Fatigue Risk Management Systems

An operator perspective

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What causes fatigue?

Sleep-related factors (acute/chronic)

Circadian factors (time of day)

Task-related factors
The problem
What is FRMS?

A data-driven means of continuously monitoring and managing fatigue-related safety risks, based upon scientific principles and knowledge, that ensures relevant personnel are performing at adequate levels of alertness.

- Aims to manage fatigue irrespective of the cause.
- Based on science and empirical findings.
- Is data driven.
- Requires a systematic, organizational approach.
<table>
<thead>
<tr>
<th>What is FRMS NOT?</th>
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</thead>
<tbody>
<tr>
<td>• It isn’t just a model</td>
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<td>• It isn’t a negotiating tool</td>
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<td>• It isn’t the job of just one party</td>
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<td>• It isn’t a set of manuals</td>
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<td>• It isn’t a cost-cutting tool</td>
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<td>• It isn’t a way to get rid of limits</td>
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</table>
1. FRMS policy and documentation

2. FRMS risk management
   Identify hazards
     - Reactive, Proactive, Predictive
   Assess risks
   Interventions to control risks

3. FRMS assurance processes
   including measures of effectiveness

4. FRMS promotion processes – training, education
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Identify hazards (reactive)

- Fatigue Reporting:
  - Report forms carried on all aircraft
  - Crews encouraged to report if high levels of fatigue
    - de-identified if requested
  - Forms passed to management and the CASG
  - Monitored for persistent problems
  - Particular duties may be recommended for in-depth study
ID Hazards: Proactive

Top of Descent Survey

Last descent of duty day

Self rated fatigue (SP, VAS)

Three months

>9000 responses
1. Fully Alert, wide awake
2. Very lively, responsive, but not at peak
3. OK, somewhat fresh
4. A little tired, less than fresh
5. Moderately tired, let down
6. Extremely tired, very difficult to concentrate
7. Completely exhausted, unable to function effectively
0. Not Applicable
The first year

4973 responses; 1825 sectors (50% flights, 38% pilots)

Short<Long  (p<0.001)

“7” ratings = 0.14%
Identify hazards (predictive):

- **Fatigue modelling** - used to identify potential fatigue issues and to investigate possible solutions.

- The predicted levels of alertness are colour-coded:
  - green = alert
  - red = fatigued
  - blue = sleep

- Identifies routes that may require data collection.
Comparison with SAFE predictions

\[ r = 0.88 \]
FRMS Elements - ICAO

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Assessment: Study methodology

• Typically 20-30 pilots over six weeks
• Studies conducted without an experimenter on board
  – crews are briefed prior to the first departure
• Participants wear a wrist actigraph throughout the study
  – provides an indication of the timing of their sleep periods
• In-flight information obtained using a Palm Pilot computer
  – subjective assessments of fatigue, sleepiness and mood
  – a choice reaction time test
Assessment: Palm Pilot

Subjective assessments

Performance task (validated)
## Interventions: Studies with Palm

<table>
<thead>
<tr>
<th>Pilots</th>
<th>Cabin Crew</th>
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<tr>
<td>AKL-LAX-LHR-LAX-SYD</td>
<td>AKL-NAN-RAR-PPT-RAR-NAN-AKL*</td>
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<tr>
<td>SYD-KIX-BNE-SYD (Ansett)</td>
<td>AKL-KIX-CHC-AKL</td>
</tr>
<tr>
<td>SYD-LAX-AKL* 3 vs 4 pilot</td>
<td>AKL-PER-AKL</td>
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<tr>
<td>AKL-LAX-AKL* 1 vs 2 nights</td>
<td>AKL-TBU-HNL-AKL*</td>
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<tr>
<td>AKL-LAX-LHR-LAX-AKL 1 vs 2 night</td>
<td>AKL-LAX-APW-AKL</td>
</tr>
<tr>
<td>CHC-BNE-CHC* B737/A320</td>
<td>AKL-LAX-AKL</td>
</tr>
<tr>
<td>AKL-HKG-LHR-HKG-AKL x2</td>
<td>CHC-BNE-CHC</td>
</tr>
<tr>
<td>AKL-ADL-AKL</td>
<td>AKL-PPT-AKL*</td>
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Cabin Crew Data

![Graph showing Mean Reaction Time (mS) across different test numbers and locations.](image)
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Control and mitigation

- AKL-PPT-AKL: Re-timed service
- NRT-CHC-AKL: Fresh crew
- Many: No change
- Advice on rest pre-flight
- AKL-LAX-AKL: Industrial solution
- Pilots: Some had extra pilot
- CHC-BNE-CHC: Layover
Risk controls – use of models in rostering

- Intention is to integrate SAFE into the roster build
- Trials proceeded
- Parallel builds occurring
- Similar efforts with Jeppesen (CARMEN) and models
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Significant fatigue from the job - changes since 1993

- Once a week or more
- Once every two weeks or less

Year | Percentage
--- | ---
1993 | 80% (dark) 20% (light)
2001 | 70% (dark) 30% (light)
2004 | 65% (dark) 35% (light)
2006 | 60% (dark) 40% (light)
2010 | 55% (dark) 45% (light)
### Assurance: Other measures of effectiveness

- Report numbers
- Surveys
- Feedback from External Oversight Group
- Pilots - LOSA Interviews
- Pilots - FOQA – To come
- Industrial Action
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What has worked well?

- Truly collaborative
- Management commitment
- Developing trust
- Listening to critics
- Publishing
- Education and re-education
- Advice “before the fact”
What hasn’t worked well?

Getting “hijacked”
Lack of dedicated resource
Inadequate measures of effectiveness
Extra layover time
Excessive Rostering rules
References:

• Aircrew alertness during the Haj 2000 operation and the benefit of bunk sleep. Robertson KA, Spencer MB, Petrie KJ, Powell D. DERA Report DERA/CHS/CR000501/1.0 (2001)


• Pilot fatigue in short-haul operations: effect of number of sectors, duty length and time of day. Powell D, Spencer M, Holland D, Broadbent E, Petrie K. Aviat Space Environ Med 2007; 78:698-701


• Fatigue in airline pilots after an additional day’s layover period. Powell DMC, Spencer MB, Petrie KJ. Aviat Space Environ Med 2010; 81:1-5
Questions?

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