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European Aviation Safety Agency

An introduction to the new EU fatigue management framework

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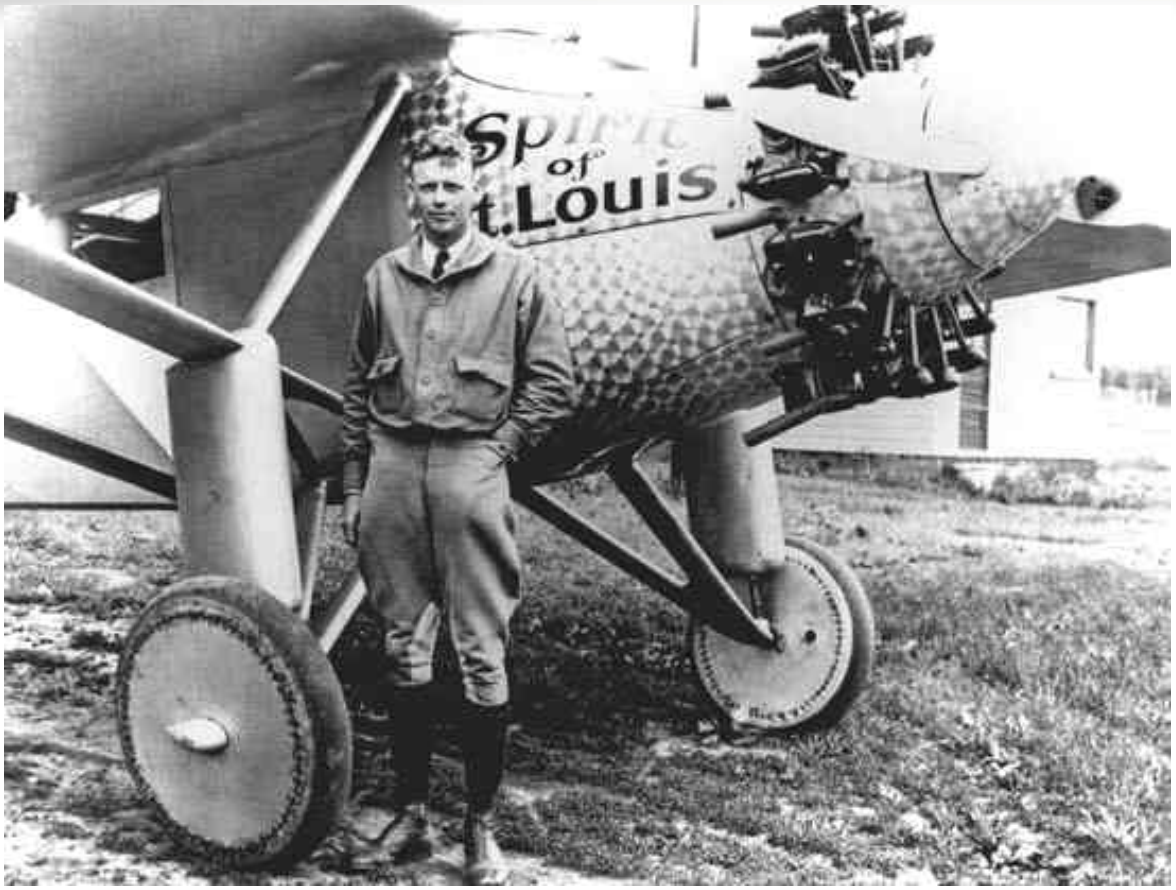
Overview

- What is fatigue?
- The science of sleep and circadian rhythms
- What are fatigue hazards in aviation?
- The new approach to fatigue management

What is fatigue?

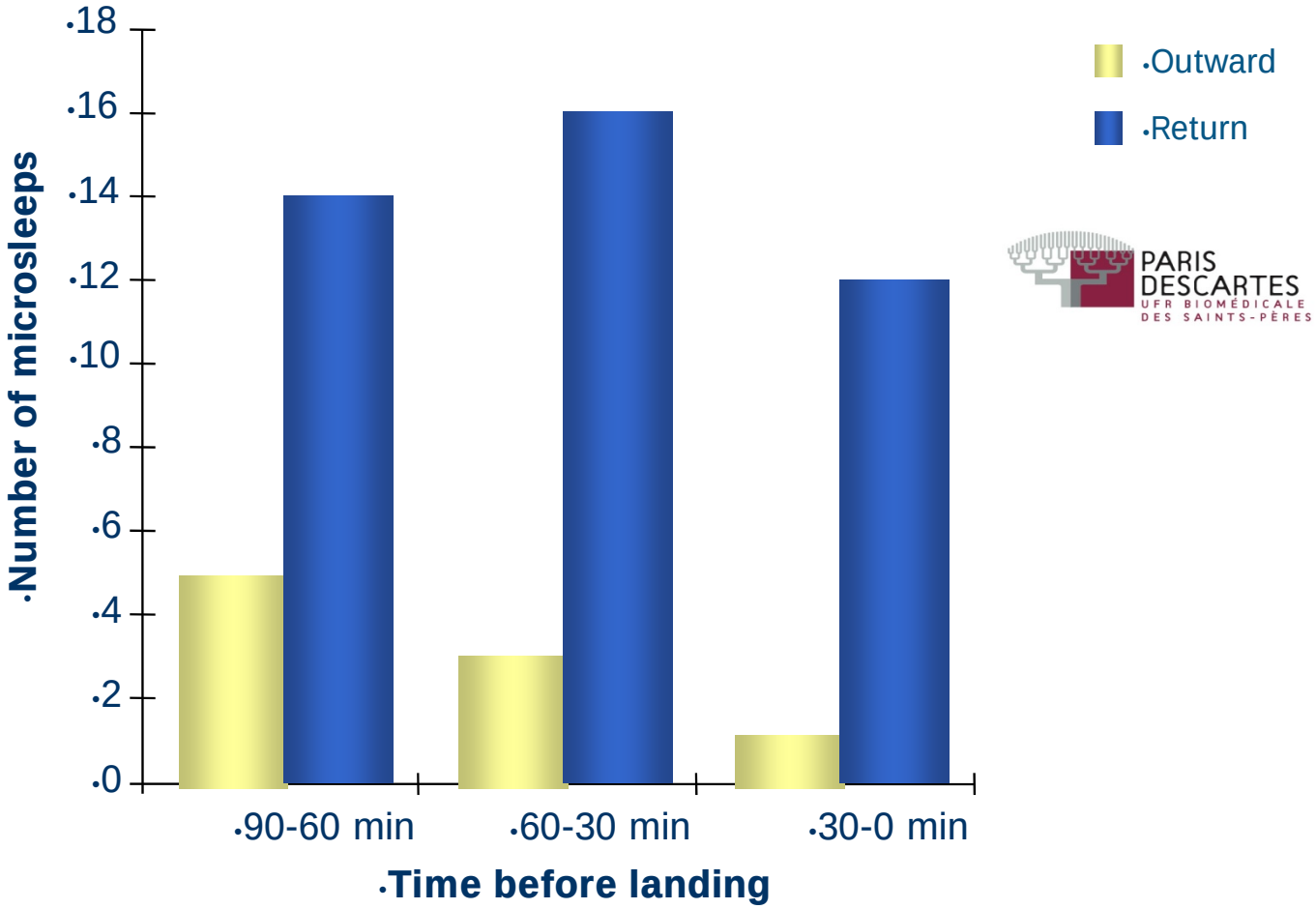


"My mind clicks on and off…I try letting one eyelid close at a time while I prop the other open with my will. But the effort's too much. Sleep is winning. My whole body argues dully that nothing, nothing life can attain, is quite so desirable as sleep."

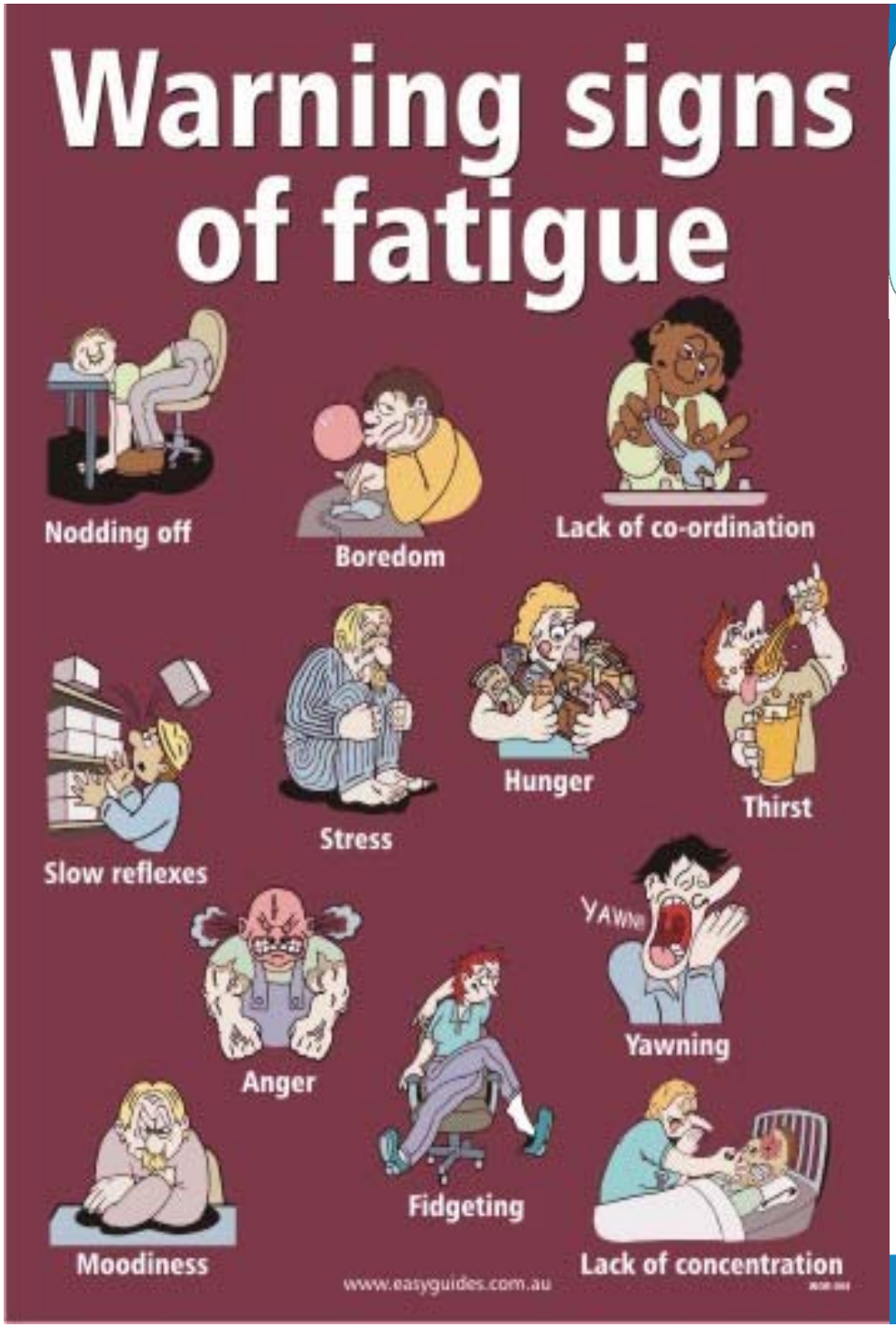
– Charles Lindbergh, describing the fatigue that struck him nine hours into his 33-hour solo Atlantic crossing.

Microsleeps

Microsleeps detected using PSG

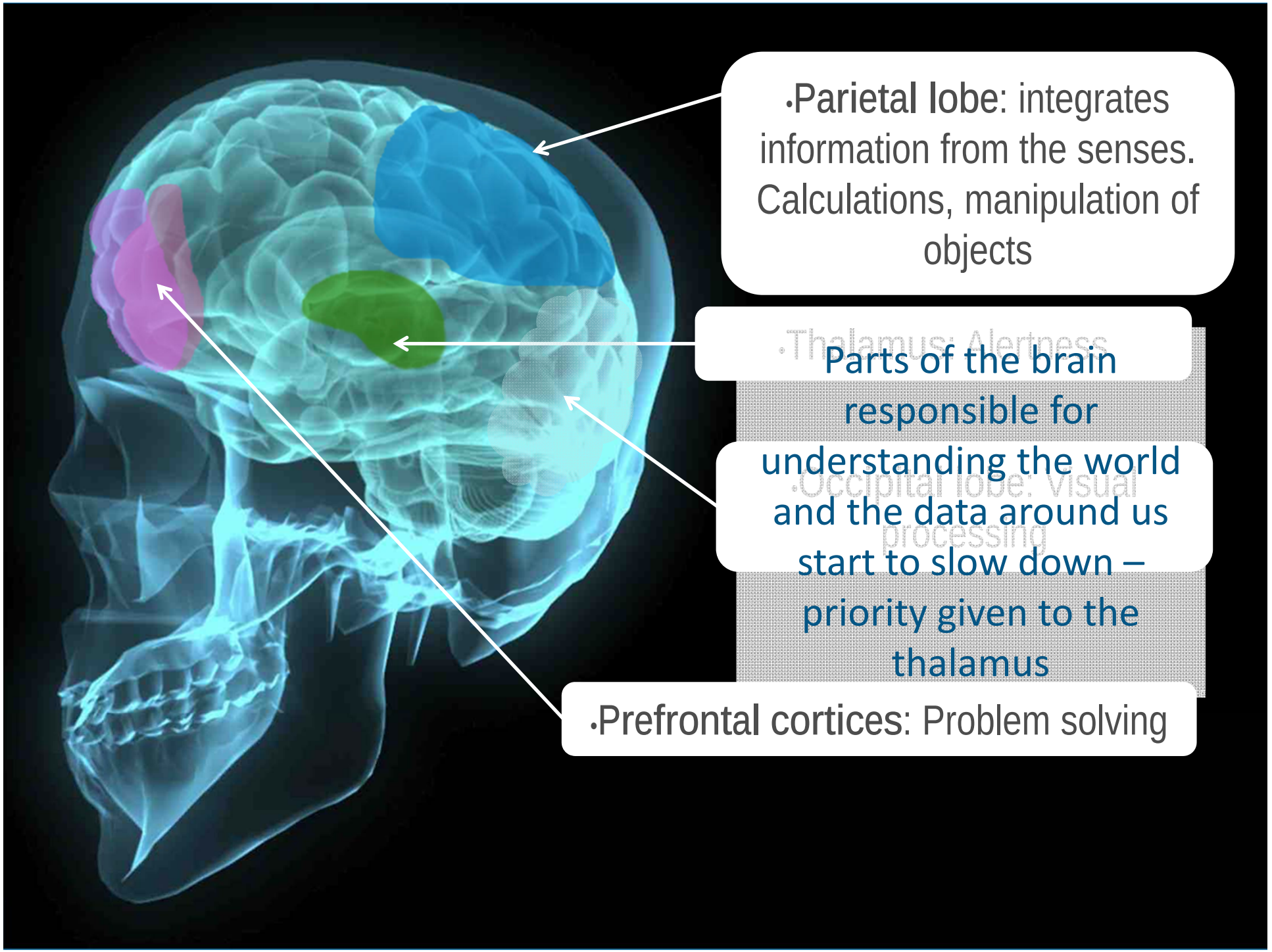


Number of microsleeps before landing during A340 certification flights TLS-SFO-TLS and TLS-SIN-TLS

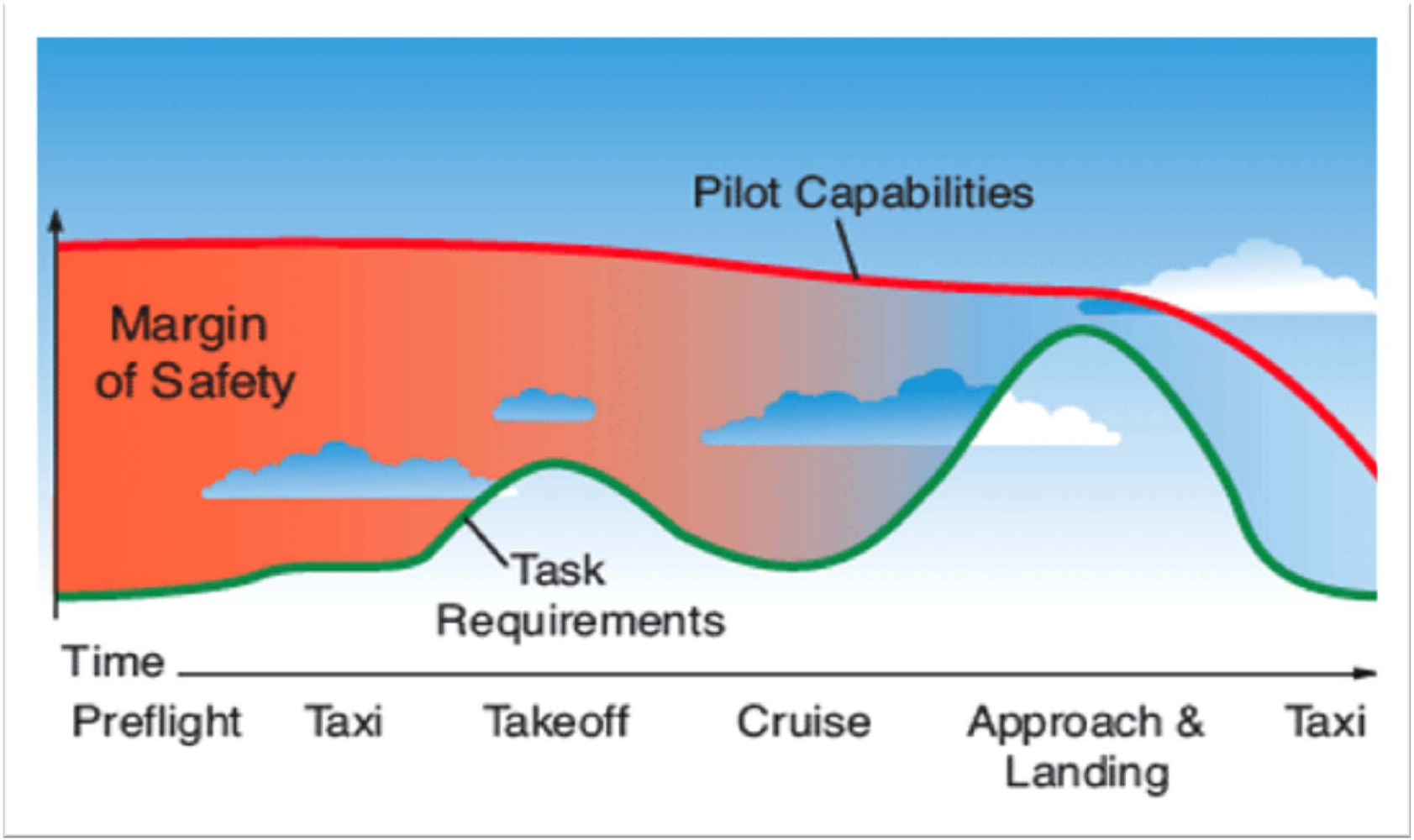


Fatigue degrades performance

- Perception of risk lowered
- Increased risk tolerance
- Situational awareness reduced
- Tunnel vision
- Tasks forgotten or ignored
- Increased errors
- …

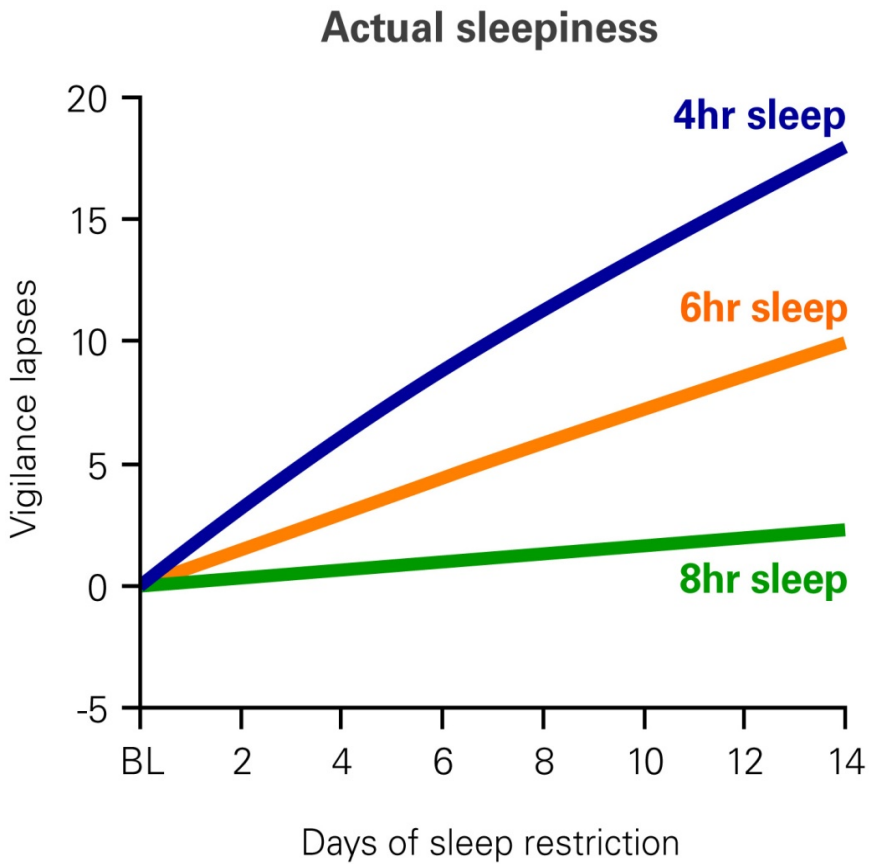

•Parietal lobe: integrates information from the senses. Calculations, manipulation of objects
•Thalamus: Alertness
Parts of the brain responsible for understanding the world and the data around us start to slow down – priority given to the thalamus
•Occipital lobe: Visual processing
•Prefrontal cortices: Problem solving

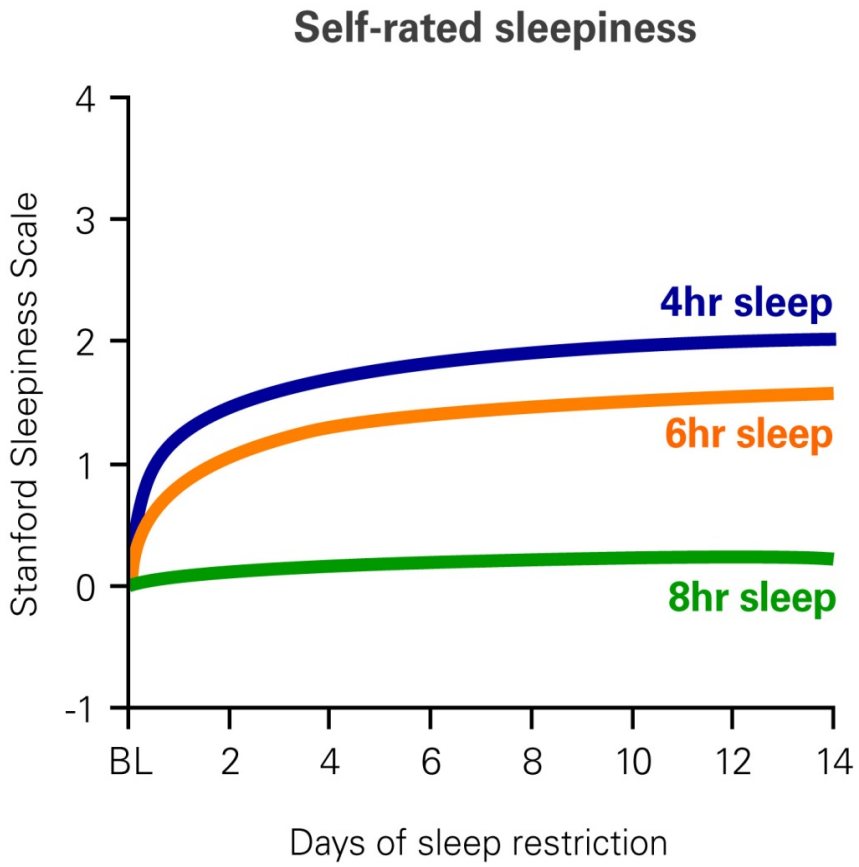
Fatigue reduces the safety margin



What is fatigue in aviation?

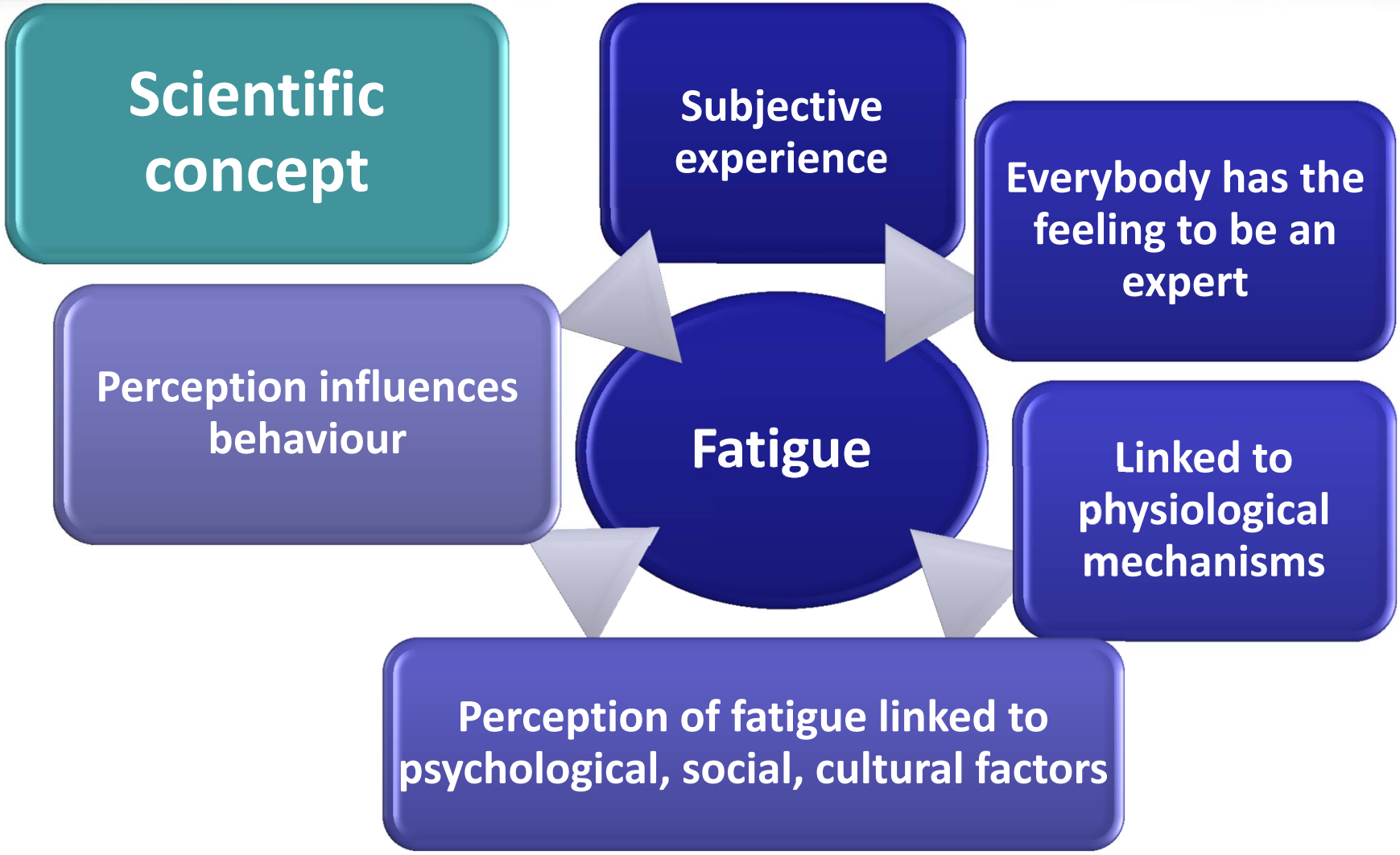
Self-assessments of fatigue are not accurate





Van Dongen, Maislin, Mullington, and Dinges (2003)

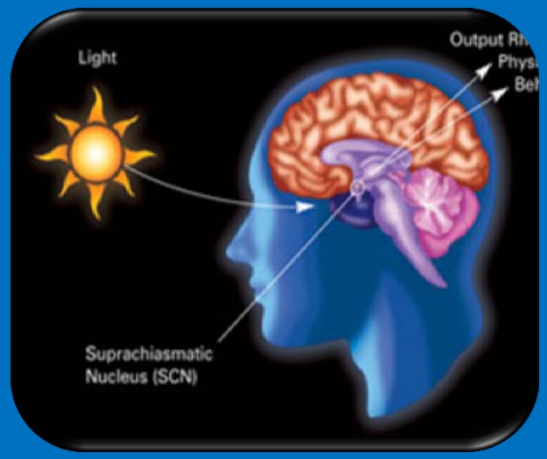
From intuition to science



Alertness is regulated by three processes

1. Sleep/wake

Alertness increases with sleep and decreases with hours awake



2. Circadian rhythms

Alertness varies in a 24-hour rhythm

3. Sleep inertia

Temporary grogginess experienced upon waking from sleep

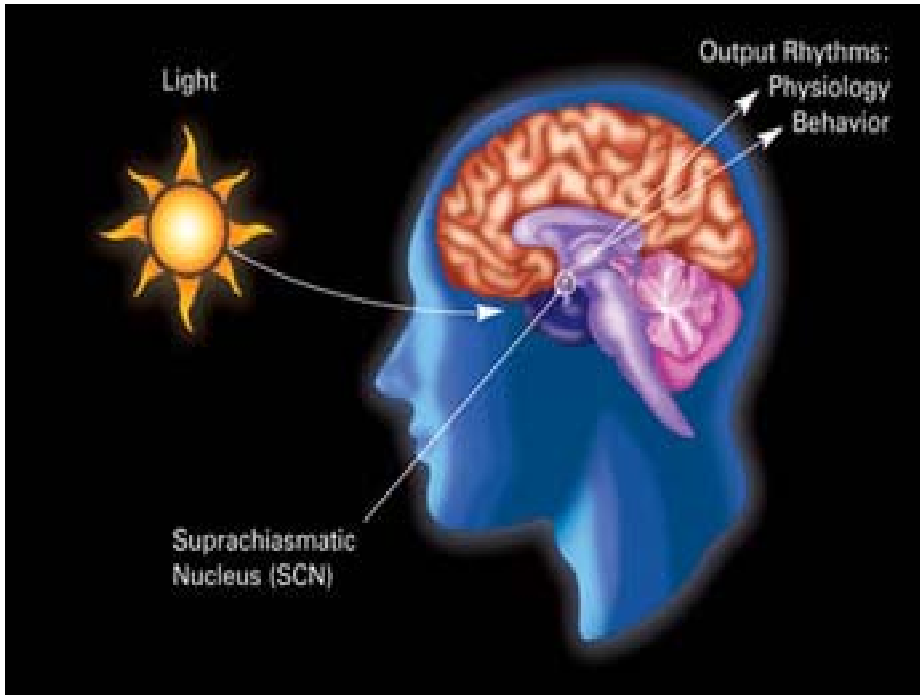
•*Folkard, S. and T. Akerstedt, (1991) A three-process model of the regulation of sleepiness and alertness. In Ogilvie, R. and Broughton, R. (eds.) Sleep, arousal and performance: problems and promises, Boston, Birkhäuser, 1991:11-26 .*

Circadian rhythms

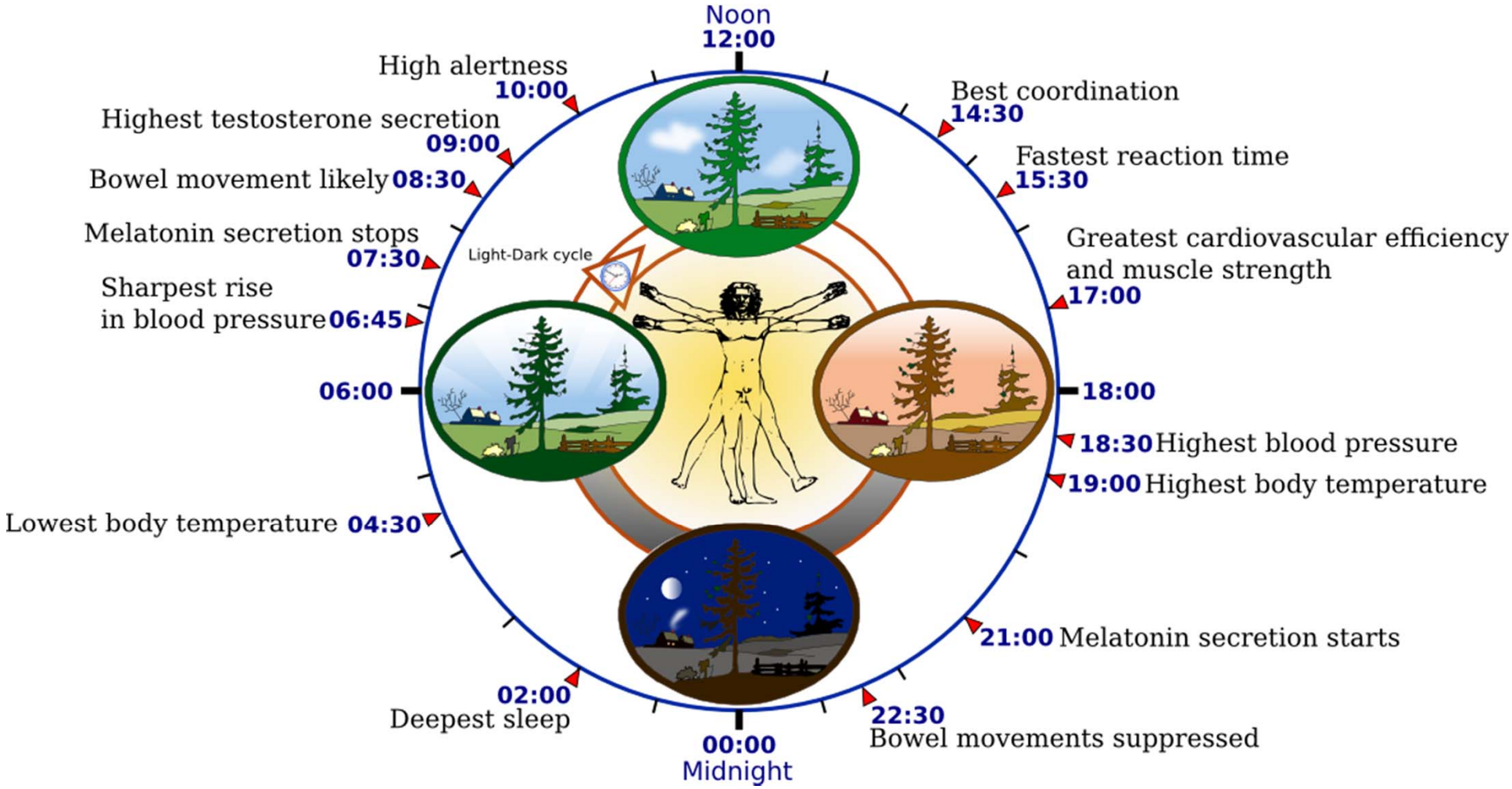
Generated by the **body clock**, located in the hypothalamus

Prepare us for **activity** during day and **sleep** at night

Timing influenced by external cues, particularly **light**.

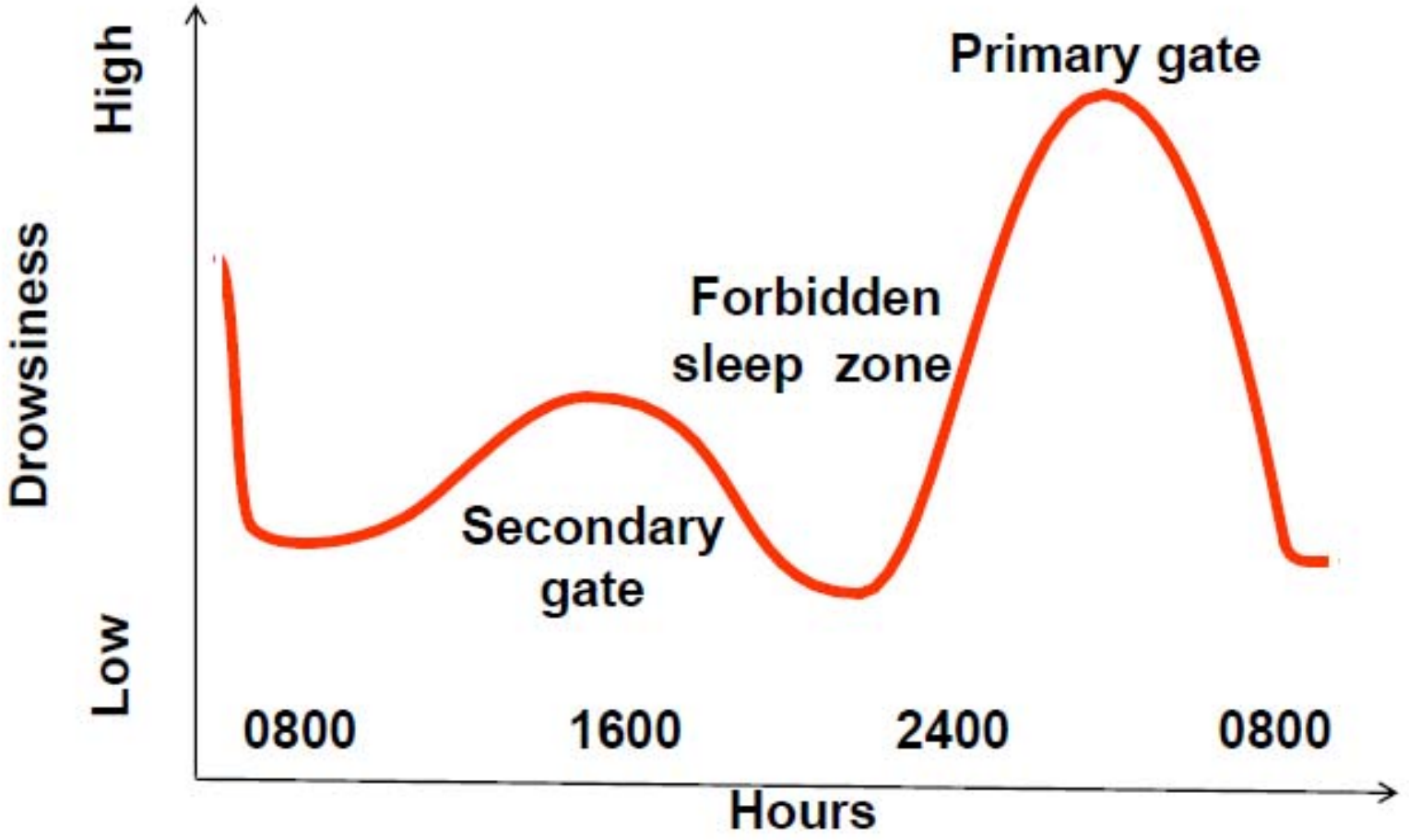


The body clock



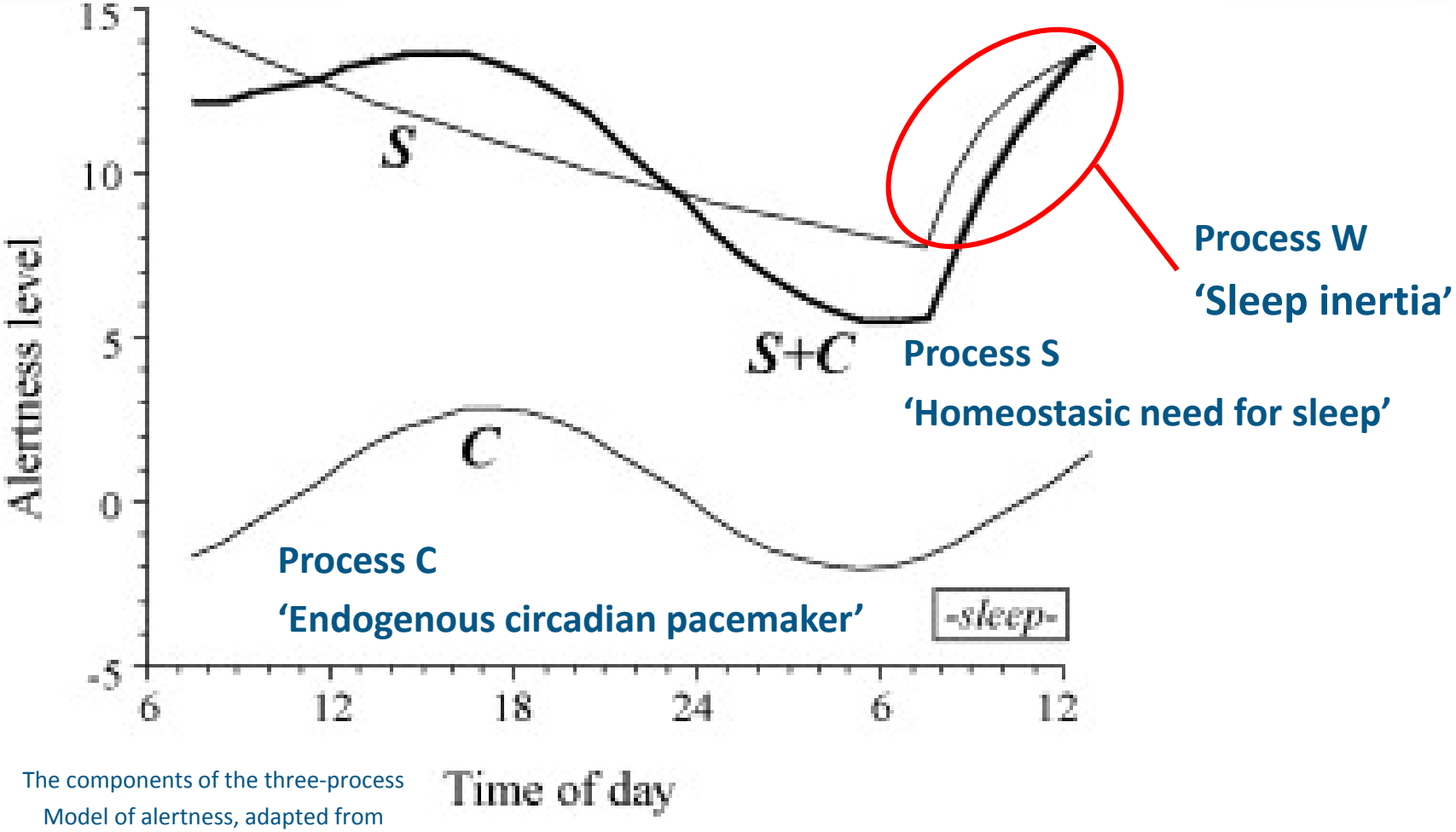
- Taken from Wikimedia Commons

Sleep propensity



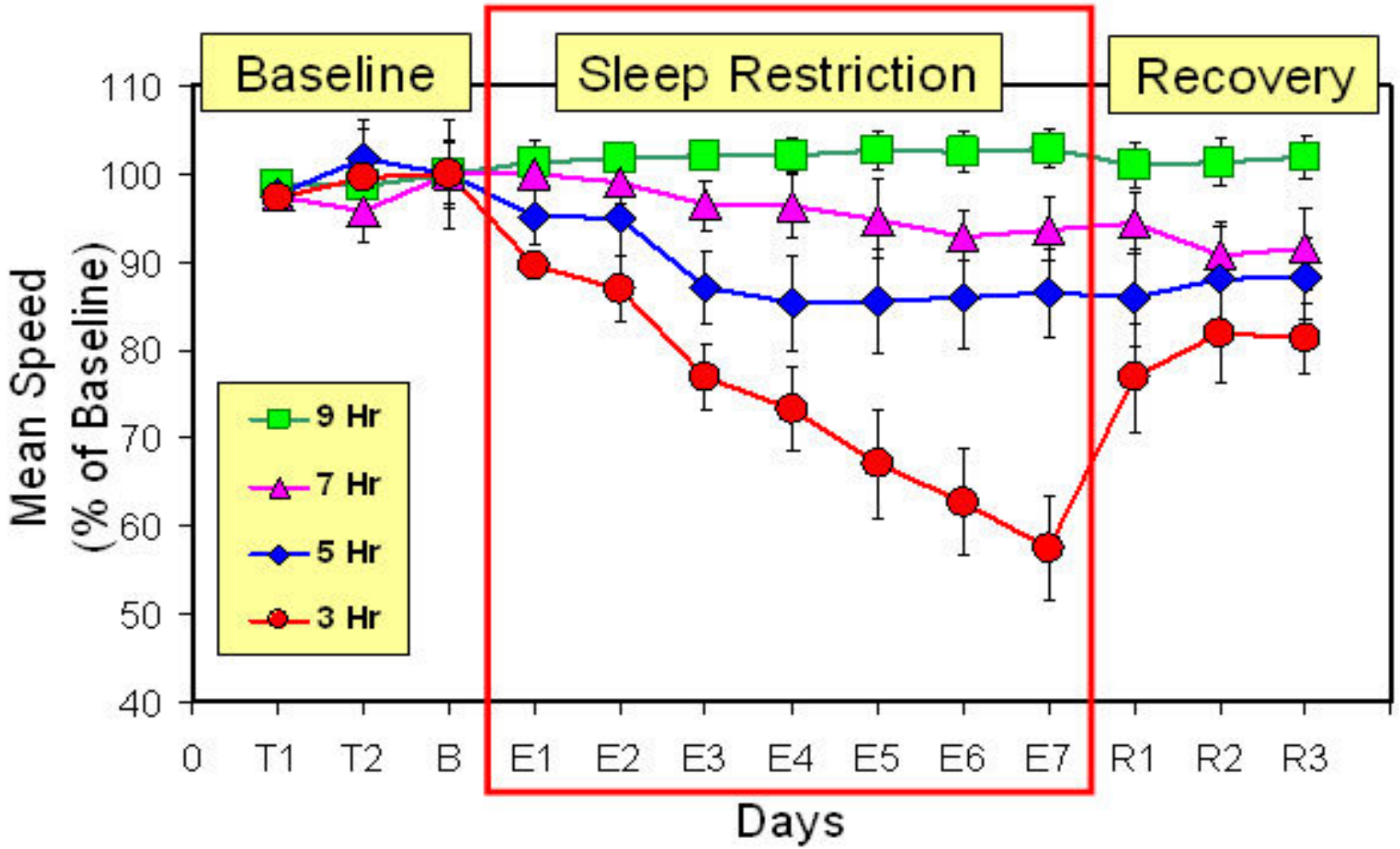
Schematic representation of time periods favouring sleep onset
(from Stampi, 1989)

Alertness components



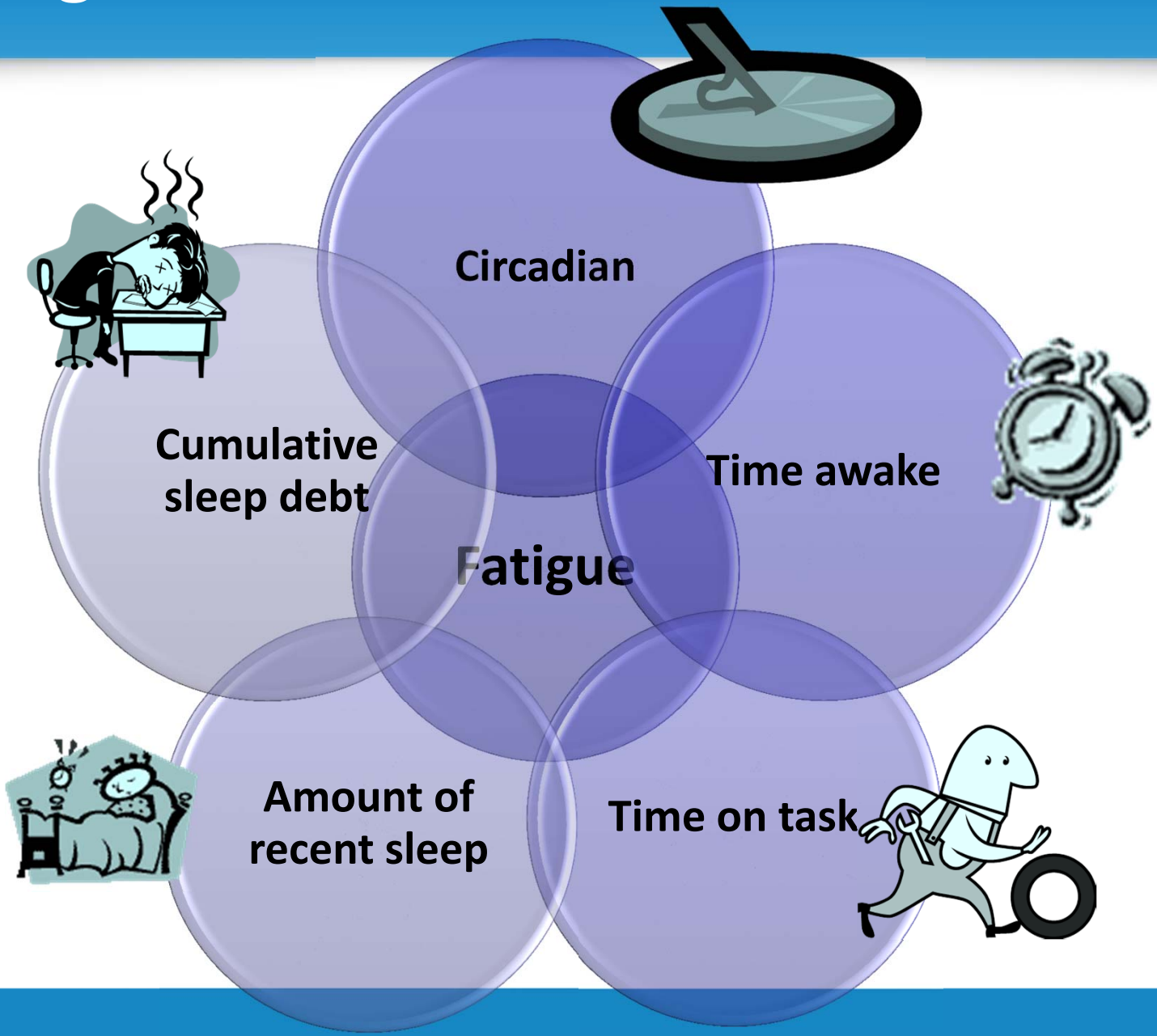
The components of the three-process Model of alertness, adapted from Åkerstedt et al,2008

What is cumulative sleep loss?



•From Belenky G, Wesensten NJ, Thorne DR, Thomas ML, Sing HC, Redmond DP, Russo MB, Balkin TJ (2003). Patterns of performance degradation and restoration during sleep restriction and subsequent recovery: a sleep dose-response study. Journal of Sleep Research 12: 1-12.

Fatigue factors



Sleep inertia

Most severe in the first 5 min after waking

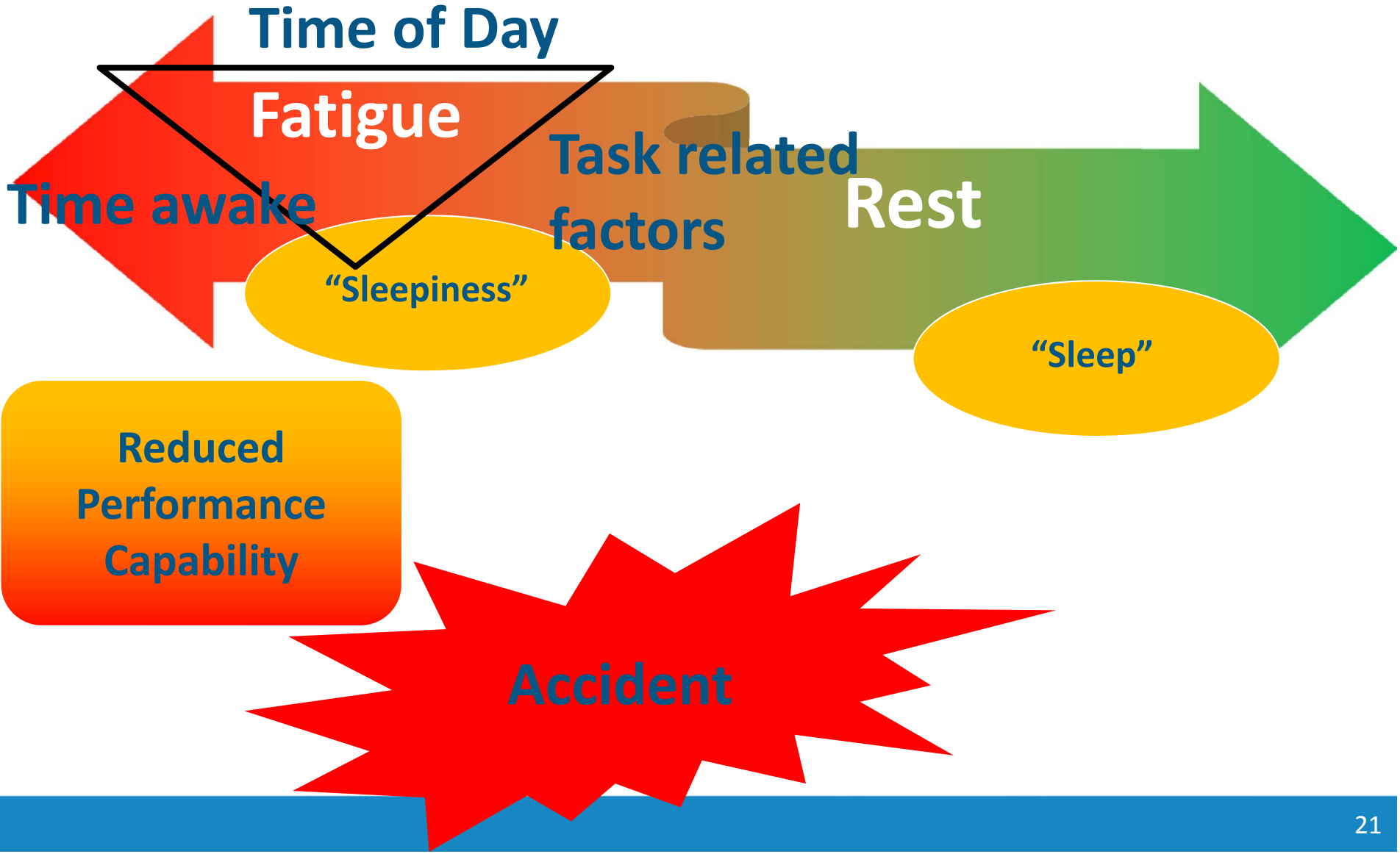
Temporary feeling of grogginess and reduced performance that occurs immediately after waking

Impaired short-term memory, reaction time, decision making ability

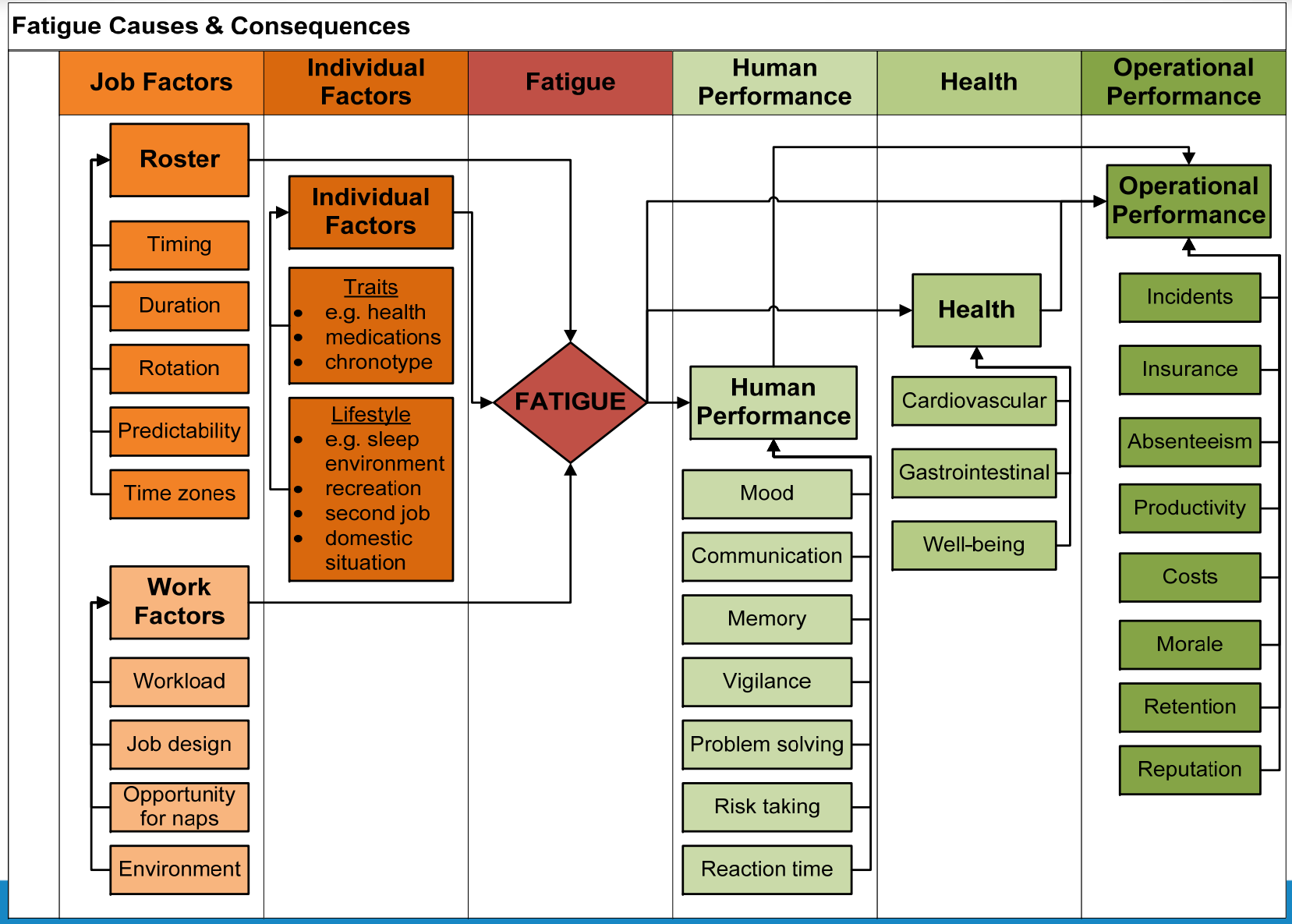
Effects can last longer than 30 min

Worst when woken from deep sleep, particularly if this coincides with the WOCL

Fatigue: a hazard in aviation



Causes and consequences of fatigue



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Fatigue

reduces the safety margin;

has multiple causes;

and the true cost may be hidden.

Effective fatigue control needs more than just ‘numbers’.

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Strengths and weaknesses of FTL schemes

Strengths	Weaknesses
Clear boundaries	Limits not based on science and do not adequately consider the circadian rhythms in sleep and alertness
Offer a simple level of protection to employees	Only address one cause of fatigue (hours of work) and not fatigue caused by the nature of work, lifestyle factors, health difficulties, commuting or the environment
	Maximum limits perceived as safe and often used as “targets”.
	We assume that if “it’s legal, it’s safe”
	“One size fits all” and static: don’t reflect differences between operators or changes over
	Responsibility remains with the regulatory authority/State

Scientific principles in FTL

…regulations shall be based upon scientific principles and knowledge,…

…rules based on scientific knowledge and best practices…

…taking into account the latest scientific and technical evidence…

The new EU fatigue management framework

When? Reg. 83/2014 Art. 2 – **18 February 2016**

To whom? CAT operations by aeroplane **except** Air Taxi, Single Pilot & EMS

Opt out In-flight rest until **17 February 2017**

Cover Regulation

Derogations / deviations to address particular national considerations

Interaction with working time requirements (social legislation)

Recitals

FTL without prejudice to more protective social legislation

Flexibility provisions Arts. 14 & 22.2

Regulation 216/2008 art 14 / art 22

- 1 immediate reaction to a safety problem
- 4 exemptions for operational needs of limited duration, not repetitive
- 6 derogation achieving equivalent level of safety by other means
- Individual flight time specification schemes

Continuous review of effectiveness

Impact of new rules on aircrew alertness

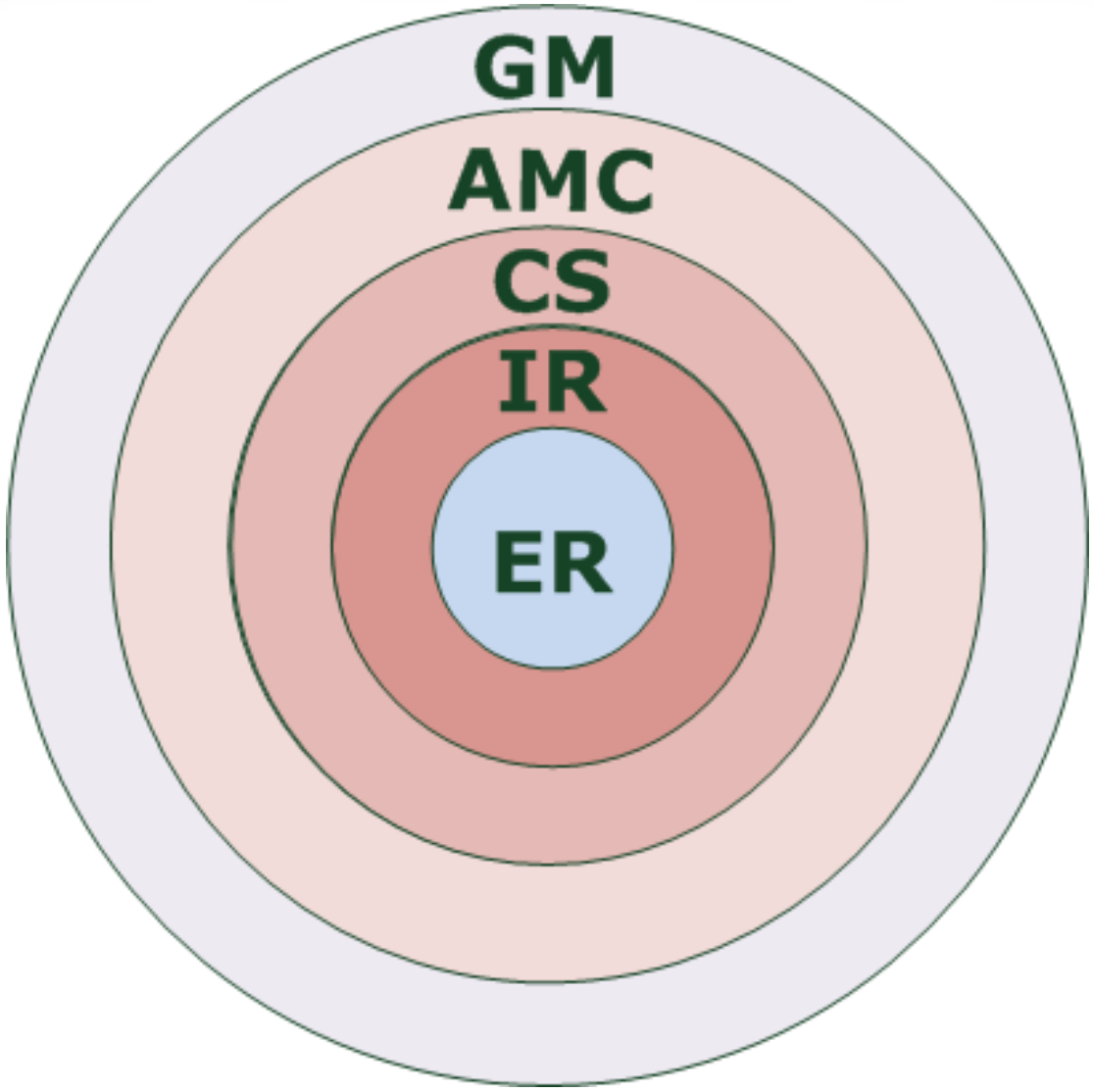
Implementation

ARO.OPS.230
Determination of disruptive schedules

ARO.OPS.235
Approval of individual flight time specification schemes

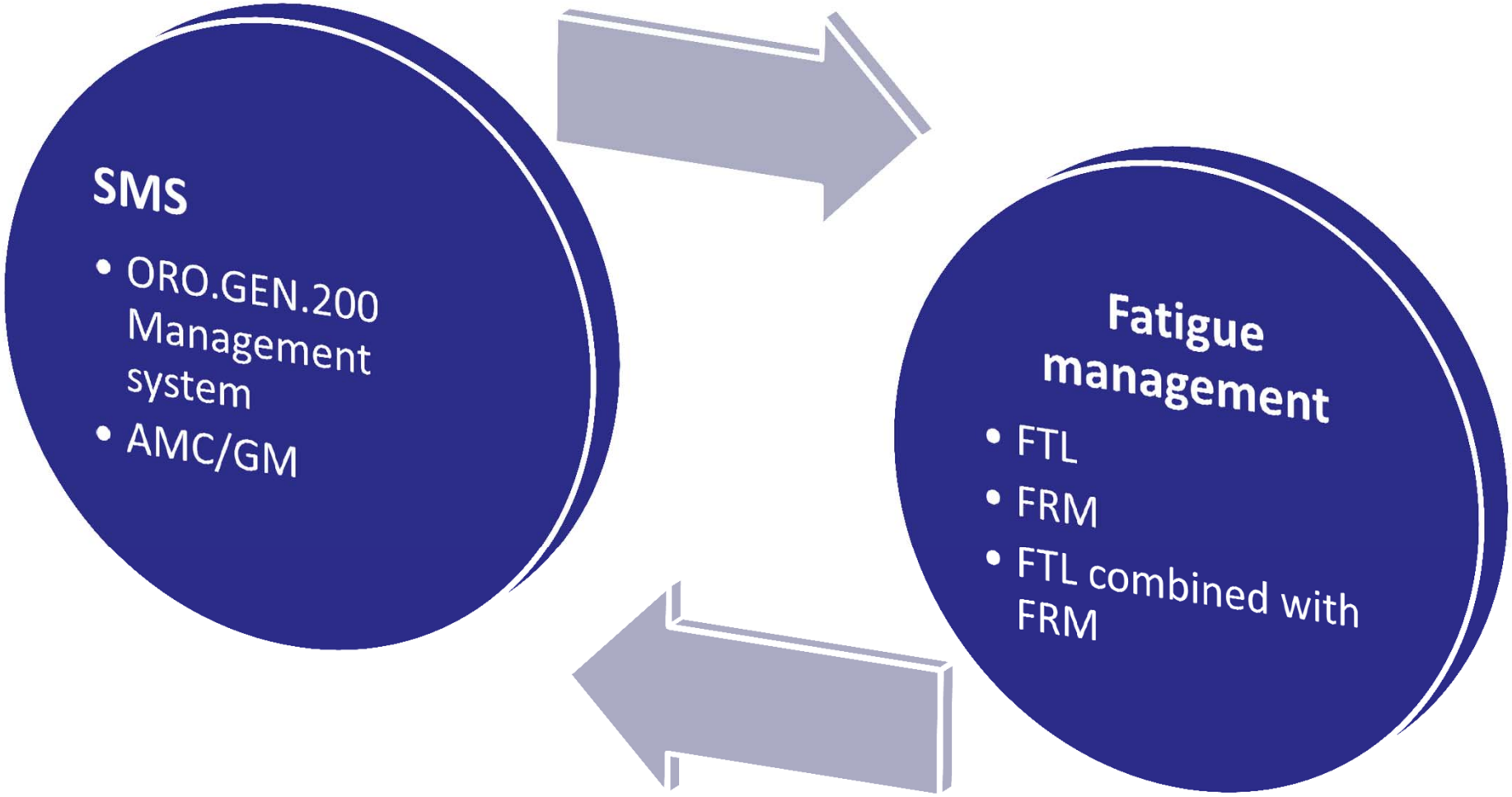
Flight time specification schemes

ARO.OPS.235

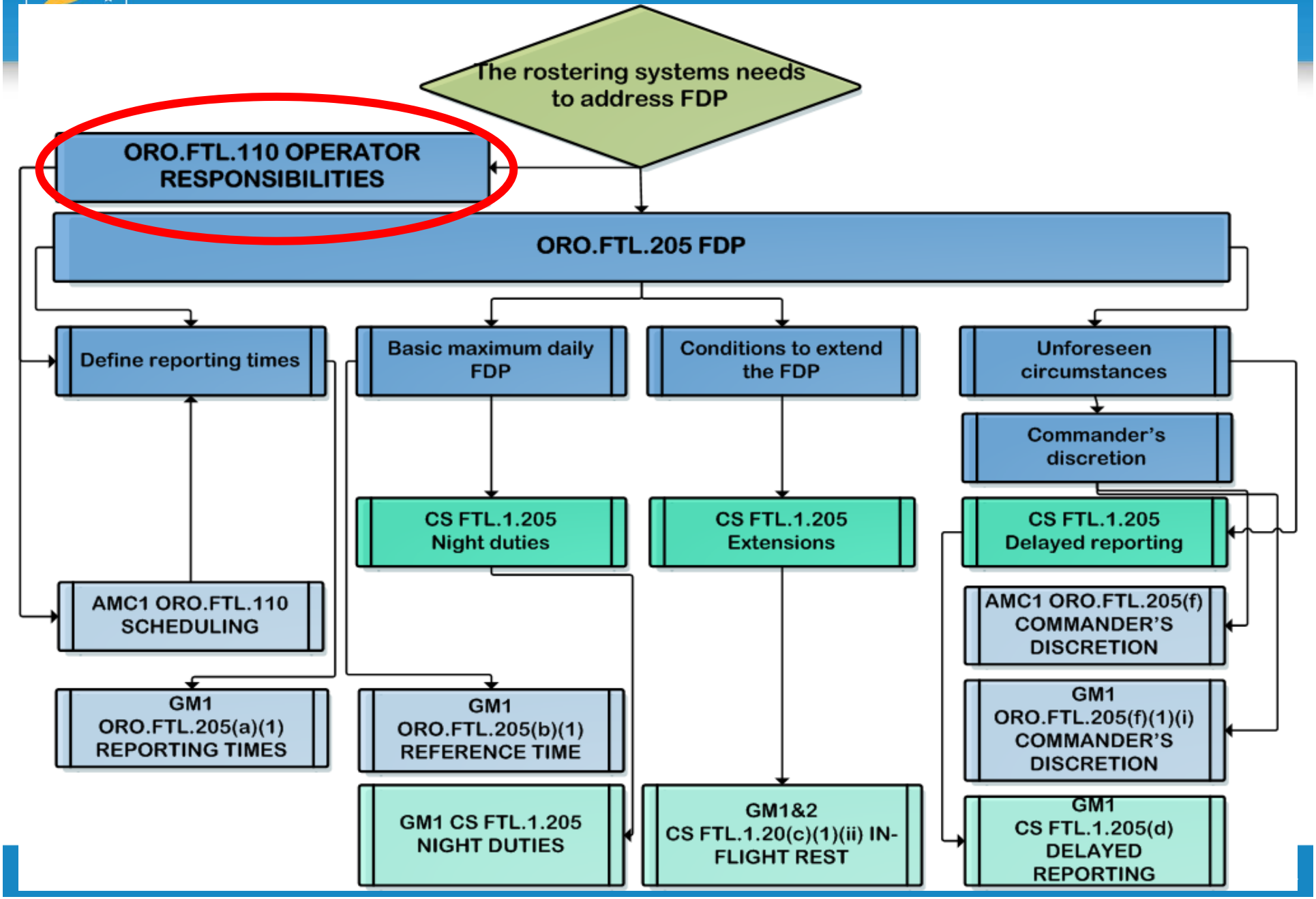


ORO.FTL.125

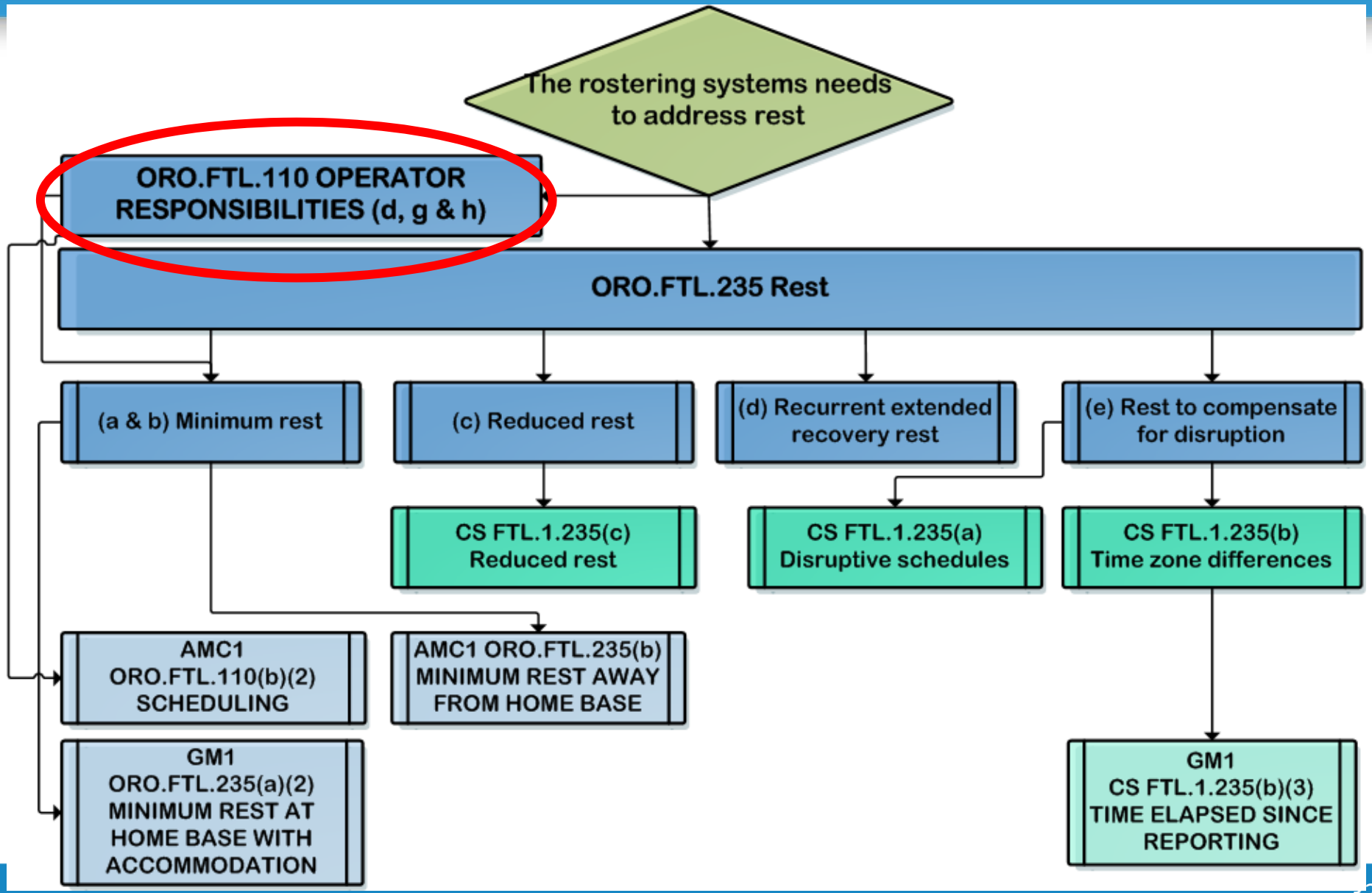
Fatigue management & SMS



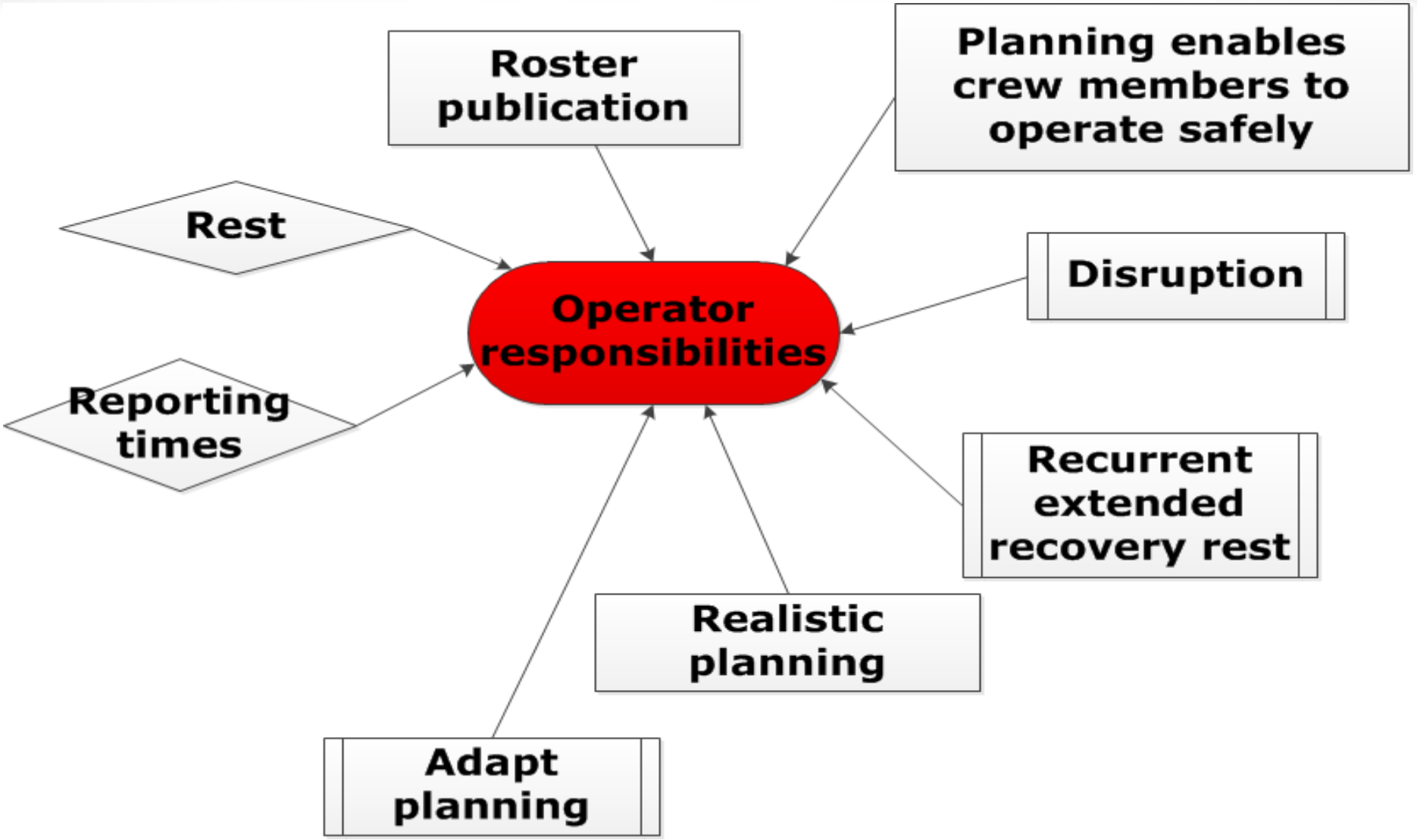
Example: FDP


The rostering systems needs to address FDP
ORO.FTL.110 OPERATOR RESPONSIBILITIES
ORO.FTL.205 FDP
Define reporting times
Basic maximum daily FDP
Conditions to extend the FDP
Unforeseen circumstances
Commander's discretion
CS FTL.1.205 Night duties
CS FTL.1.205 Extensions
CS FTL.1.205 Delayed reporting
AMC1 ORO.FTL.110 SCHEDULING
AMC1 ORO.FTL.205(f) COMMANDER'S DISCRETION
GM1 ORO.FTL.205(a)(1) REPORTING TIMES
GM1 ORO.FTL.205(b)(1) REFERENCE TIME
GM1 ORO.FTL.205(f)(1)(i) COMMANDER'S DISCRETION
GM1 CS FTL.1.205 NIGHT DUTIES
GM1&2 CS FTL.1.20(c)(1)(ii) IN-FLIGHT REST
GM1 CS FTL.1.205(d) DELAYED REPORTING

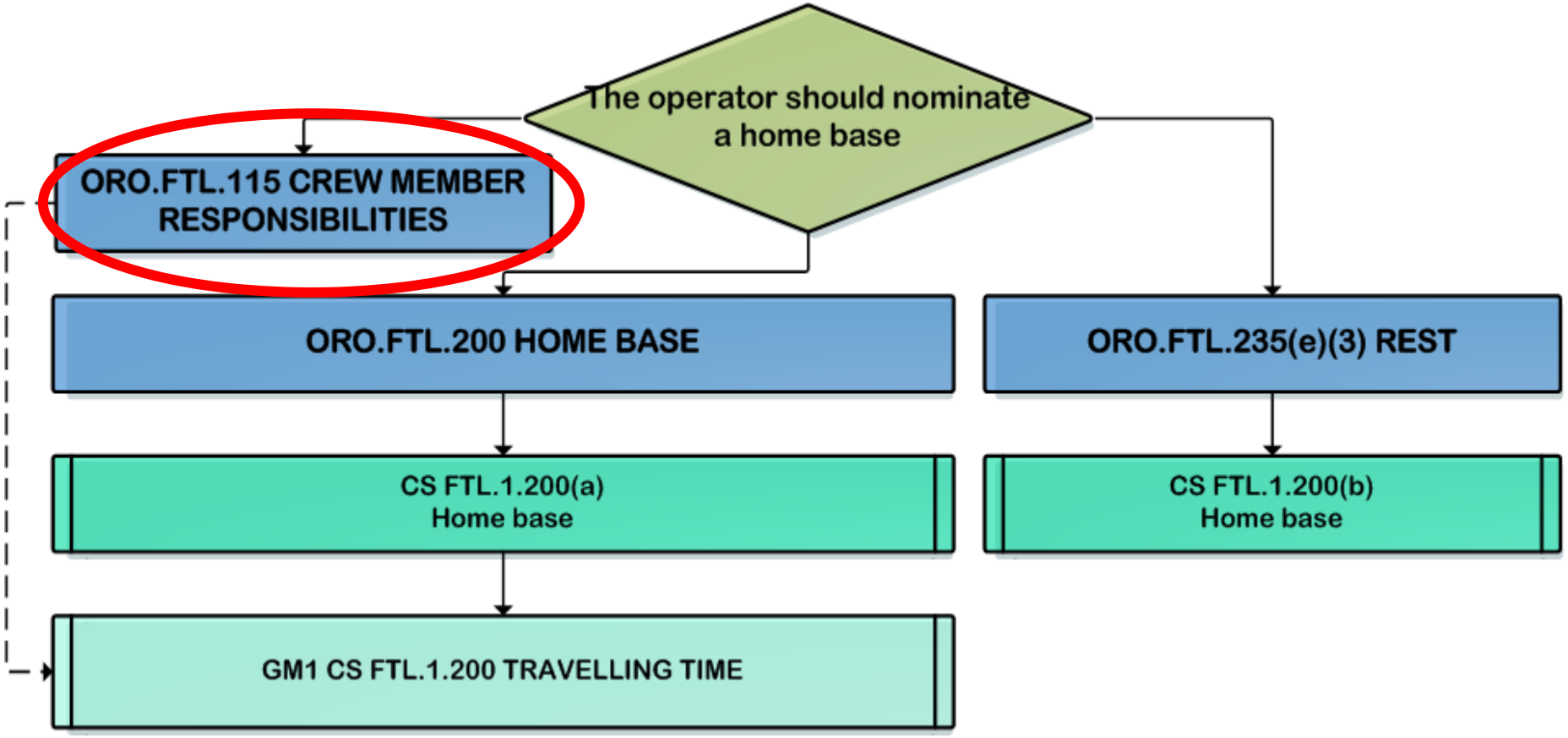
Rest


The rostering systems needs to address rest
ORO.FTL.110 OPERATOR RESPONSIBILITIES (d, g & h)
ORO.FTL.235 Rest
(a & b) Minimum rest
(c) Reduced rest
(d) Recurrent extended recovery rest
(e) Rest to compensate for disruption
CS FTL.1.235(c) Reduced rest
CS FTL.1.235(a) Disruptive schedules
CS FTL.1.235(b) Time zone differences
AMC1 ORO.FTL.110(b)(2) SCHEDULING
AMC1 ORO.FTL.235(b) MINIMUM REST AWAY FROM HOME BASE
GM1 ORO.FTL.235(a)(2) MINIMUM REST AT HOME BASE WITH ACCOMMODATION
GM1 CS FTL.1.235(b)(3) TIME ELAPSED SINCE REPORTING

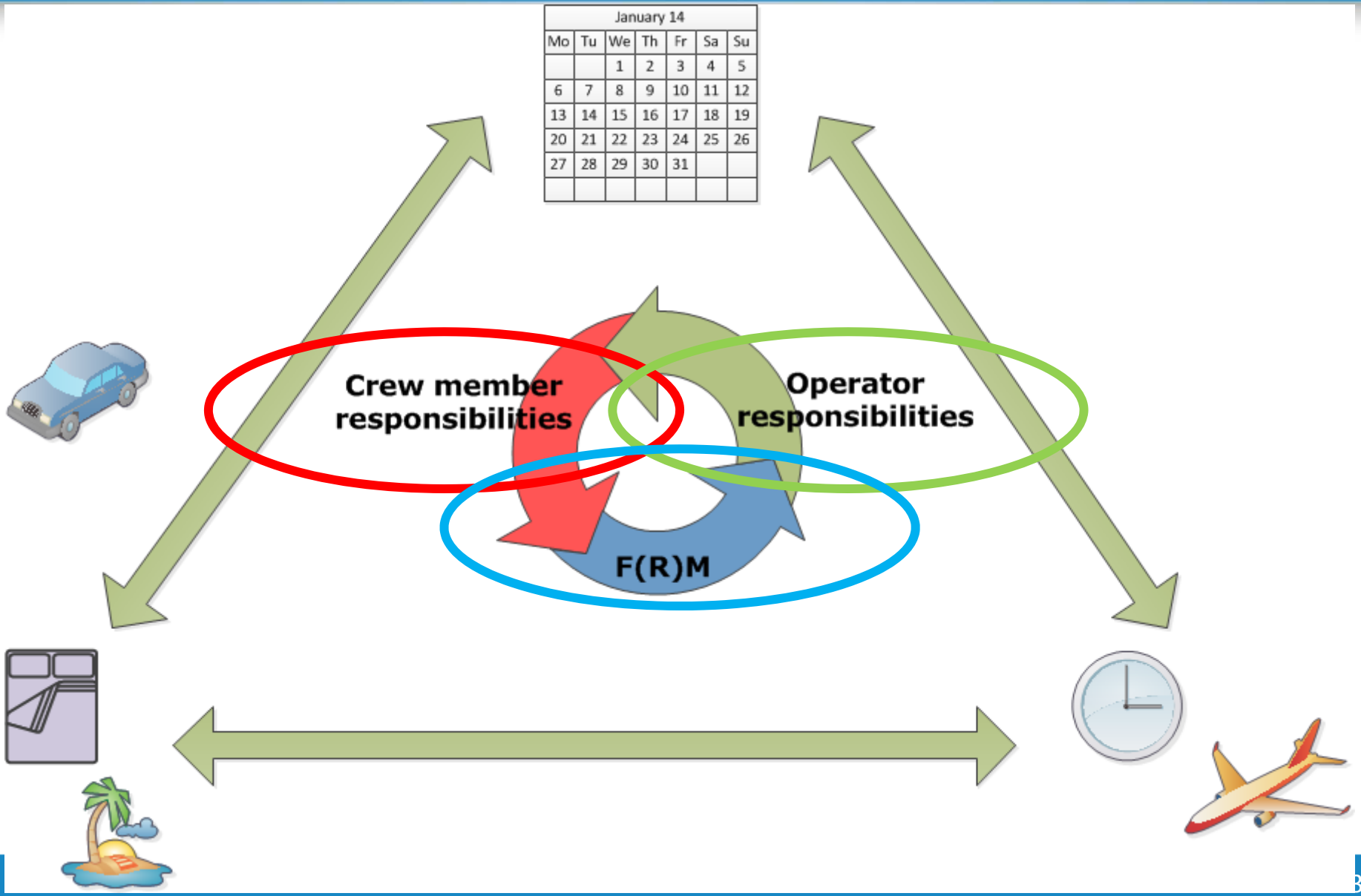
ORO.FTL.110 & AMC/GM



Home Base


The operator should nominate a home base
ORO.FTL.115 CREW MEMBER RESPONSIBILITIES
ORO.FTL.200 HOME BASE
ORO.FTL.235(e)(3) REST
CS FTL.1.200(a) Home base
CS FTL.1.200(b) Home base
GM1 CS FTL.1.200 TRAVELLING TIME

Flight time specification scheme



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KEY POINTS

- IR, CS, AMC and GM are a system, they complement each other
- Don’t look at rules or numbers in isolation
- Fatigue management is a shared responsibility

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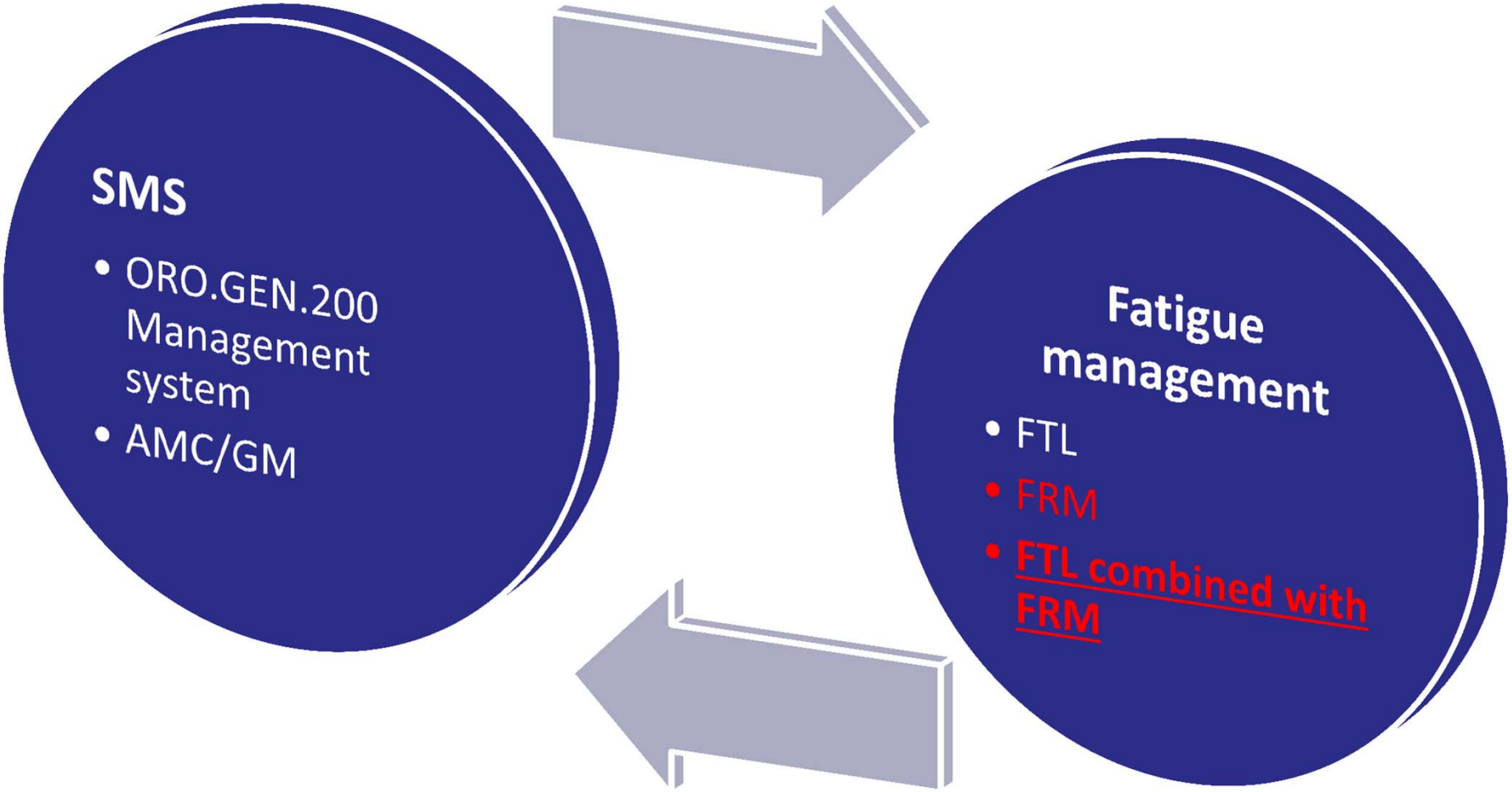
What is new?


SMS
• ORO.GEN.200 Management system
• AMC/GM
Fatigue management
• FTL
• FRM
• FTL combined with FRM

What is fatigue risk management?

Fatigue Risk Management

A data-driven, business risk management approach to fatigue

Processes for measuring, mitigating and managing fatigue risk

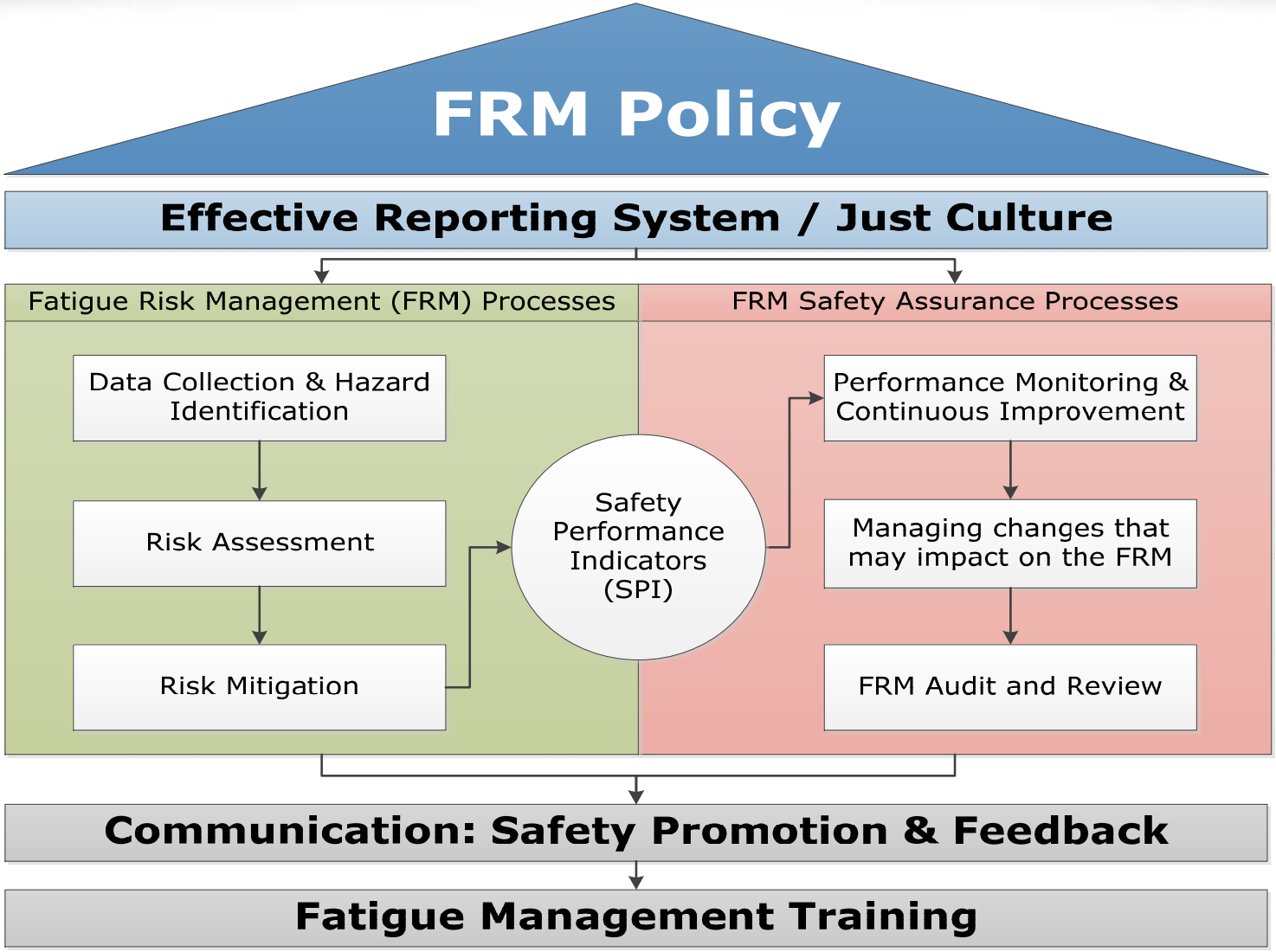
More effective than FTL alone

Based on scientific principles and knowledge, data collection and analysis, and so enables to maintain an equivalent level of safety whilst allowing greater operational flexibility.

FRM is an integral part of SMS

SMS	FRM
Safety policy & objectives	FRM policy & documentation
Safety risk management	Fatigue risk management process • Identification of hazards • Risk assessment • Risk mitigation • Implementation
Safety assurance	Fatigue safety assurance • Monitor effectiveness of FRM • Management of change • Continuous improvement of FRM
Safety promotion	FRM promotion process • Training programmes • FRM communication plan

FRM Structure

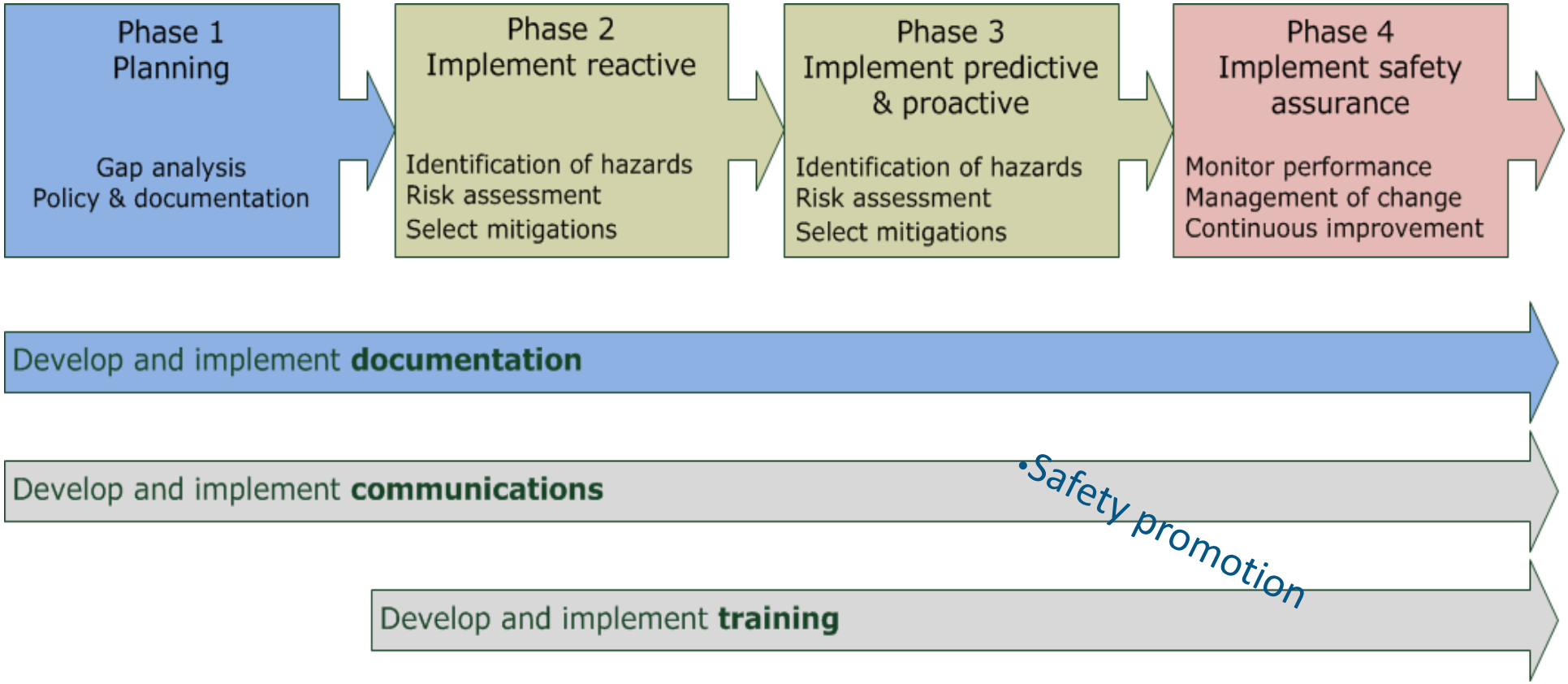


Example sources of data on fatigue

- Roster metrics e.g. stability, standby usage, number of sectors
- Statistics: absenteeism, sickness, turn-over, commute
- Fatigue reports and incident investigations
- Ergonomic assessment of work and sleep environment
- Fatigue model analysis of rosters
- Crew surveys and focus groups
- Scientific studies e.g. sleep diaries, actigraphy

Approval & Oversight (1)

Phased Implementation



Approval & Oversight (2)

Substance

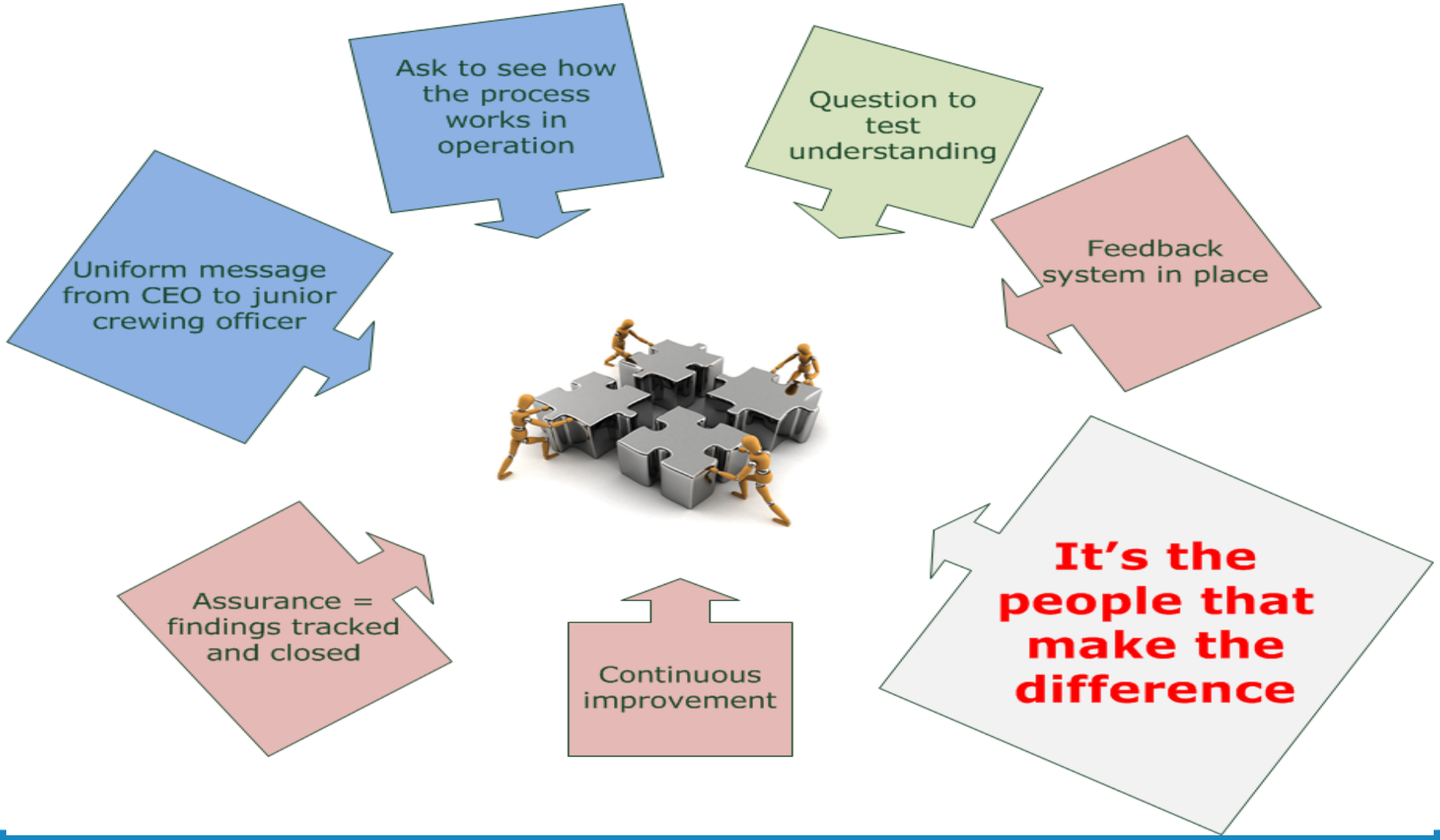
•Aesthetics versus Substance

Balanced communication	Eye candy
Clear reporting process	Flashy power points
Appropriate reporting forms	Overly detailed reporting forms
Manual relevant to the operator	“Familiar” Manual
Assurance finding	“Perfect” paperwork
Access to all	Waffle

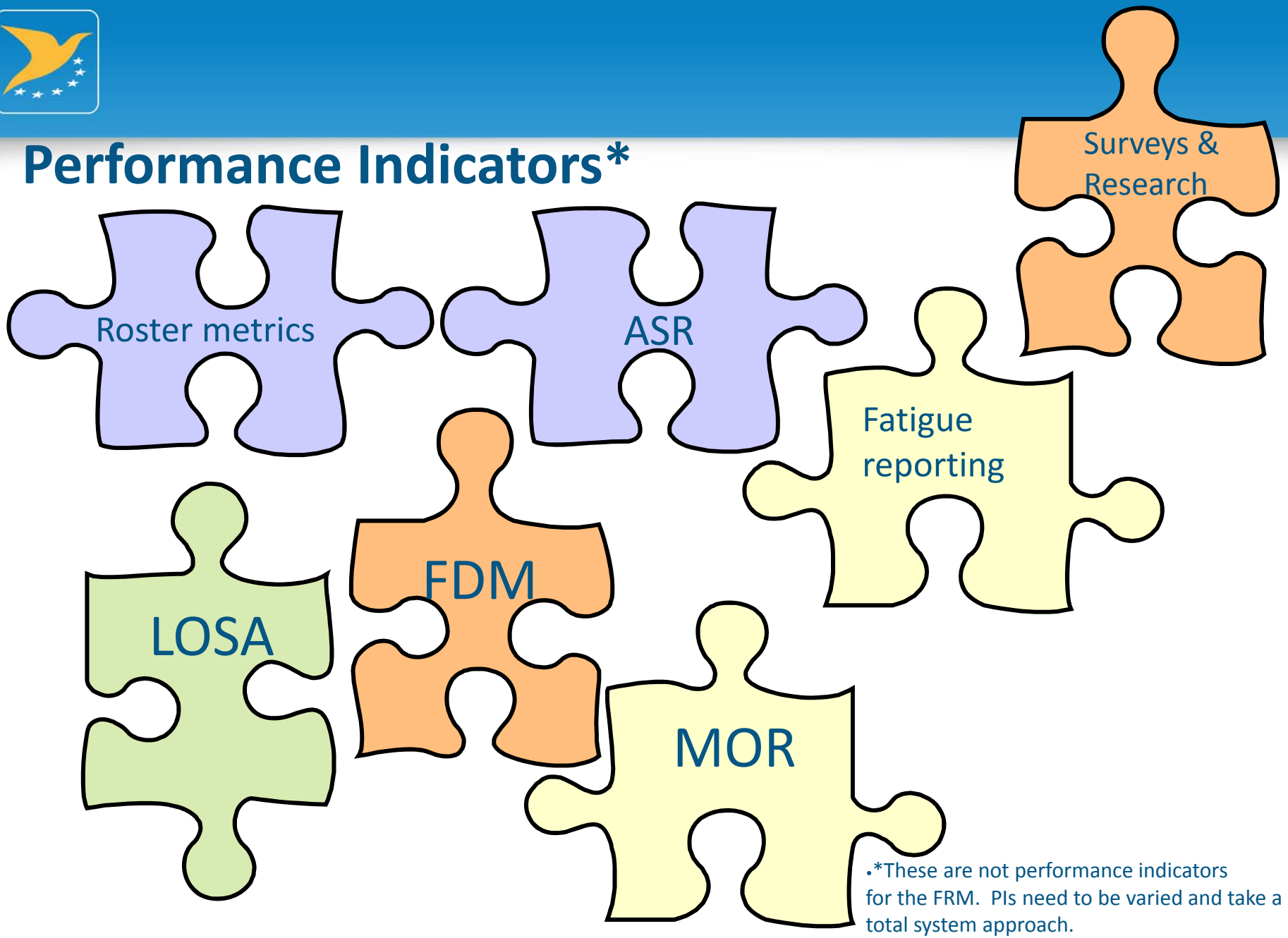
Aesthetics

Approval & Oversight (3)

- How to tell the difference?



Performance Indicators*

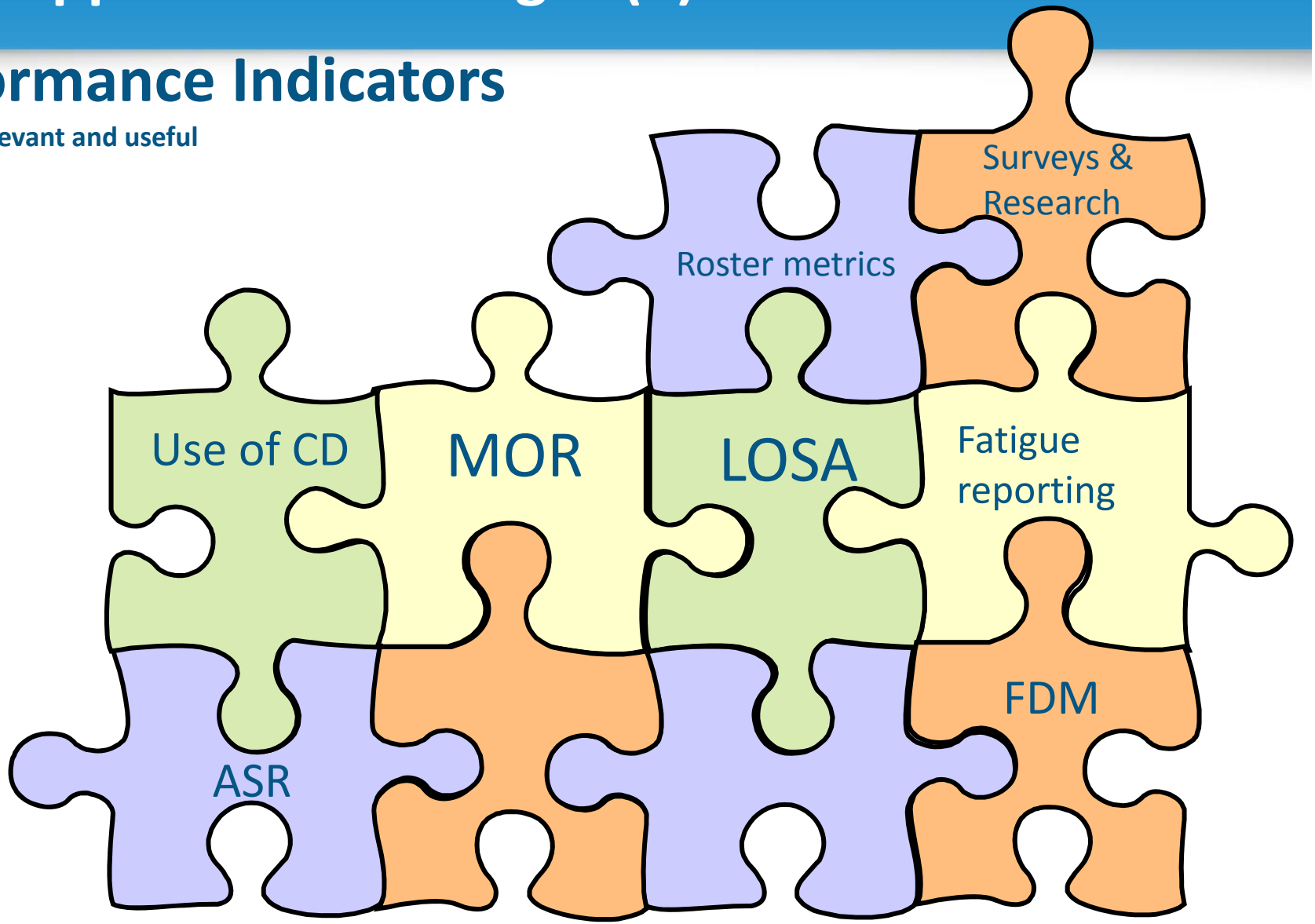


- *These are not performance indicators for the FRM. PIs need to be varied and take a total system approach.

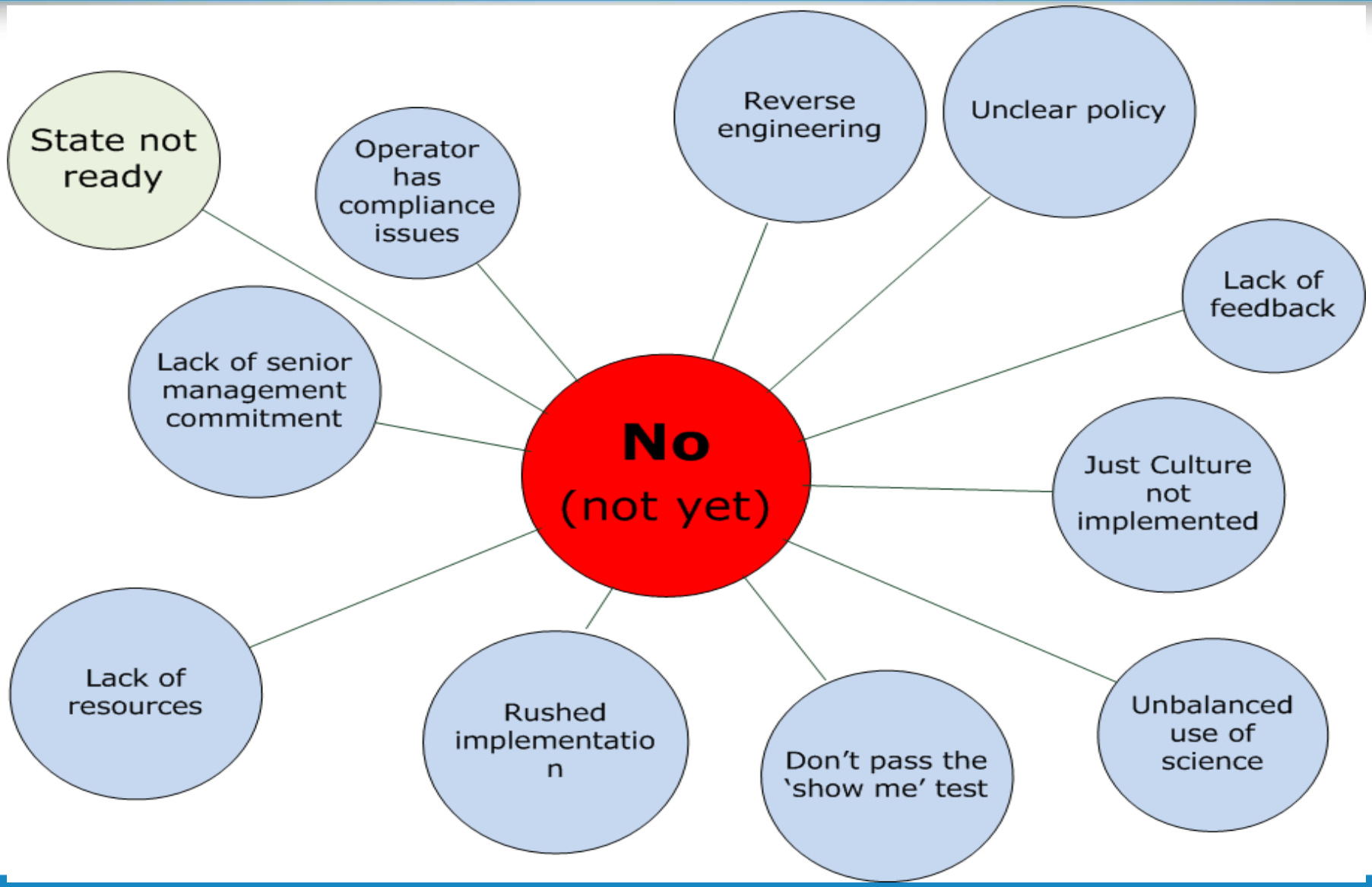
•Approval & Oversight (5)

Performance Indicators

Must be relevant and useful



•Approval & Oversight (6)



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State needs to be ready

Operator demonstrates compliance with FTL through fatigue management

Relevant PIs, reporting system etc.

Demonstrable commitment to FRM

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Benefits of FRM

Rather than complying with prescriptive limits, FRM relies on actually measuring and managing the fatigue-related risks.

Increased risk knowledge enables enhanced management of safety.

Benefits include reduced safety events, informed strategic decisions, increased operational flexibility, reduced insurance premiums, more effective regulatory oversight and improved relations with the unions.

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