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EBAA Annual Safety Summit 2019

Making Use of Predictive Fatigue Models *(in business aviation)*

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Köln, November 13th 2019

Hello!

- Scheduling Safety Specialist
- With Jeppesen since 2011
- BSc in computer science and statistics from Uppsala University
- Previously: crew tracking infrastructure expert, knowledge management consultant in banking sector, IT manager, propagandist, postal worker…

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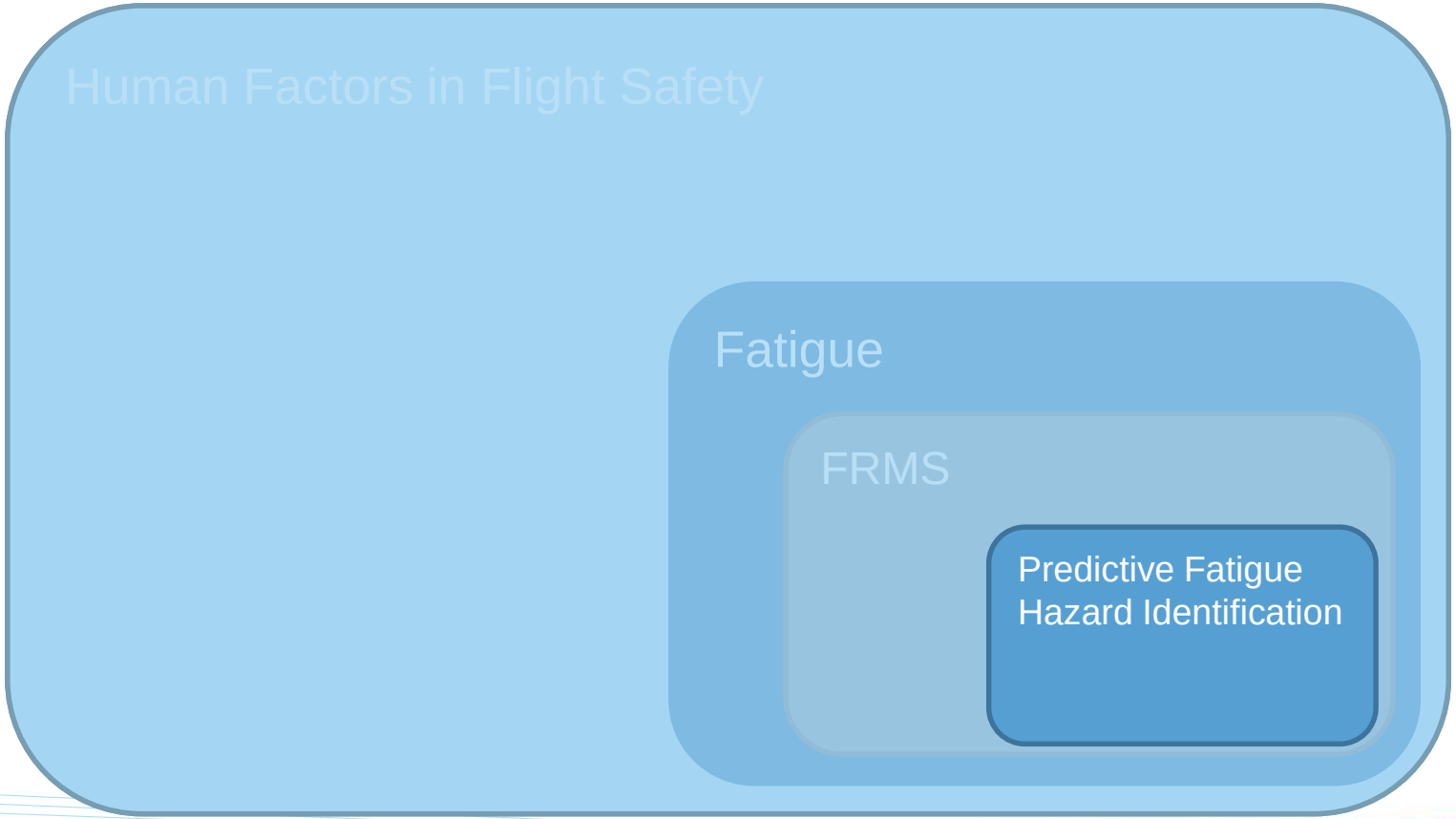
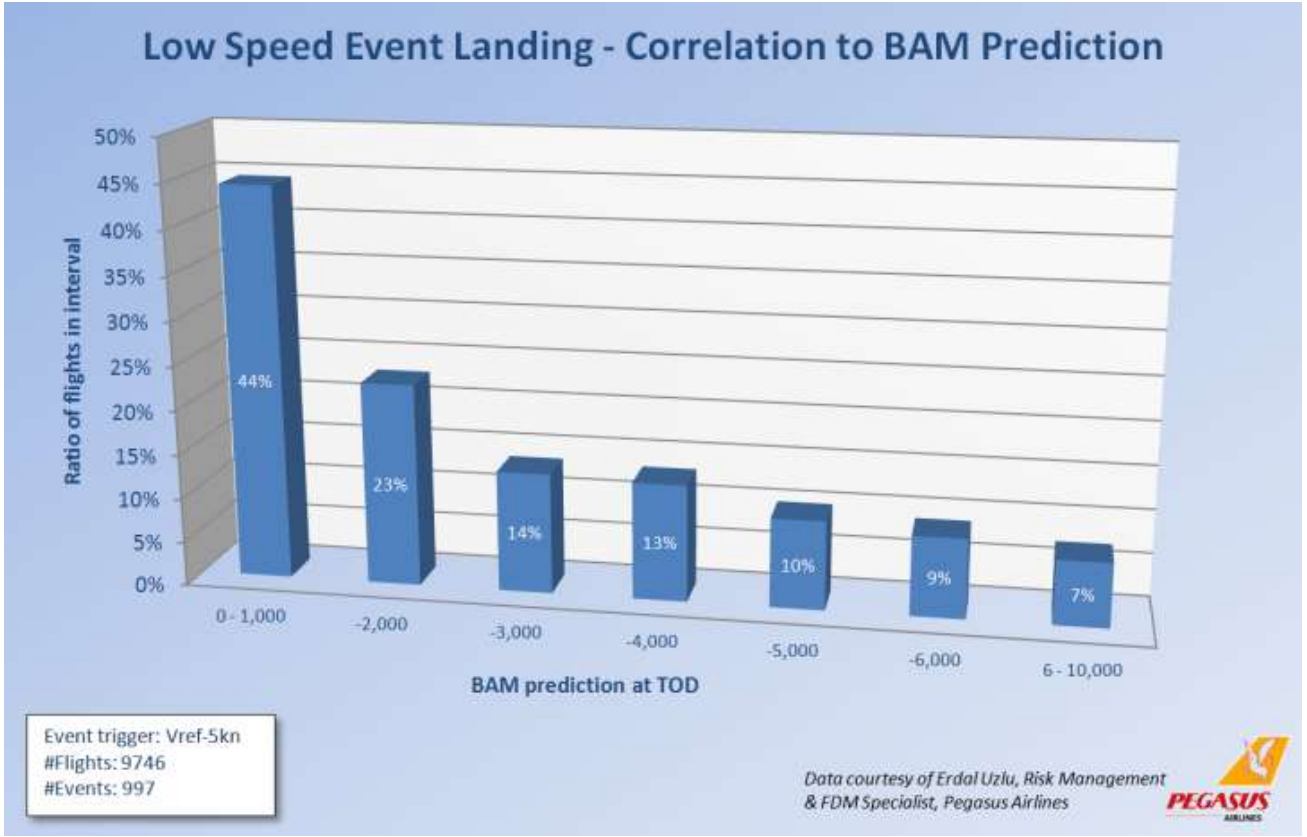
Who is using Jeppesen FRM software?

What will I talk about?

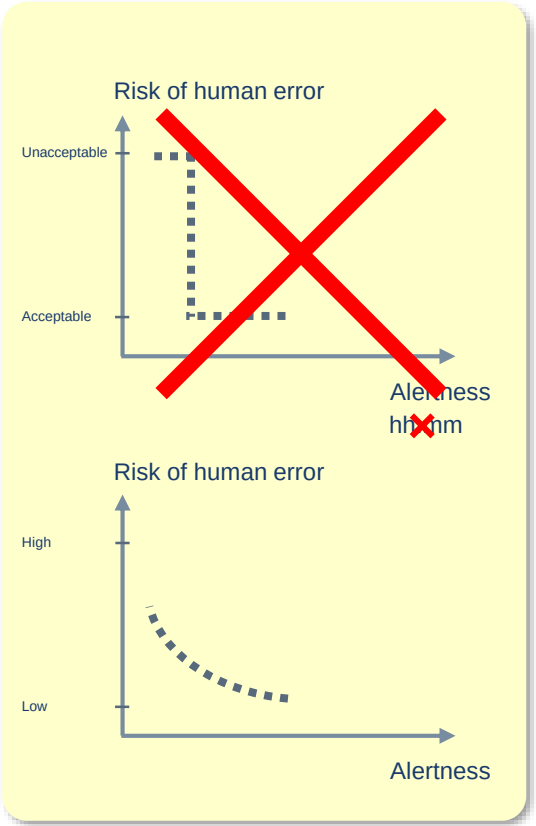


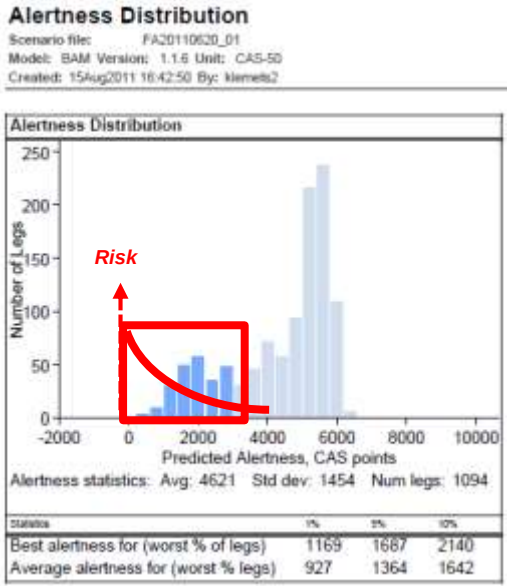

Accidents
Serious incidents
Minor incidents
Well-being
Sickness
Morale
Recruitment
Reputation
Industrial action
Productivity
Fuel efficiency

Pilot Fatigue and Pilot Performance



FTL:s are binary risk models





FTL:s are a compromise

Safe and healthy FTL:

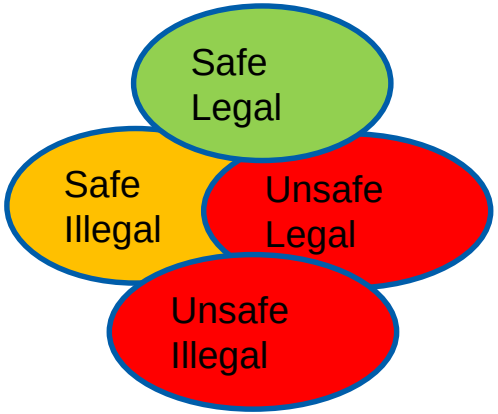
- No duty may force a *wake-up* before 06:00
- No duty may block *being in bed* by 22:00
- No duty may exceed nine hours without class 1 rest facility and extra crew.
- All times adjusted with conservative assumption of state of acclimatization
- No take-offs or landings in the afternoon dip
- Minimum two nights and one day (~24 hours) between duties
- Minimum two consecutive days off per rolling seven day cycle

Minor side effect: The end of civil aviation?

FTL:s are a compromise

Actual FTL:

- What can we realistically measure and control?
- How can we rein in the most obvious extremes?
- How do we avoid annoying the general public and protect the competitiveness of our economy?



FRMS is a (better) compromise

Annex 6, Part I, Appendix 8 – FRM Processes

2.1.1. Predictive

The predictive process shall identify fatigue hazards by examining crew scheduling and taking into account factors known to affect sleep and fatigue and their effects on performance. Methods of examination may include but are not limited to:

a) operator or industry operational experience and data collected on similar types of operations;

b) evidence-based scheduling practices; and

c) bio-mathematical models

s within current flight
ut are not limited to:

c) relevant flight and cabin crew performance data;

d) available safety databases and scientific studies; and

e) analysis of planned versus actual time worked

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b) confidential reports;

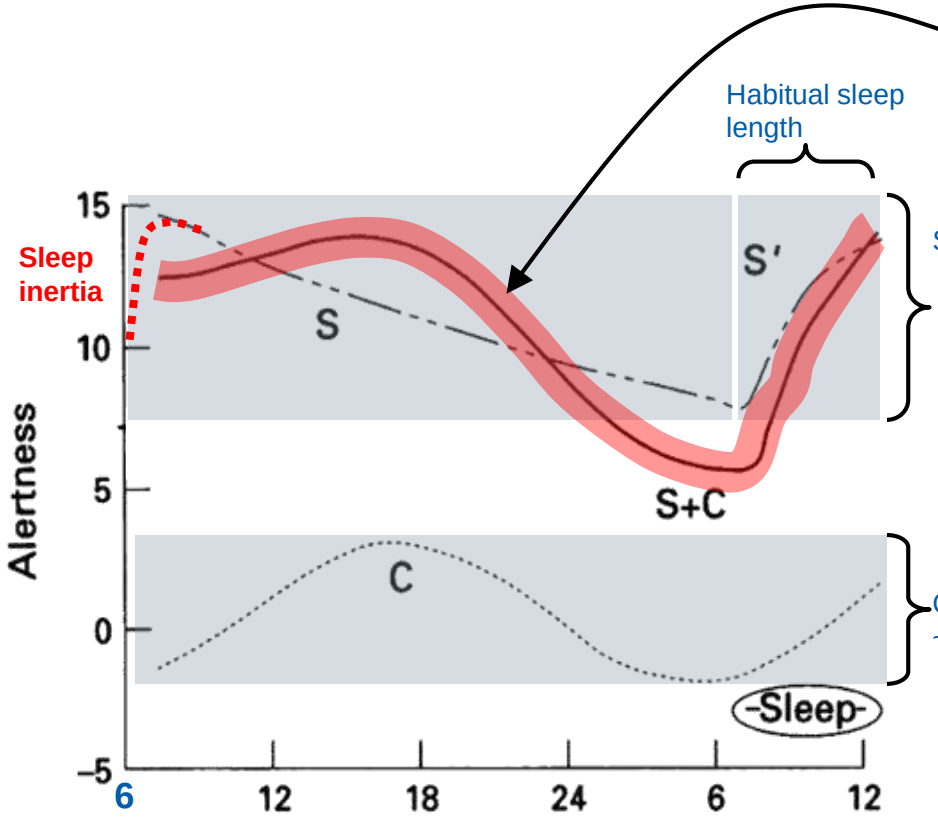
c) audit reports;

d) incidents; and

e) flight data analysis events

Predicting Fatigue

Bio-Mathematical Modelling of Fatigue



S + C (+ other effects) are summed to predict alertness as a fxn of prior work and sleep history

S represents the homeo-static effect of time awake

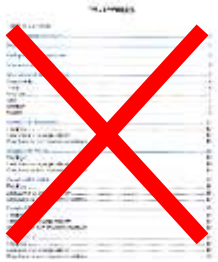
S' represents the recovery effect associated with sleep

C represents the effect of the ~24hr circadian rhythms

+ Duty time
+ Number of sectors
+ Afternoon dip
+ Prediction of sleep!

Putting the Fatigue Model to work

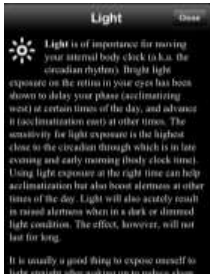
Commercial Aviation FRM Tools



Regulator Relations

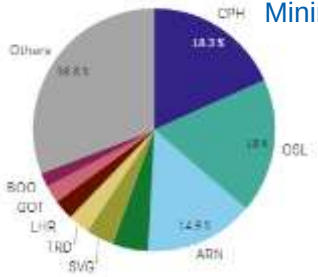
Network Planning

Trip analysis



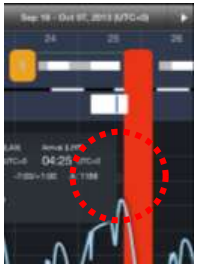
Crew Training

Fatigue BI / Data Mining



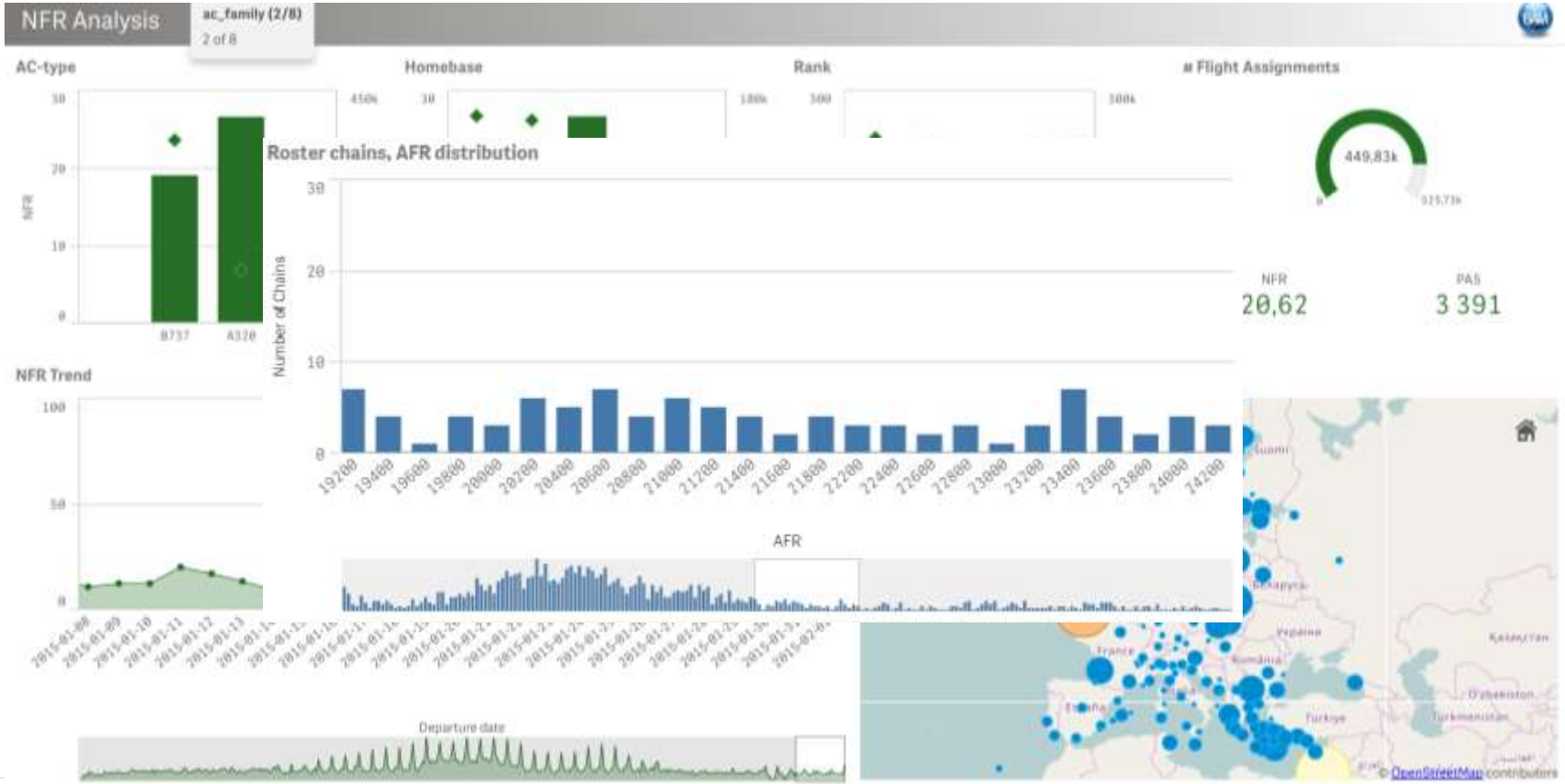
Fatigue-aware Optimization

Fatigue-aware Dispatch



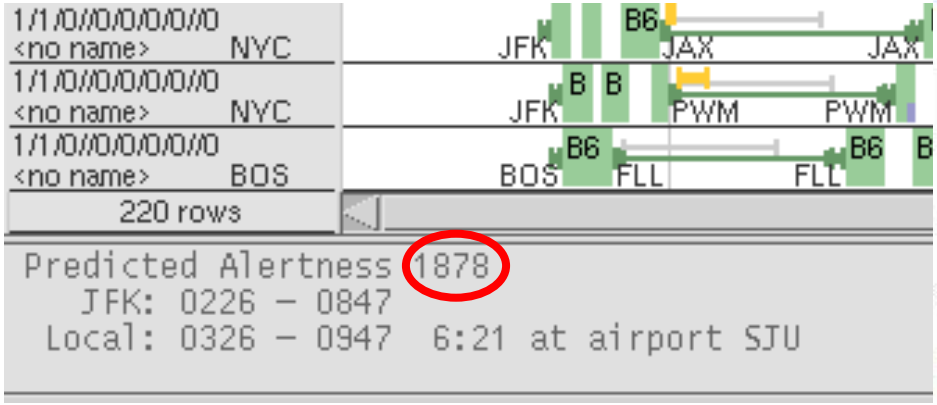
Fatigue Reporting and Surveys

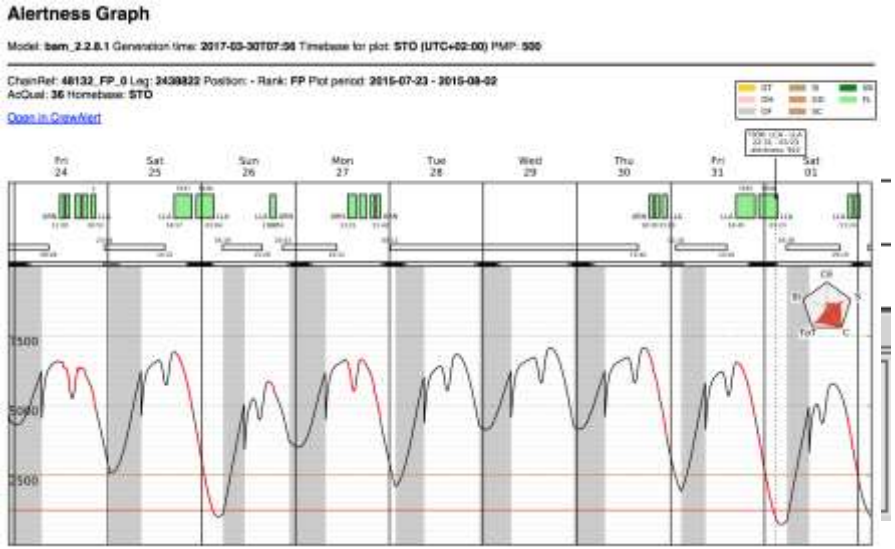
Fatigue Risk Data Mining



Fatigue Aware Dispatch / DayOfOps

- Who is most fit to fly the next flight?
- How are people doing in the field?





Fatigue Reporting and Surveys, Trip Analysis

Summary

- FTL:s will never ”solve” fatigue
- Fatigue can be meaningfully predicted from a schedule
- Fatigue Risk is more than just your worst few rosters
- Applying a fatigue model to your historical rosters can give you lots of interesting insights
- There are plenty of interesting fatigue tools that apply to any kind of operation, even those without a timetable!