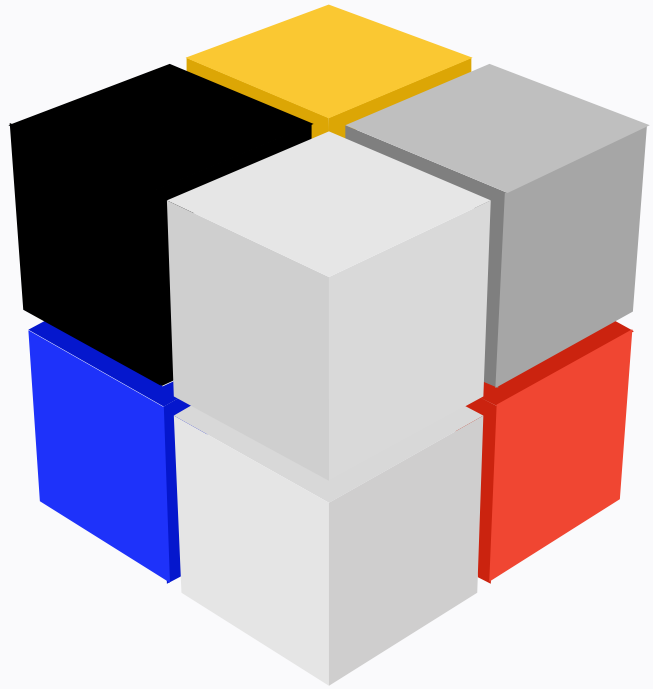
ORGANIZATIONAL

SUPPORTS

OPERATIONAL

How to implement an FRMS in phases:

- Phase 1 – Preparation
- Phase 2 – Trial
- Phase 3 – Launch
- Phase 4 – Continuous Improvement

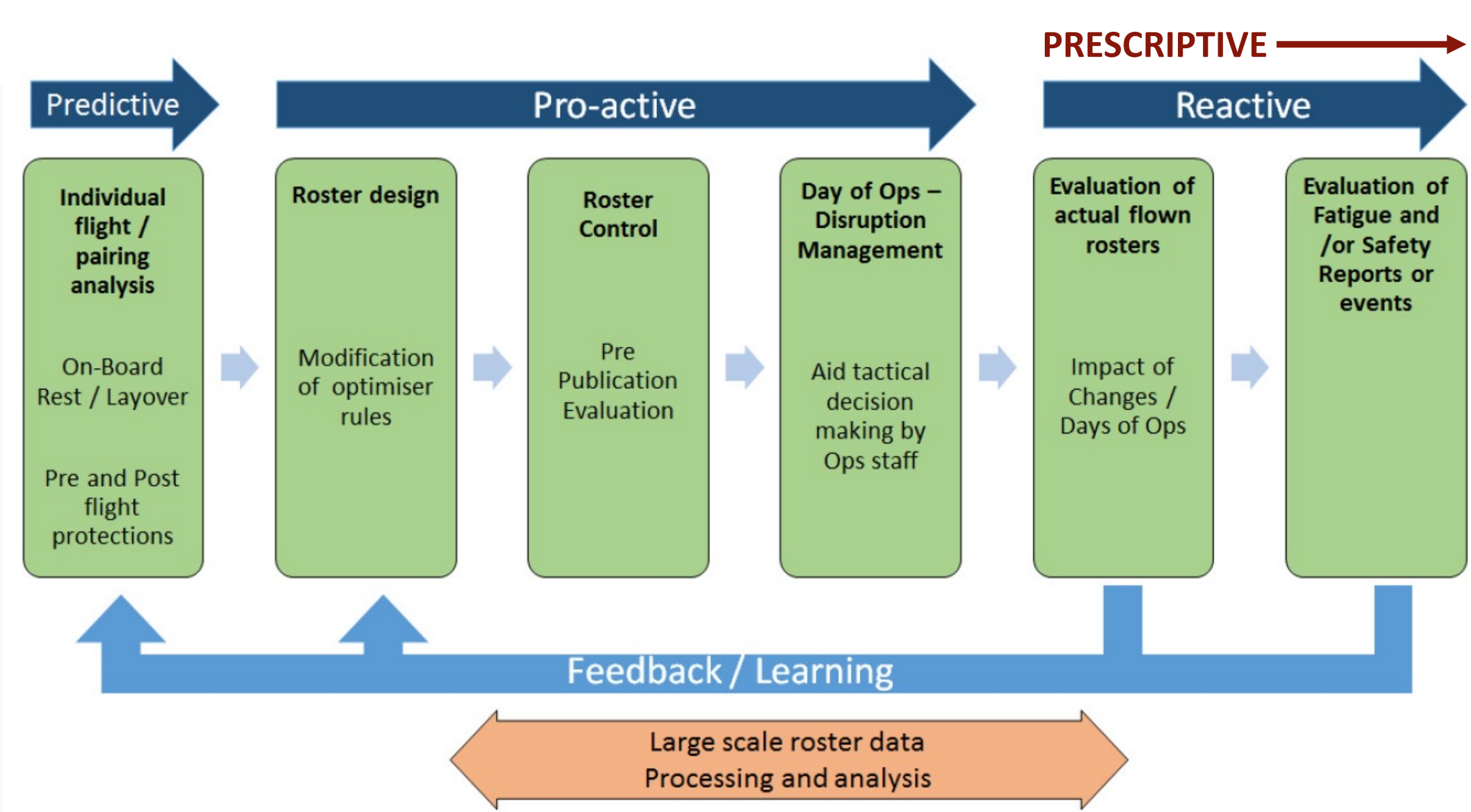


Key ideas on implementing FRMS

- There is no ‘off-the-shelf’ version of an FRMS that will suit all operators
- Each operator needs to develop an FRMS that is appropriate to its organization and operations and the nature and level of the fatigue risks
- The implementation of an FRMS can be done in stages, as is recommended for SMS
- The idea is to have a series of manageable steps so that resources and workload can be allocated over time
- Fatigue hazard identification has to be more comprehensive

FRMS approach requirements

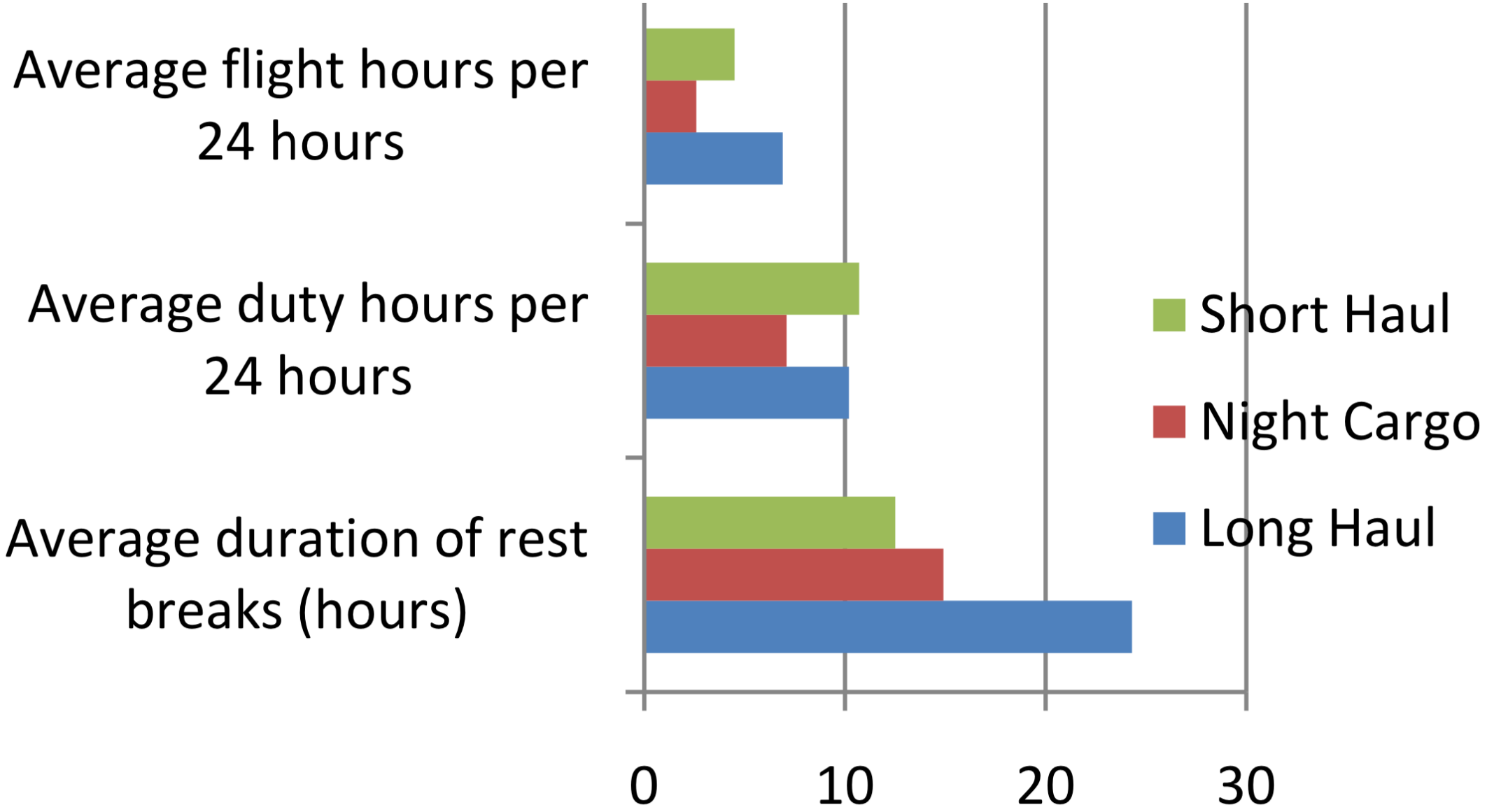
- Operator must propose limits based on operational evidence and scientific principles
- Regulator involvement is essential
- FTL rules in the Operations Manual may be more stringent
- Operators should use the Scientific principles in pairing and roster design
- More comprehensive Fatigue management training is required.
- Requires additional resources
- May require proactive and predictive hazard identification capability


FRMS
PRESCRIPTIVE
Predictive
Pro-active
Reactive
Individual flight / pairing analysis
On-Board Rest / Layover
Pre and Post flight protections
Roster design
Modification of optimiser rules
Roster Control
Pre Publication Evaluation
Day of Ops – Disruption Management
Aid tactical decision making by Ops staff
Evaluation of actual flown rosters
Impact of Changes / Days of Ops
Evaluation of Fatigue and /or Safety Reports or events
Feedback / Learning
Large scale roster data
Processing and analysis

Notes on Implementation

- Time to progress will depend on complexity, anticipated level of risk and readiness of both Operator & the Regulator
- Each regulator may have some differences in approach
- Expertise and resources are a challenge
- Operator and Regulator need to work together closely through each phase

Fatigue Risks in Different Types of Operations


Average flight hours per 24 hours
Average duty hours per 24 hours
Average duration of rest breaks (hours)
Short Haul
Night Cargo
Long Haul
0
10
20
30

Short Haul Operations

- The daytime short haul operations (2-person crews) had the longest daily duty hours
- Averaged 4-5 sectors per day
- Had the shortest rest periods
- Crossed a maximum of 1 time zone per 24 hours
- The rest breaks occurred at night, during the optimal part of crewmembers' circadian body clock cycle for sleep
- Restricted sleep caused by short rest periods and early duty report times
- High workload, flying multiple sectors in high density airspace across long duty days

Night Cargo Operations

- They had the shortest duty periods
- Averaged 3 flights per duty period
- Had longer rest periods than the short haul operations
- Also crossed a maximum of 1 time zone per 24 hours
- Rest periods occurred during the day and their circadian body clocks did not adapt to this pattern

Freighter Crew Fatigue

- Shorter, less restorative sleep during the day
- Being required to work at night mostly at time in the circadian clock cycle when self-rated fatigue and mood were worst
- Additional effort would be required to maintain alertness and performance.

Long-Haul Operations

- Typically, long duty periods with 2,3 or 4 pilots
- Averaged only 1 flight per duty period
- Had the longest rest periods before/after flight duty
- However, every layover can be in a different time zone
- Multiple time zones crossed per 24 hours
- The crewmembers' circadian body clocks did not adapt to the time zone changes

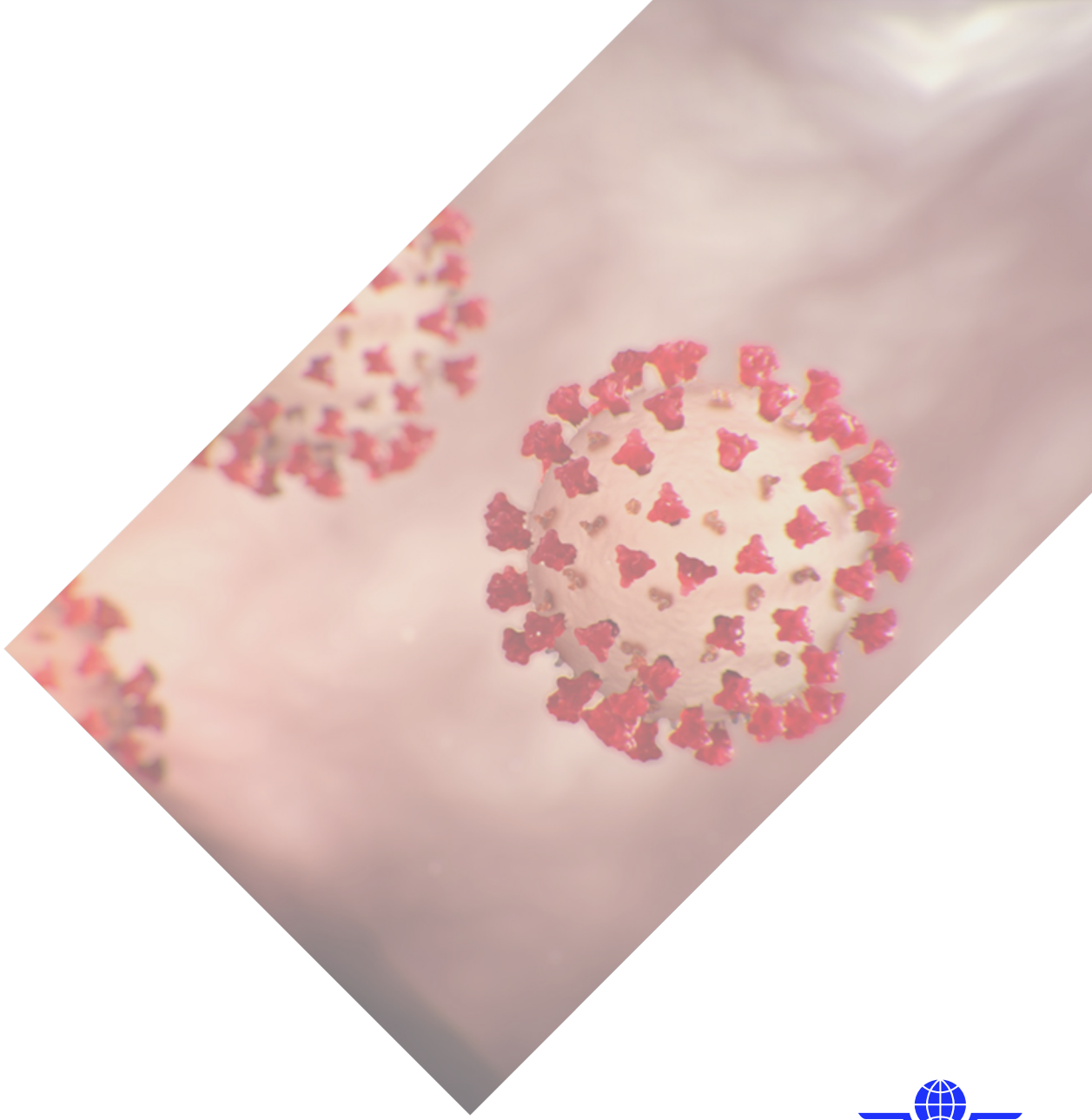
Causes of Fatigue in Long Haul

- Long periods of wakefulness (average 20.6 hrs) on duty days
- Operating the aircraft at the Circadian Low Window
- Split sleep patterns and short sleep episodes on layovers
- On some trip patterns, the circadian body clock drifted away from crewmembers' domicile time zone
- As a result, additional time for circadian re-adaptation was needed for full recovery after the trip

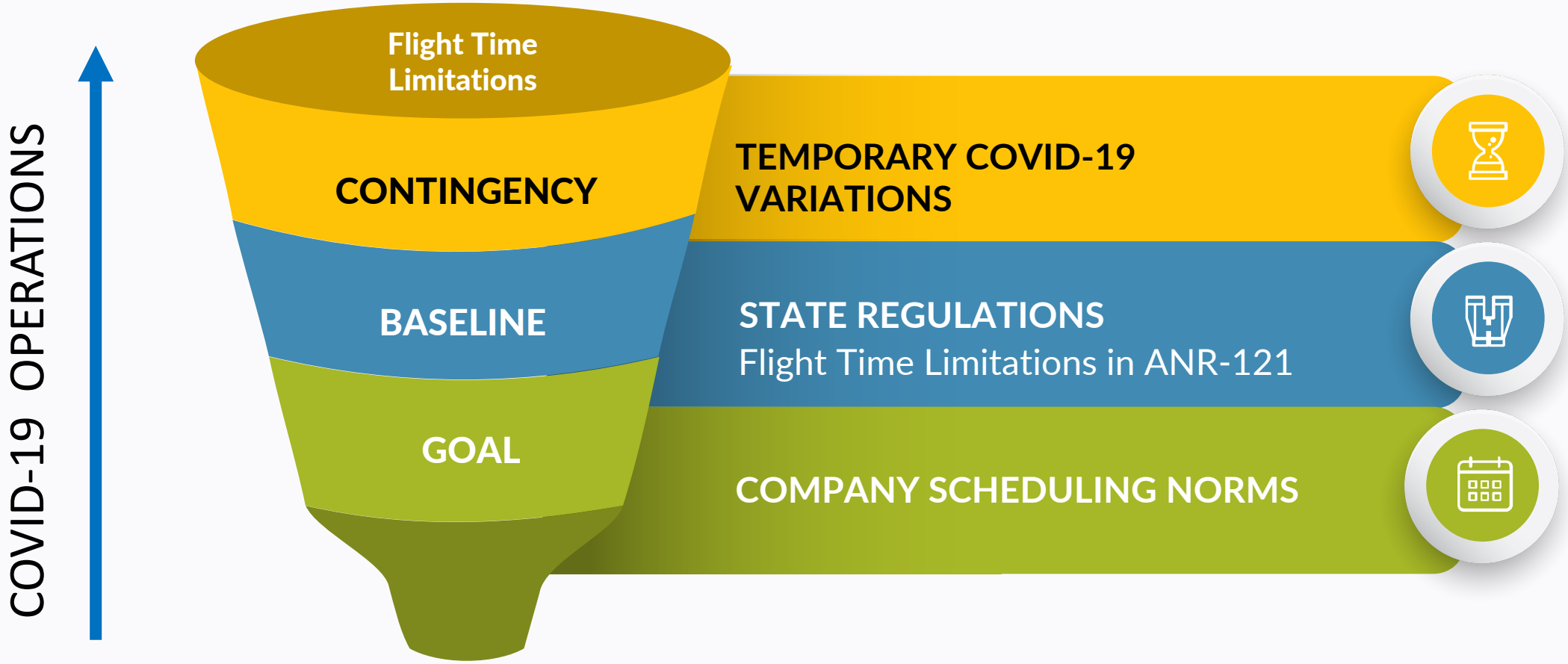
Impact of COVID-19 on Fatigue

Summary of the hazards that cause fatigue in the COVID-19 Pandemic:

- Restrictions **on** laying over
- Restrictions **during** layover
- Additional PPE may fatigue people more quickly
- Multi-crew multi-sector flights
- Longer duty times due ground delays



Impact of COVID-19



Impact of COVID-19

SOME CHALLENGES	IMPACT
Need to reduce crew's exposure to COVID-19	Avoiding layover or reducing layover duration (e.g., 2N to 1N)
Restriction on layover due to local regulations	Operations with increased medium-haul turnarounds (sector-length or 4-7 hours)
Use of medium-haul aircraft for turnaround flights with augmented crew (3 or 4 pilots)	Lack of crew bunks with crew having to use cabin seats for inflight rest.
Isolation/quarantine requirements during layover and /or upon return to base	Increased mental stress possibly leading to higher fatigue

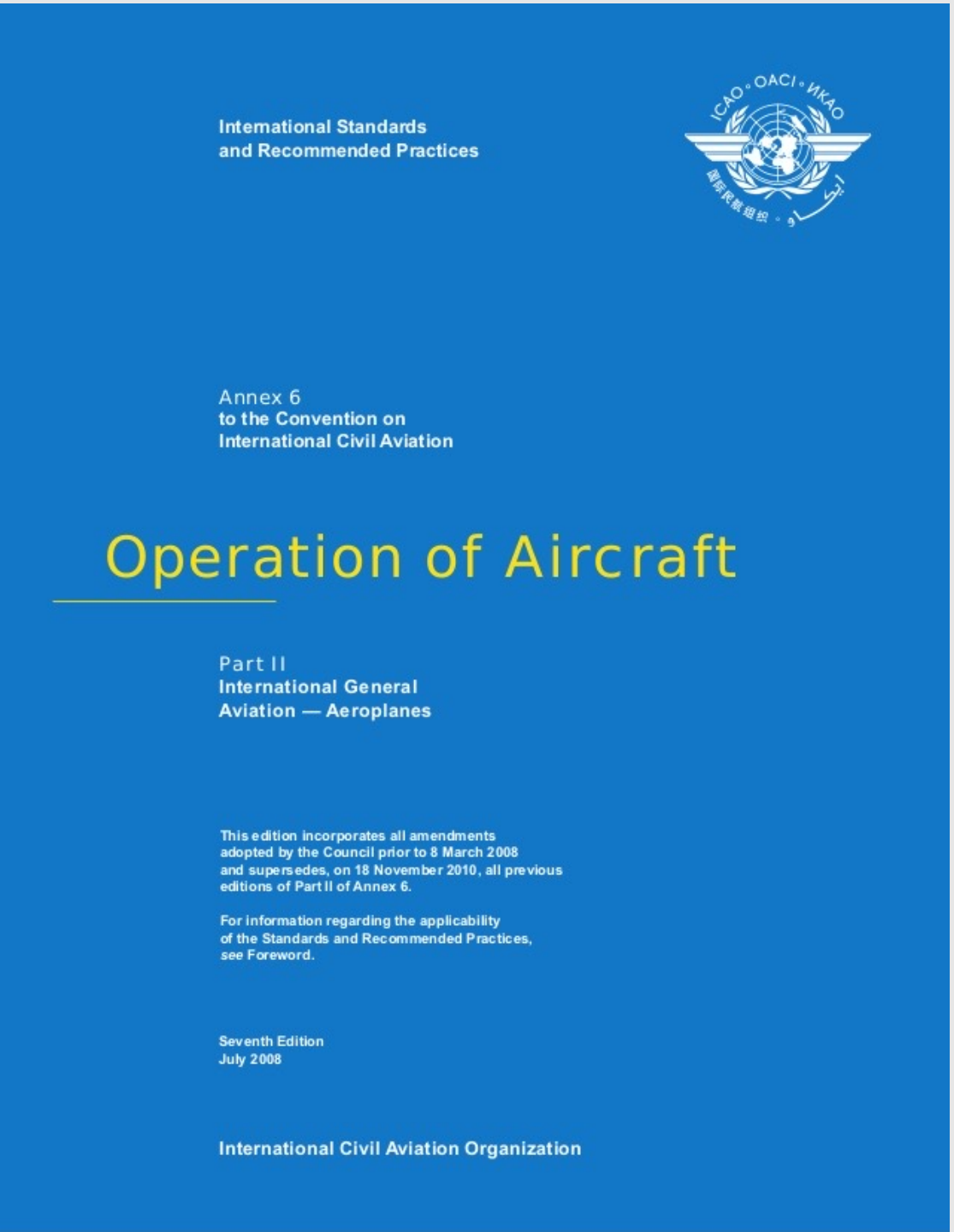
Primary Fatigue Factors

- Extended duty periods (turnarounds iso of layovers)
- Difficulty in balancing workload and inflight rest for multiple sectors with a combination of long & short sectors. e.g. JNB-NBO-AMS (first sector flight time is ˜3:00 hours of flight time and second sector is ˜8:30 hours)
- Some operations without crew bunks (i.e. crew rest in cabin seats)
- Increased general stress due to COVID situation, job security, financial loss & isolation requirements

Moving from Prescriptive Approach → FRMS

Need to start slow and build upon capabilities

- A robust & functioning SMS is a must
- Basic Fatigue Management training
- Effective Fatigue Reporting & Reactive Fatigue management
- Involvement of pilot representatives – Fatigue Safety Action Group
- Proactive/Predictive hazard identification (Surveys, Actigraphy, BMM etc)
- Comprehensive FRMS training
- Close involvement of regulator
- Setting FRMS processes……..



USEFUL REFERENCES FOR FRMS

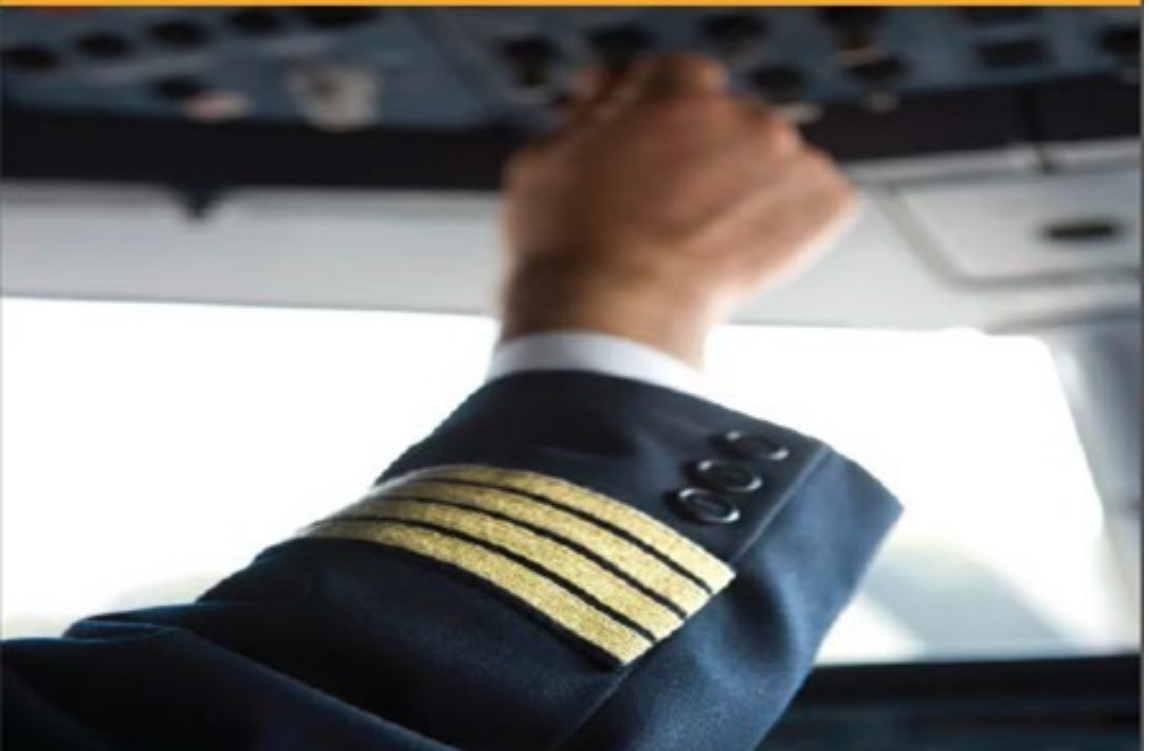
IATA

ICAO

IFALPA
The Global Voice of Pilots

Fatigue Management Guide for Airline Operators

Second Edition, 2015



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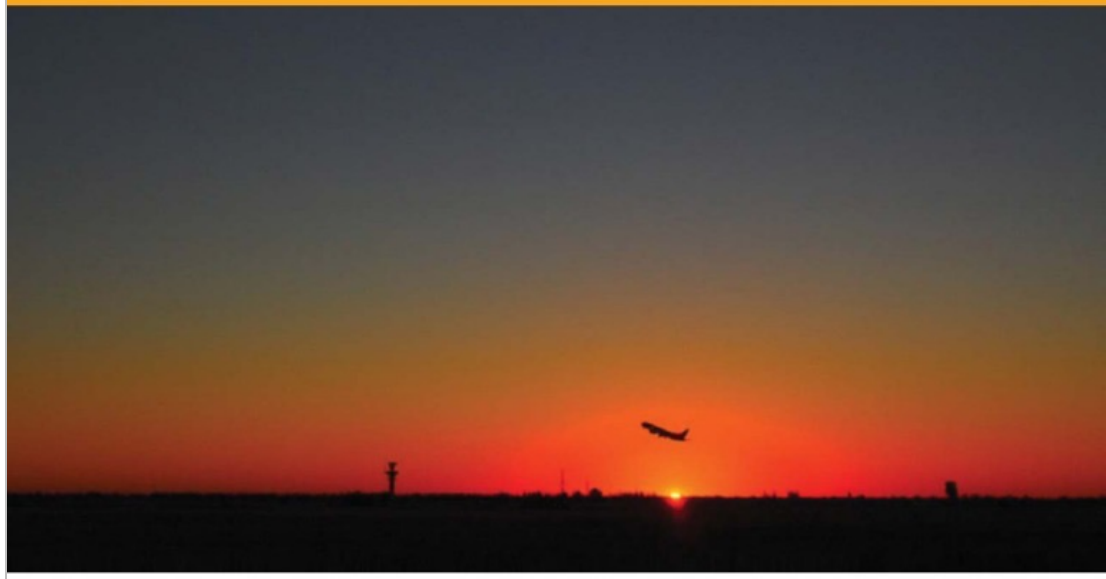
Doc 9966

Manual for the Oversight of Fatigue Management Approaches

Second Edition - 2016



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