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# Safe and Efficient Crew Rosters

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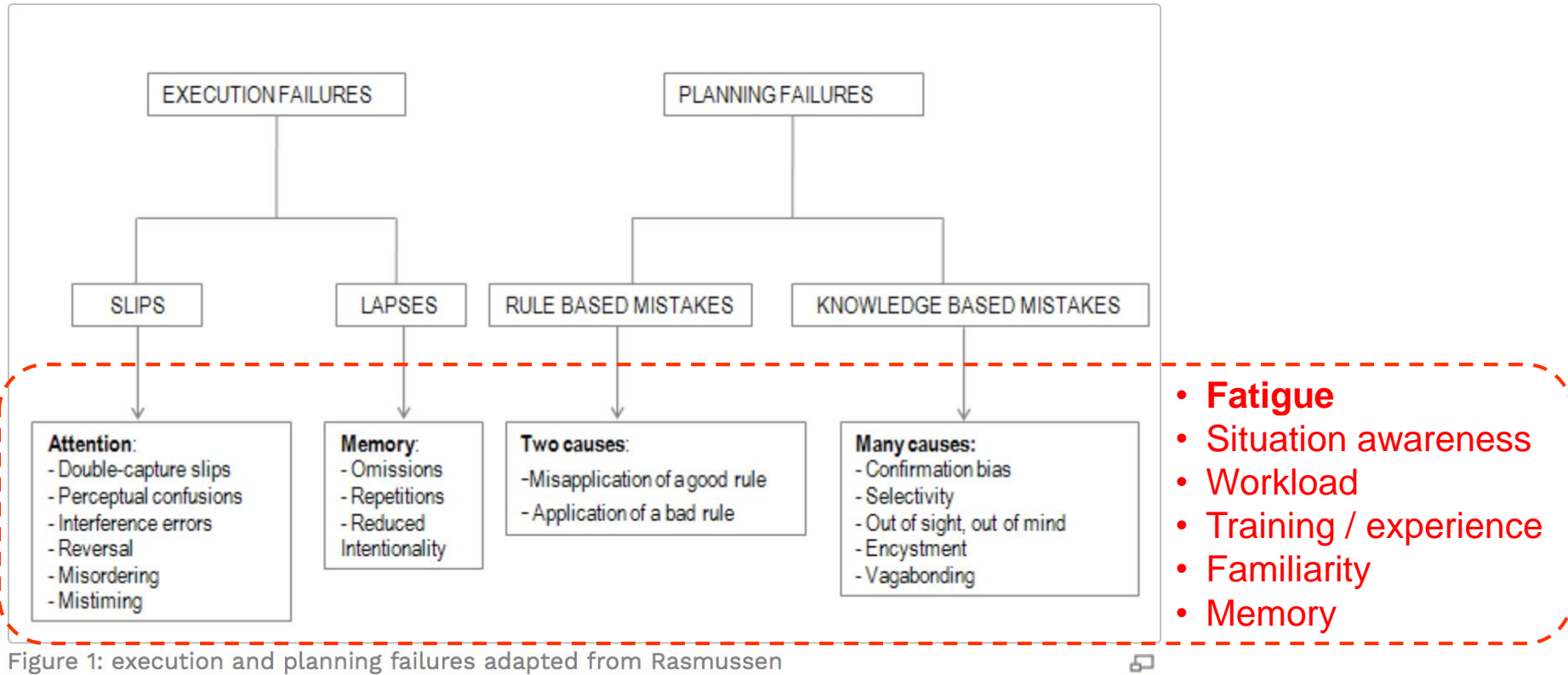
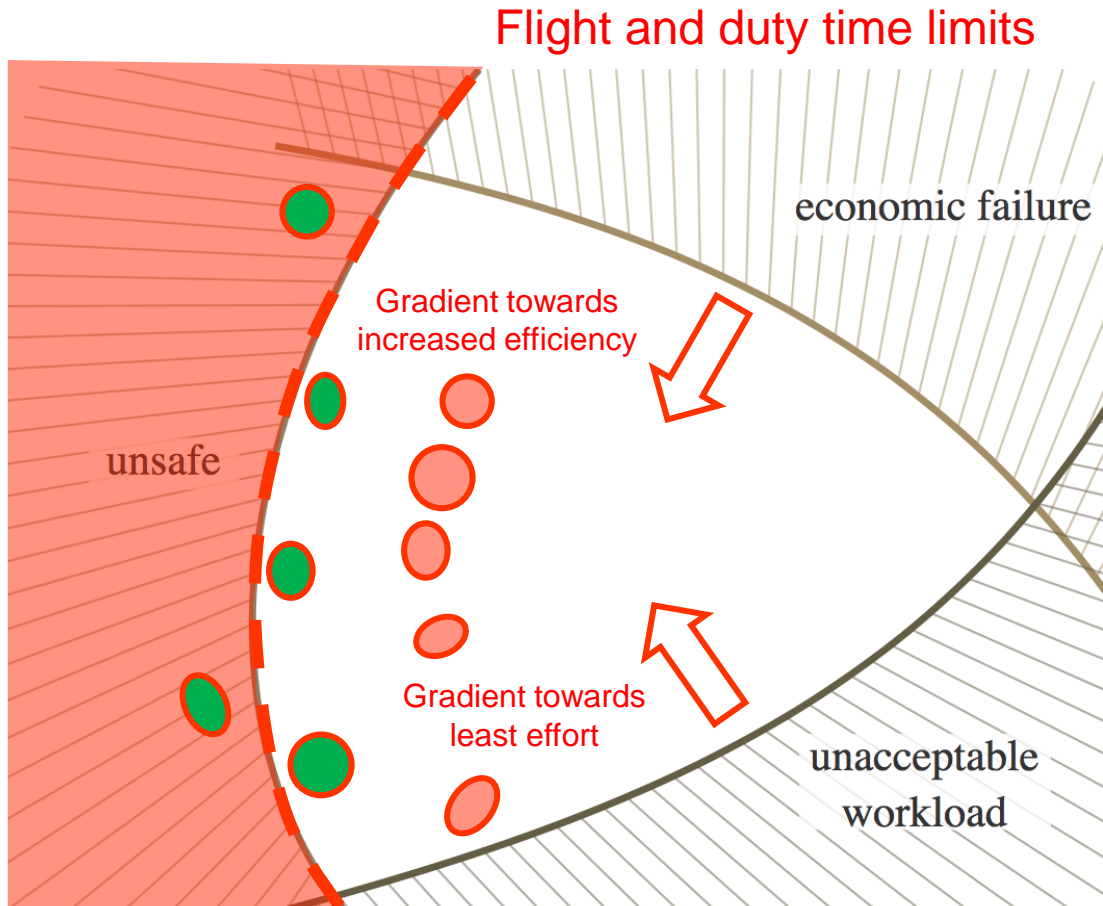


Figure 1: execution and planning failures adapted from Rasmussen

*Fatigue Risk ≈ the risk of a **lapse**, **slip**, **mistake** and/or **violation** by crew as a consequence of reduced alertness, negatively impacting flight safety.*

# The core of the problem...

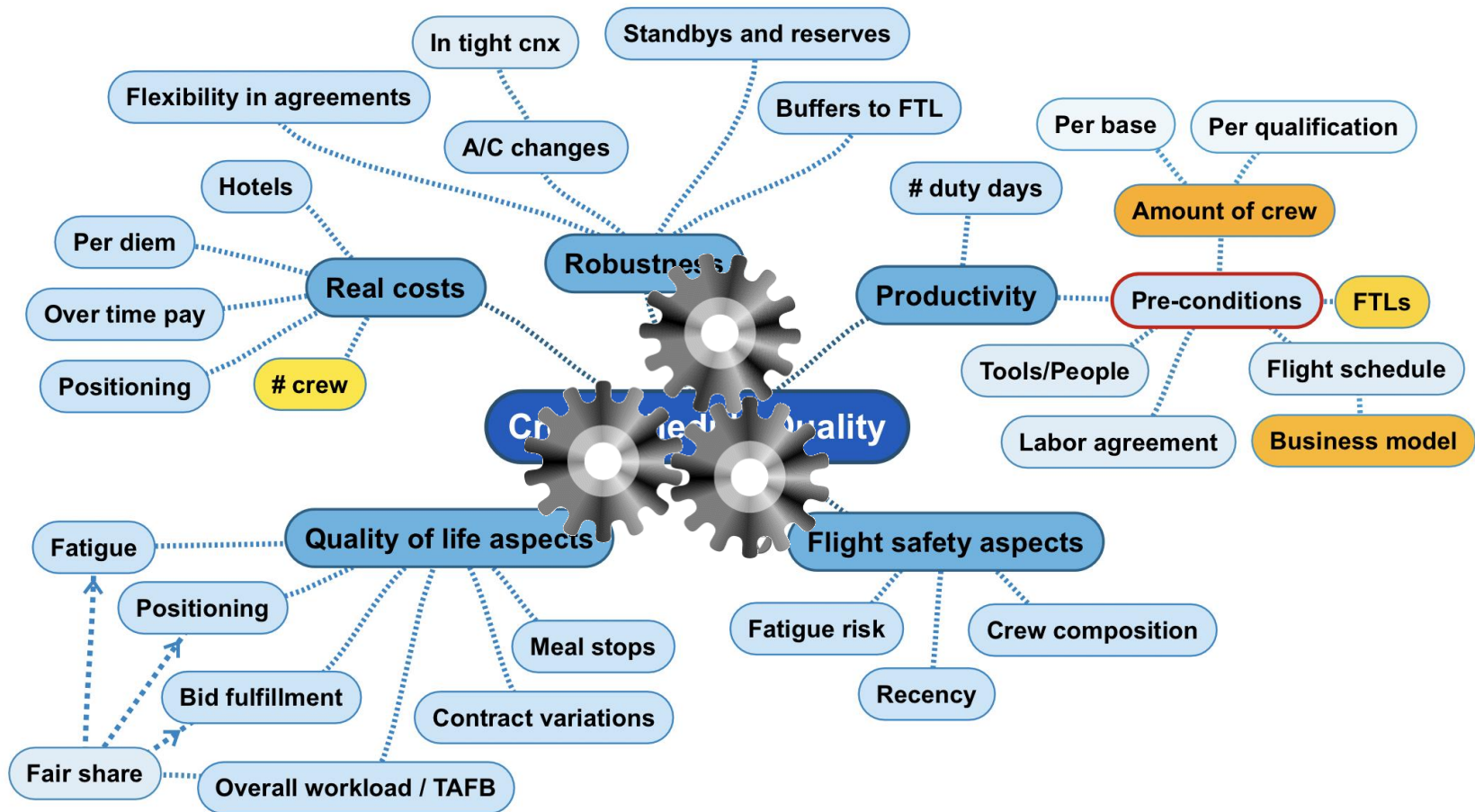


## Rule sets are 'flawed' x 2:

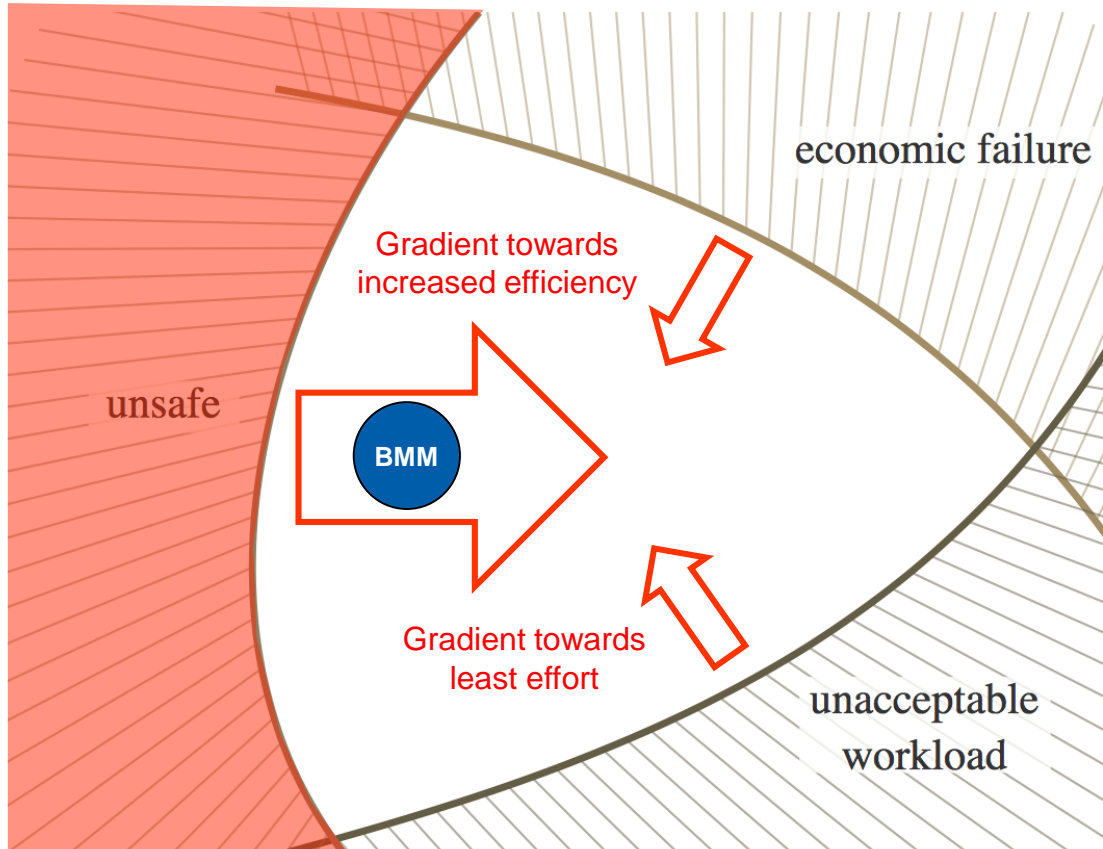
- Allow for new, unexpected fatiguing patterns to "slip through" (allowing higher risk)
- Block also fairly good patterns from being produced (lowering crew efficiency)

The space of possibilities, as described by Jens Rasmussen. Figure adapted from Rasmussen's 1997 article.

# The Crew Management Process



# The best use of fatigue models (science)

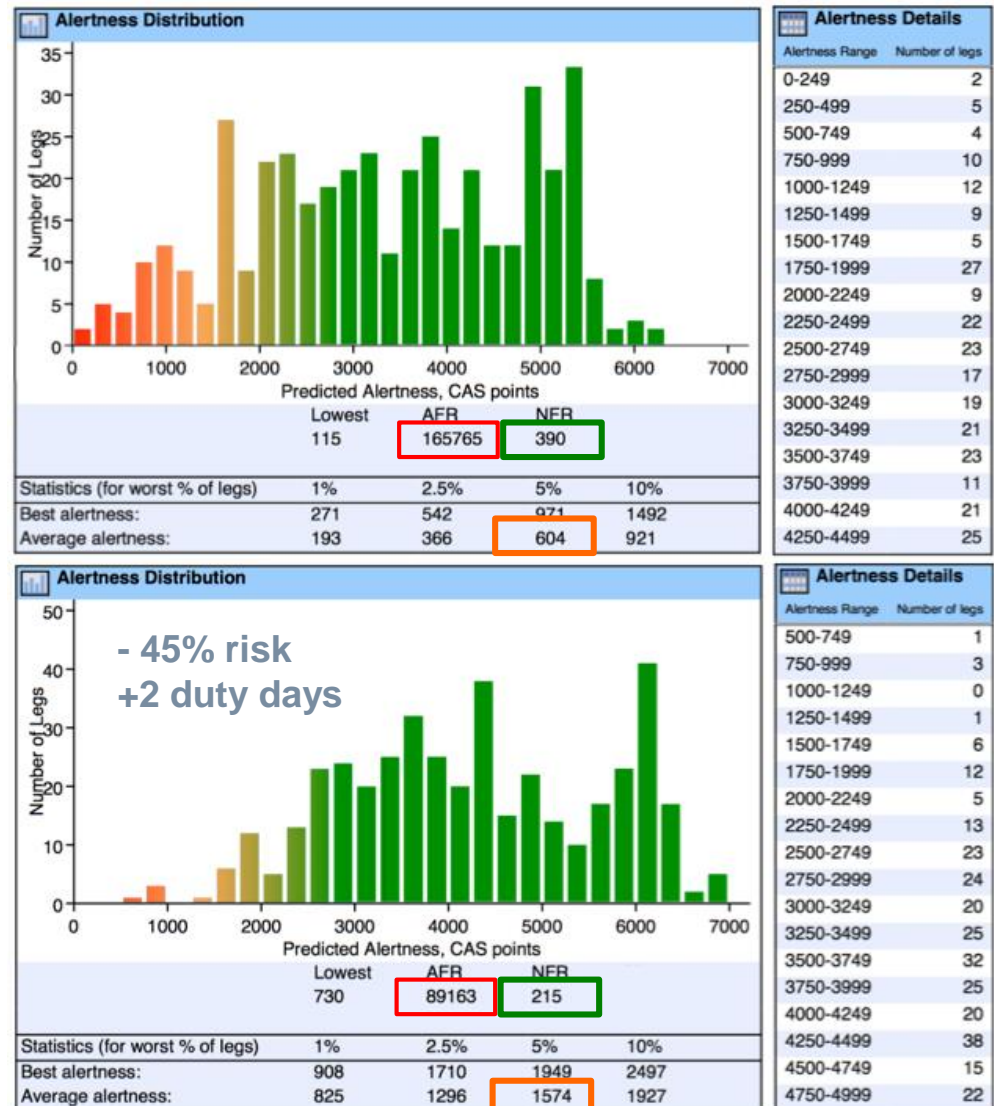


**Plus: using them for improving the rules.**



# A BMM in action reducing risk

- “Normal” planning rules/focus w/o any true guidance on human physiology
- Vs. having a BMM providing an incentive for avoiding poorly planned flights.
- Same data. Same rules. Almost identical crew efficiency. **But much lower risk.**



# Concluding...

## Company:

- Provide for diversity
- Allow crew influence
- Build in buffers to rule limits (for the sake of roster stability)
- Suppress overall risk using a BMM during planning
- Distribute risk using a BMM in planning
- Collect and use operational experience
- Improve (if allowed) also the rules

## Crew:

- Don't expect perfection: the business model will dictate a certain fatigue risk level
- Assist in gathering quality data; report, collect data, answer surveys.
- Make sleep a priority: to recover and prepare
- ...





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