

# The Germanwings FRMS Experience

Active Fatigue Risk Management



Lufthansa Group



germanwings 

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FRMS implementation started in 2007 at Germanwings

It has been IOSA audited in 2014 and is compliant to ISARPs

It is not yet approved by the competent authority.

# The Germanwings FRMS Experience

## 1 Chronology

## 2 FRMS Implementation in 10 Steps

## 3 Conclusions

## 4 What is required to achieve consistent safety beyond prescriptive FTLs

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# Chronology: From tired flight crews to a performance driven FRMS

- Oct 2002 Start of flight operations GWI
- Oct 2005 CRM recurrent training topic: „Fatigue & Vigilance“
- Aug 2006 First fatigue survey
- Dec 2006 FRMS conception: „Alertness Management Programme“
- Mar 2007 Decision by senior management to implement FRMS, policy signed
- May 2007 Initial meeting FSAG
- Jan 2008 Official application of “evidence based scheduling practices”
- Sep 2008 Scientific study of „Workload & Fatigue“ by DLR
- Dec 2008 Fatigue software introduced for performance monitoring
- Feb 2009 First „Fatigue Management Training”
- Mar 2011 Fatigue model-based optimizing of rosters
- Aug 2011 ICAO/IATA/IFALPA publish FRMS SARPs & Guidance material
- Jul 2013 new Germanwings
- Jan 2014 IOSA audit includes FRMS
- Sep 2014 New scientific study of “Standby & Sleep” by DLR

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# FRMS Conception

- CASA's early FRMS-guidance promised to fulfil LCC productivity demands and to manage fatigue risk effectively at the same time. (Today: refer to ICAO FRMS Implementation Guides)
- Our FRMS has been tailored to be appropriate to the size, specific nature and complexity of our operation

## ORO.FTL.120 FRM (c)

The FRM shall correspond to the flight time specification scheme, the size of the operator and the nature and complexity of its activities, taking into account the hazards and associated risks inherent in those activities and the applicable flight time specification scheme

**Experience:** FRMS conception and compliance may conflict each other:  
There is only one "FRMS standard" available to achieve compliance (incl. IOSA)

## Step 1: Commitment for FRMS Implementation (year 2007)

- We have accepted, that fatigue is a hazard
- We felt responsible to control fatigue risk, as a shared responsibility with our crews
- We were willing to learn from operational experience and science
- We were willing to manage fatigue differently than we did before
- FRMS implementation started from the top: Senior management commitment

AMC1 ORO.FTL.120(b)(1)

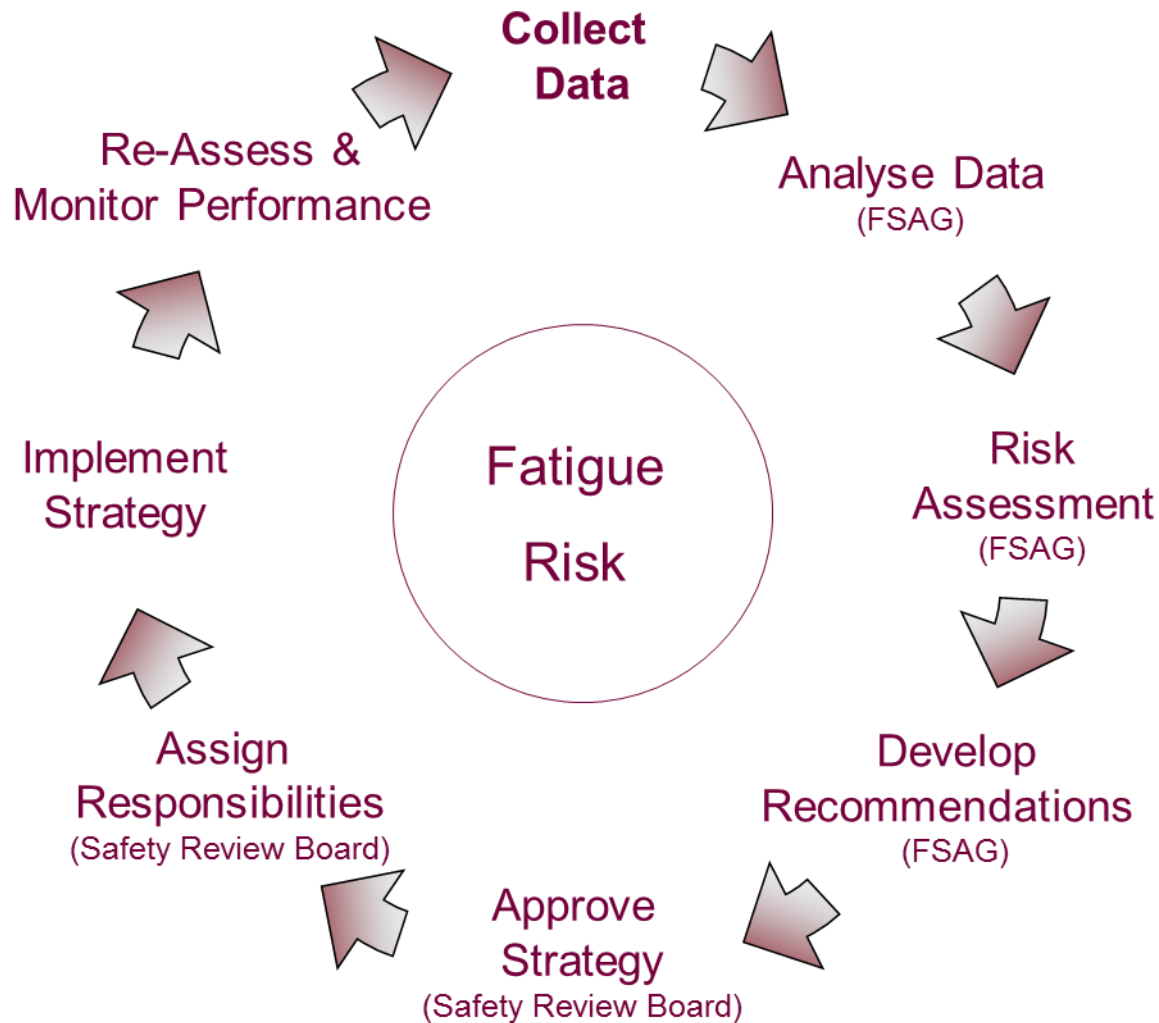
(c) The FRM policy should:

(3) declare management commitment to the provision of adequate resources...

**Experience:** Senior managers need to be certain, that FRMS is the “best industry practice” to manage fatigue today!

Consider to distinguish between “management commitment” and “policy”

# FRMS Management Cycle used by Germanwings



## Step 2: Collect Data (Step1: Commitment for FRMS)

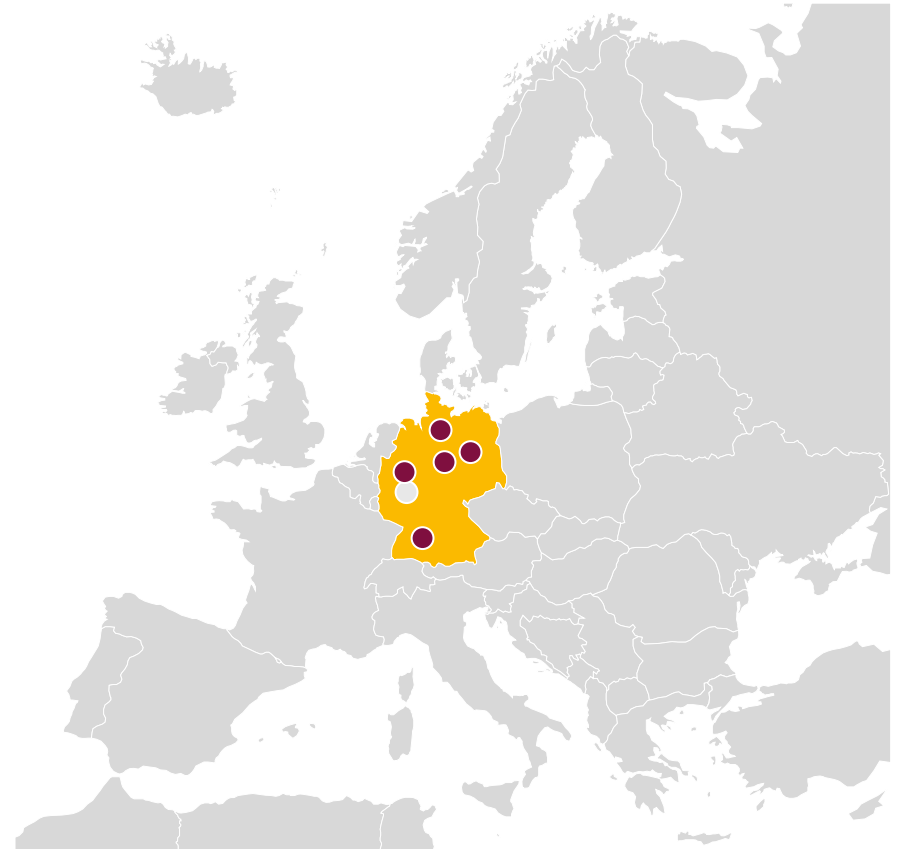
**Collect  
Data**



**Fatigue  
Risk**

## Step 2: System Description of our Operations

- Low Cost Carrier principles apply:
- Maximum crew productivity
- Maximum aircraft utilisation
- Operation is 24/7
- Tight schedule, quick turn-arounds
- Flight times from 35min – max 5h
- Ping-pong flights
- 56 Aircraft 319/320
- 7 Bases across Germany
- Area of operations: EUR
- Crews sleep at home
- All flights within prescriptive limits
- Strong market competition



**Germanwings is like no other airline: Different operators, different fatigue issues!**

## Step 2: Collect Data

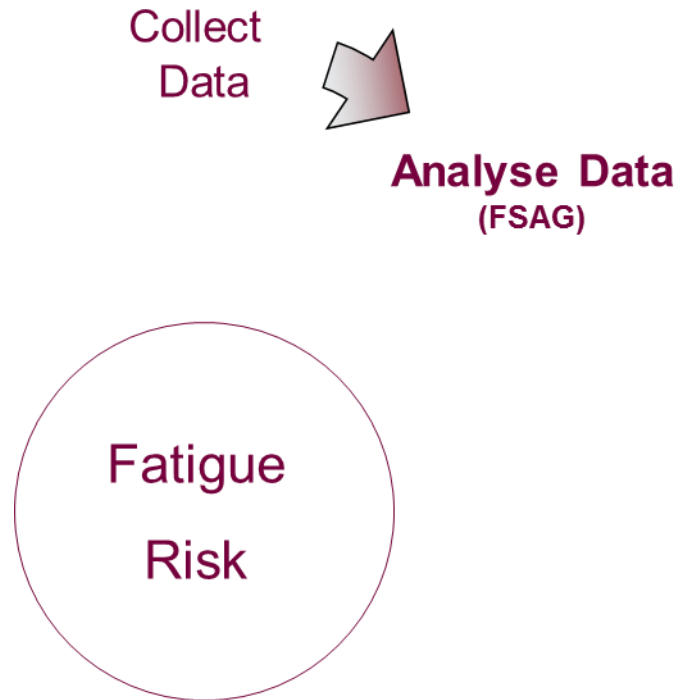
- Identify own operations: System description of own operations
- **Predictive** data: Own and industry experience on similar type of operation; evidences-based scheduling practices
- **Proactive** data: Internal reports; commander discretions; fatigue survey (internal); scientific literature; conference attendance
- **Reactive** data: Investigation reports; accident investigation reports (external)

AMC1 ORO.FTL.120(b)(4)

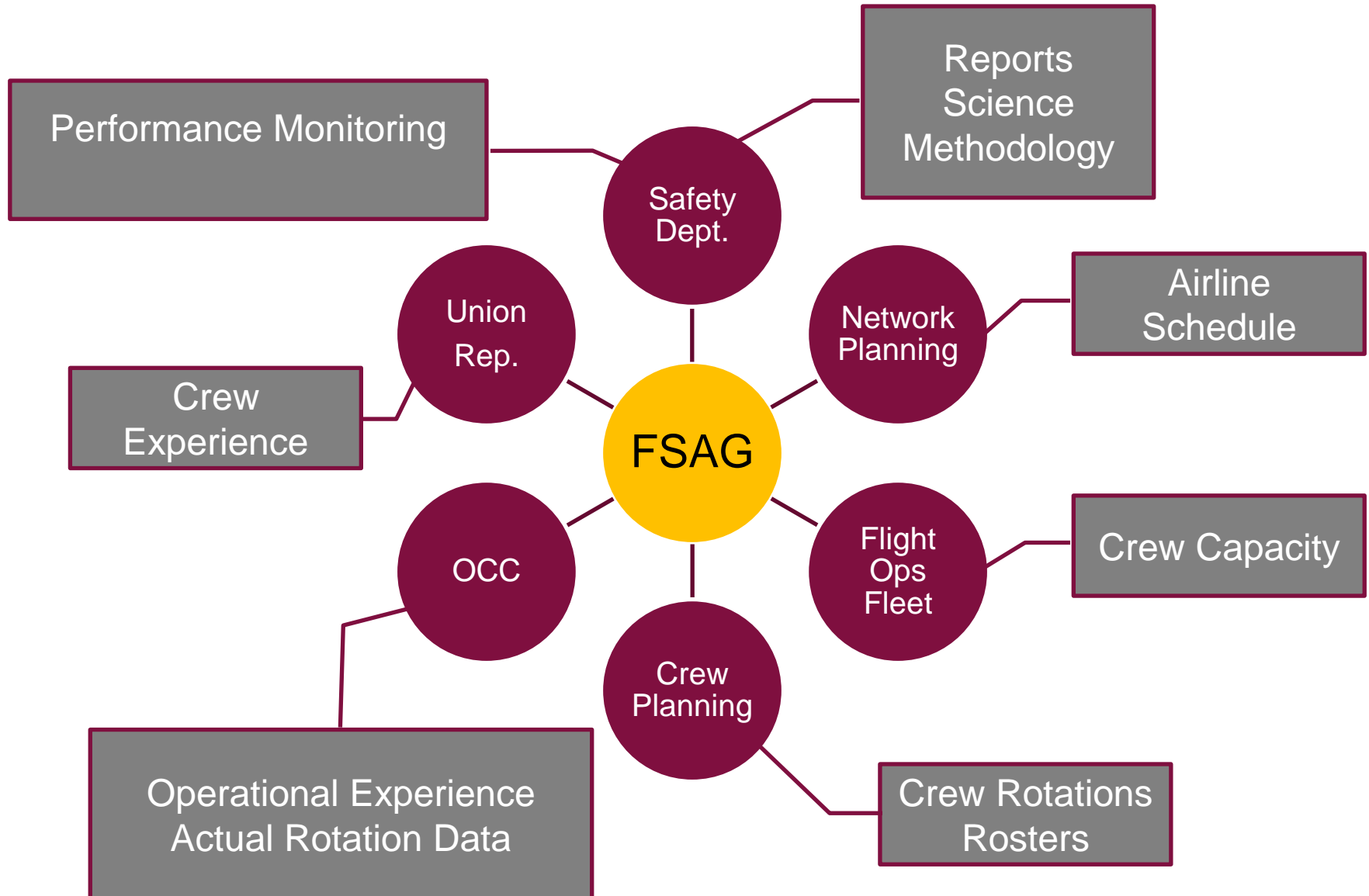
The operator should develop and maintain three documented processes for fatigue hazard identification: (a) predictive; (b) proactive (c) reactive

**Experience:** We had all types of data available from the beginning

## Step 3: Analyse Data (Hazard Identification)



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# The Germawings' Fatigue Safety Action Group (FSAG)

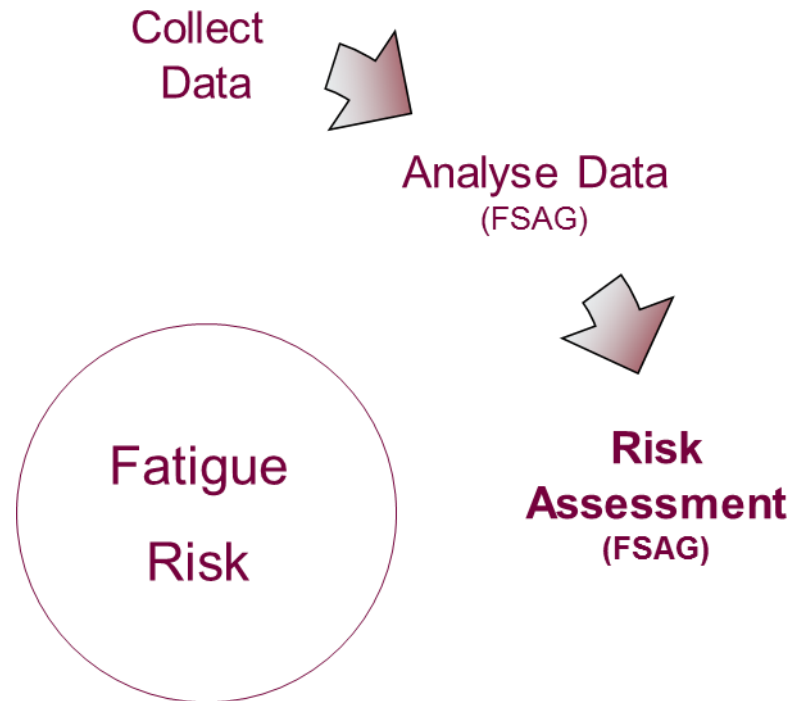


- All departments that have direct influence, and therefore responsibility, on fatigue risk are represented in the FSAG
- The FSAG is the central part where all fatigue relevant information (and data & changes) is coming together to be analysed, in order to deliver advice for the management of fatigue risk
- As a typical Safety Action Group, the FSAG consists of “non-decision-makers”, which is considered to develop the most effective mitigation strategies

There is no requirement to have a FSAG; initial guidance is provided by ICAO

**Experience:** This FSAG is a benefit itself

## Step 4: Assess Conditions – Fatigue Risk Assessment



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**Severity** depends on the task  
and the exposure to fatigue factors

**Probability**  
depends on the  
deviation of  
airline schedule  
from circadian  
cycle

And on rostering  
practices (!)

		Fatigue risk				
		Risk severity				
Risk probability		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely Improbable	1	1A	1B	1C	1D	1E

Table 4.2c: Fatigue Risk Assessment Matrix

large reduction in safety margins

significant reduction in safety margins

Refer to ICAO FRMS Implementation Guides for definitions

## Step 4: Assess Conditions – Fatigue Risk Assessment

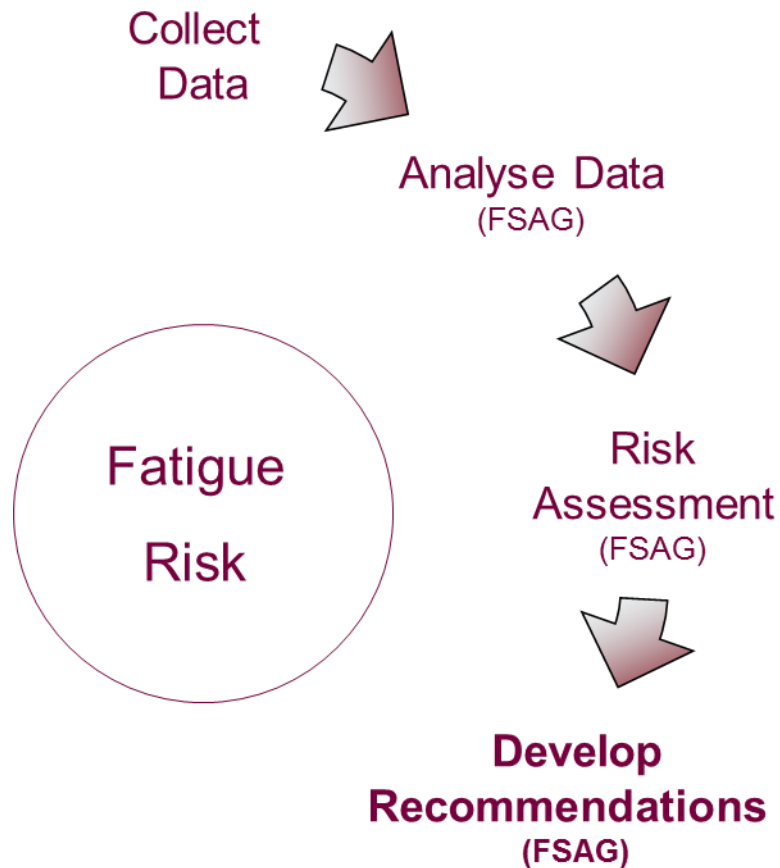
- Fatigue impairs human performance
- Fatigue itself is not the hazard
- It is the task that induces the level of severity
- Simple if an incident / occurrence is to be risk-assessed in a risk matrix
- Difficult if anything else concerning fatigue is to be assessed

### AMC2 ORO.FTL.120(b)(4)

An operator should develop and implement risk assessment procedures that determine the probability and potential severity of fatigue-related events and identify when the associated risks require mitigation

**Experience:** Assessing fatigue risk requires more specific risk assessment methodologies than provided by SMS and FRMS guidance material

## Step 5: Develop Recommendations for Risk Mitigation



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Principles of the Germanwings FSAG:

The FSAG may only “recommend” mitigation measures

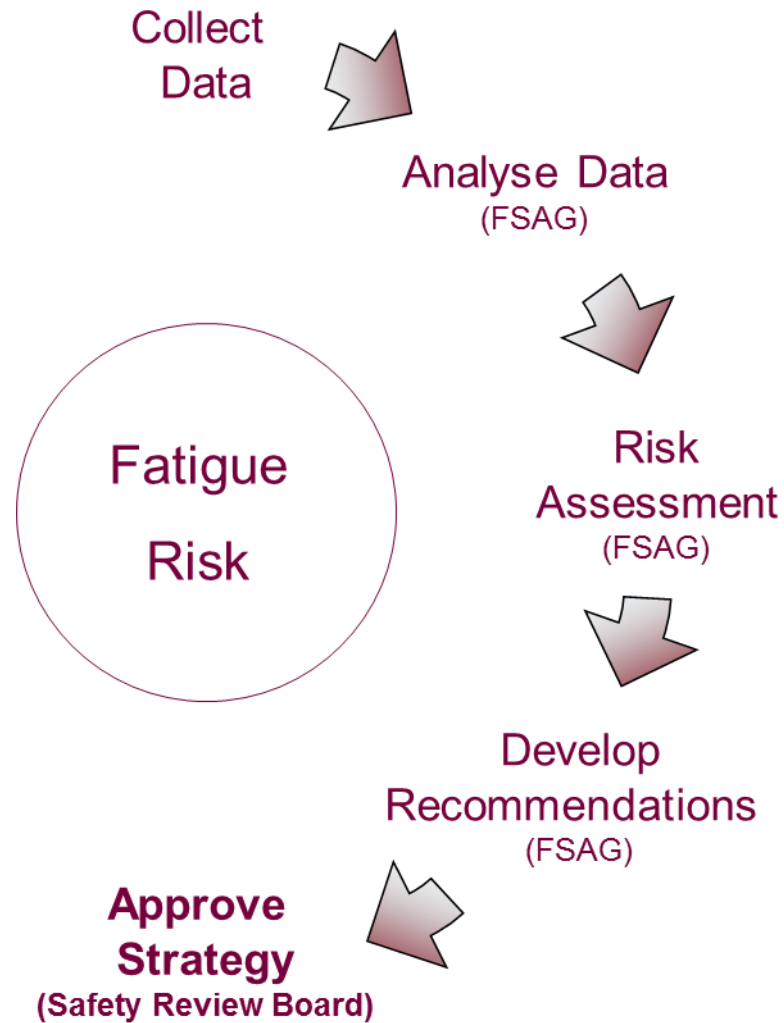
As a minimum, all recommendations of the FSAG shall be:

- Relevant for the specific Germanwings operation
- Based on scientific data
- Contribute to the company’s business objectives

### Experience:

A deep understanding of fatigue science is required to understand fatigue, to identify the specific causes of fatigue, to assess the risk, to develop effective mitigation and most important, to free fatigue from politics!

## Step 6: Approve Strategy (Risk Mitigation)



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Decision making is done by the risk owners: The decision makers approve recommended risk mitigations (Safety Review Board)

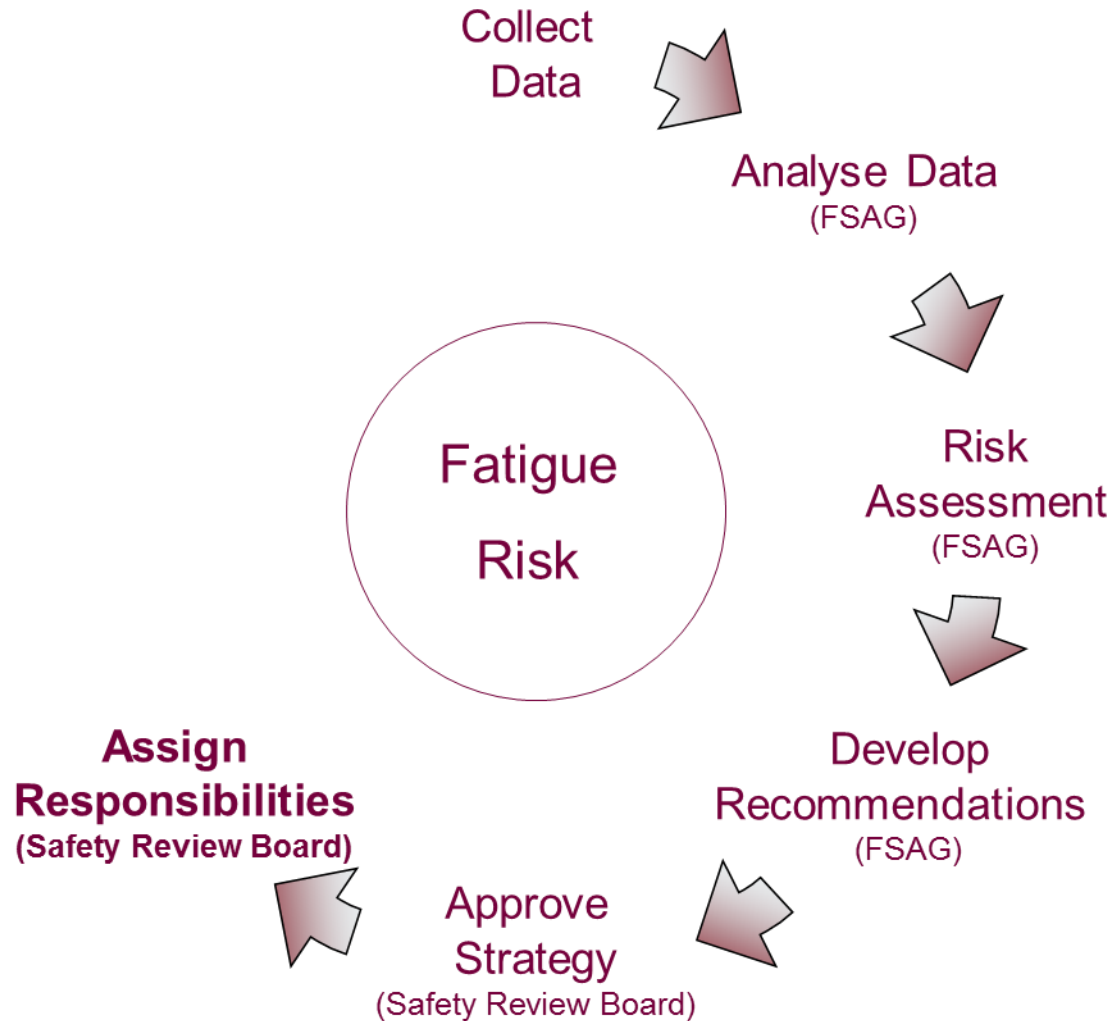
Decisions are based on:

- risk assessments and
- effectiveness of controls

AMC1 ORO.FTL.120(b)(5) An operator should develop and implement risk mitigation procedures that: (a) select the appropriate mitigation strategies

**Experience:** It was a good idea to have non decision makers in the FSAG for effective recommendations; and to let the risk owners decide what risk they are willing to take

## Step 7: Assign Responsibilities for Risk Mitigation



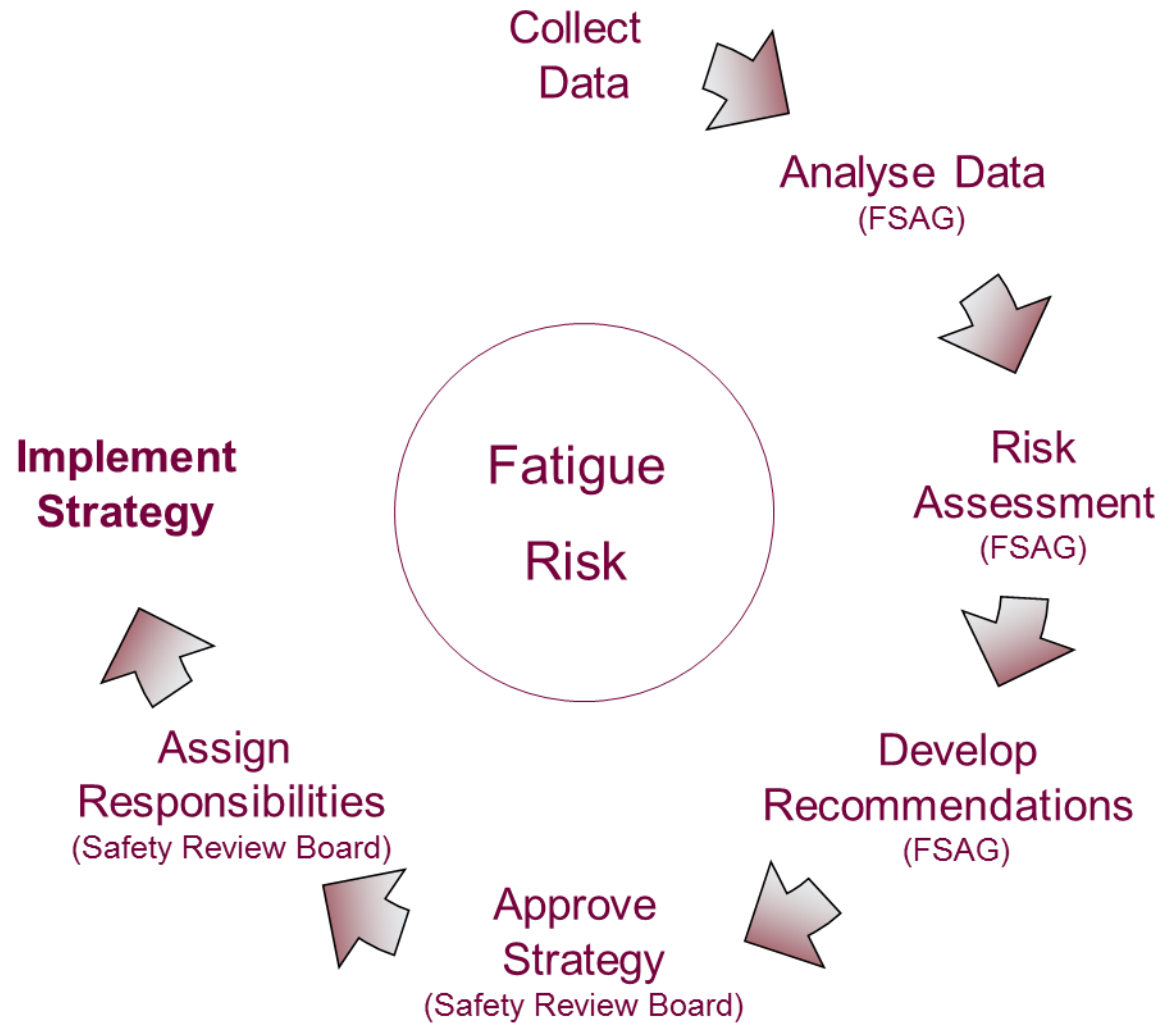
## Step 7: Assign Responsibilities for Risk Mitigation

Management is primarily responsible for the management of fatigue;

But responsibilities and resources have to be assigned to implement new strategies:

- Documentation (procedures or promotion)
- Training (promotion)
- Actual implementation (tools, e.g. software programming)
- Actual application (e.g. instruction for crew planning dept.)

## Step 8: Implement Strategy (Risk Mitigation)

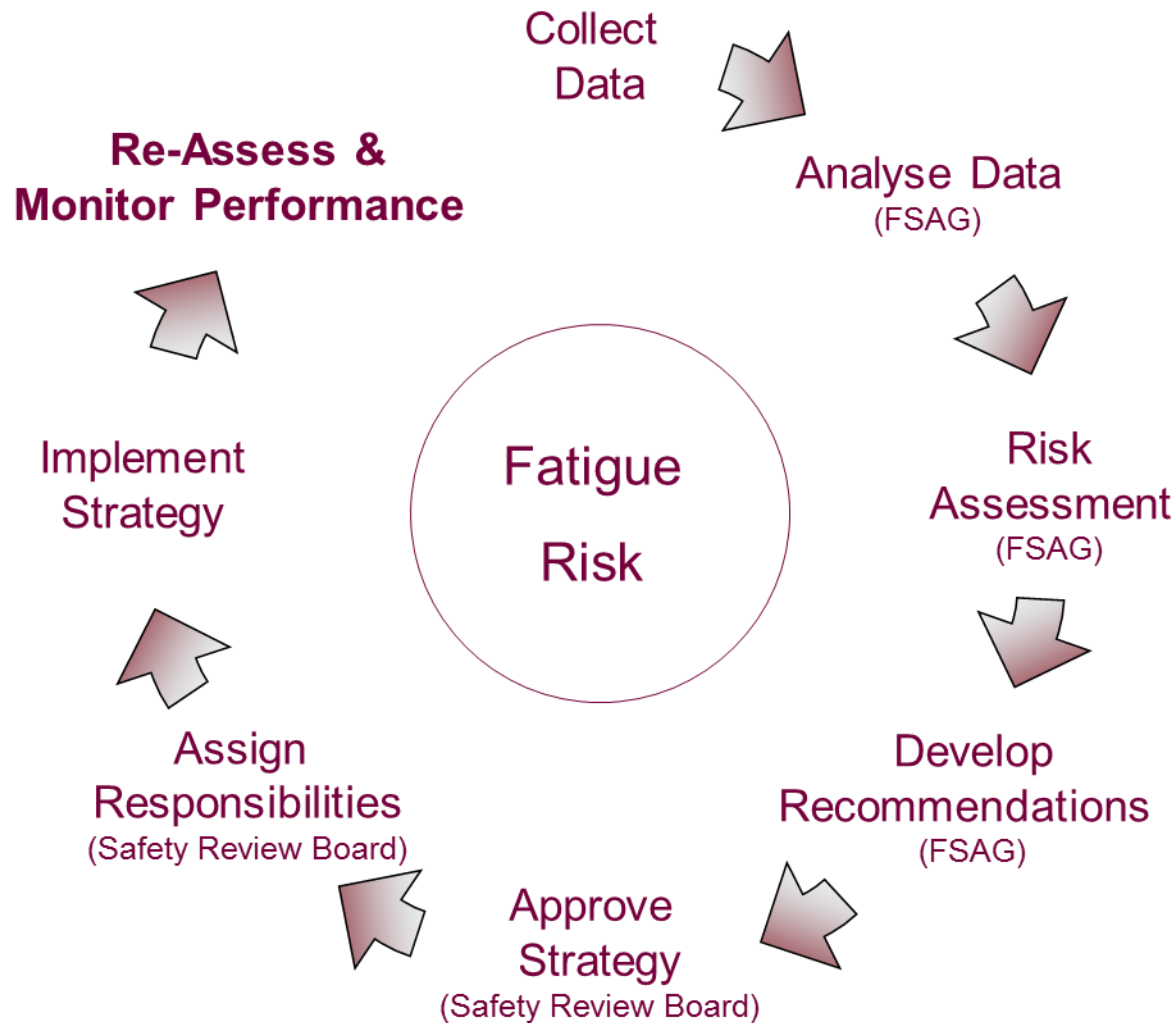


## Step 8: Implement Strategy (Risk Mitigation)

- Documentation
- Promotion
- Setting Performance Indicators

AMC1 ORO.FTL.120(b)(5) An operator should develop and implement risk mitigation procedures that:  
(c) monitor the strategies' implementation...

## Step 9: Re-Assess Situation and Monitor Performance



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### 1.) “**Compliance-based**” indicators:

- Number (%) of actual crew duty time exceedences
- Duties (%) above “x” hrs duty time
- Flights (%) “significantly” later than scheduled

### 2.) “**Performance-based**” indicators:

- Incidents/accidents with fatigue as a contributing factor
- (Fatigue-) reporting rates
- Fatigue-software results (based on scientific algorithms)

AMC1 ORO.FTL.120(b)(5) An operator should develop and implement risk mitigation procedures that:

(c) monitor the strategies’ implementation and effectiveness

**Experience:** If we can not measure it, we can not manage it!

## Step 9: Re-Assess Situation and Monitor Performance

Several Safety Performance Indicators (SPIs) are defined

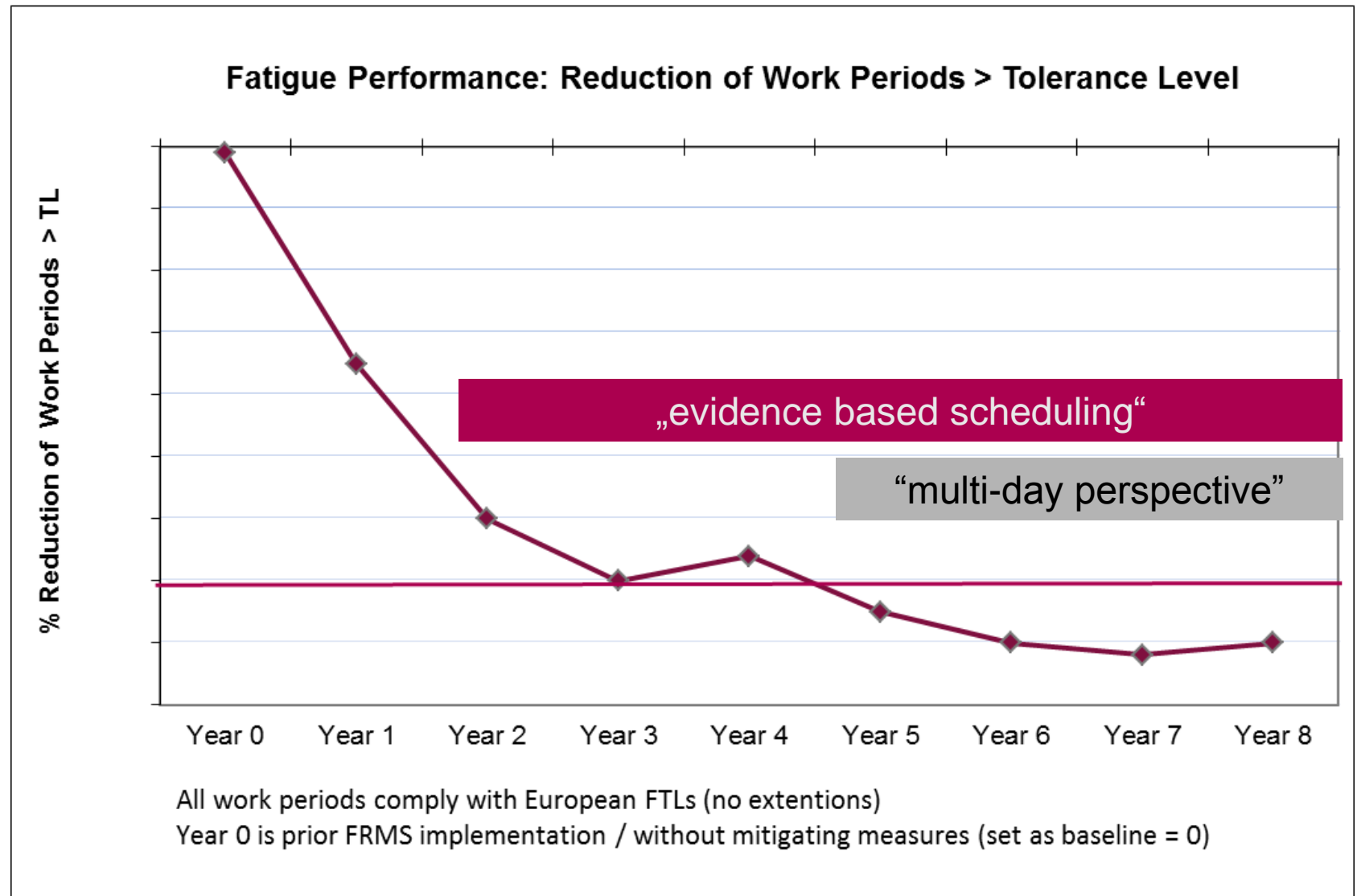
Several SPIs are required to measure overall performance

One SPI is explained at this workshop

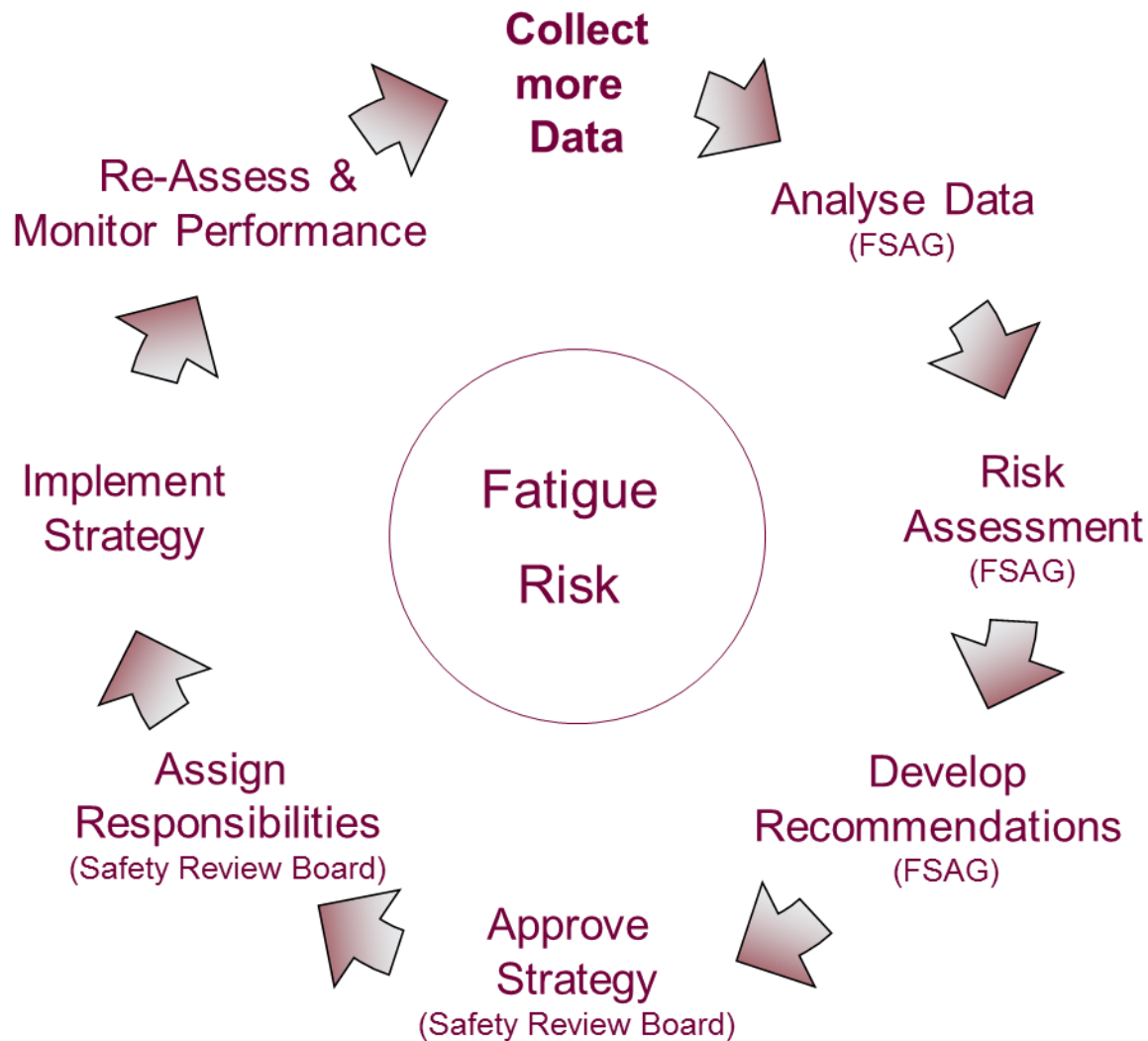
It is based on results of a fatigue modelling software

**Experience:** Before 2014 our FRMS was effective, but not entirely compliant to the published FRMS standards [remember ORO.FTL.120 FRM (c)]  
However to make an effective FRMS fully compliant was an easy task, but did not improve the effectiveness

## Fatigue Performance SPIs (example)



## Step 10: Collect more Data – Continue to improve

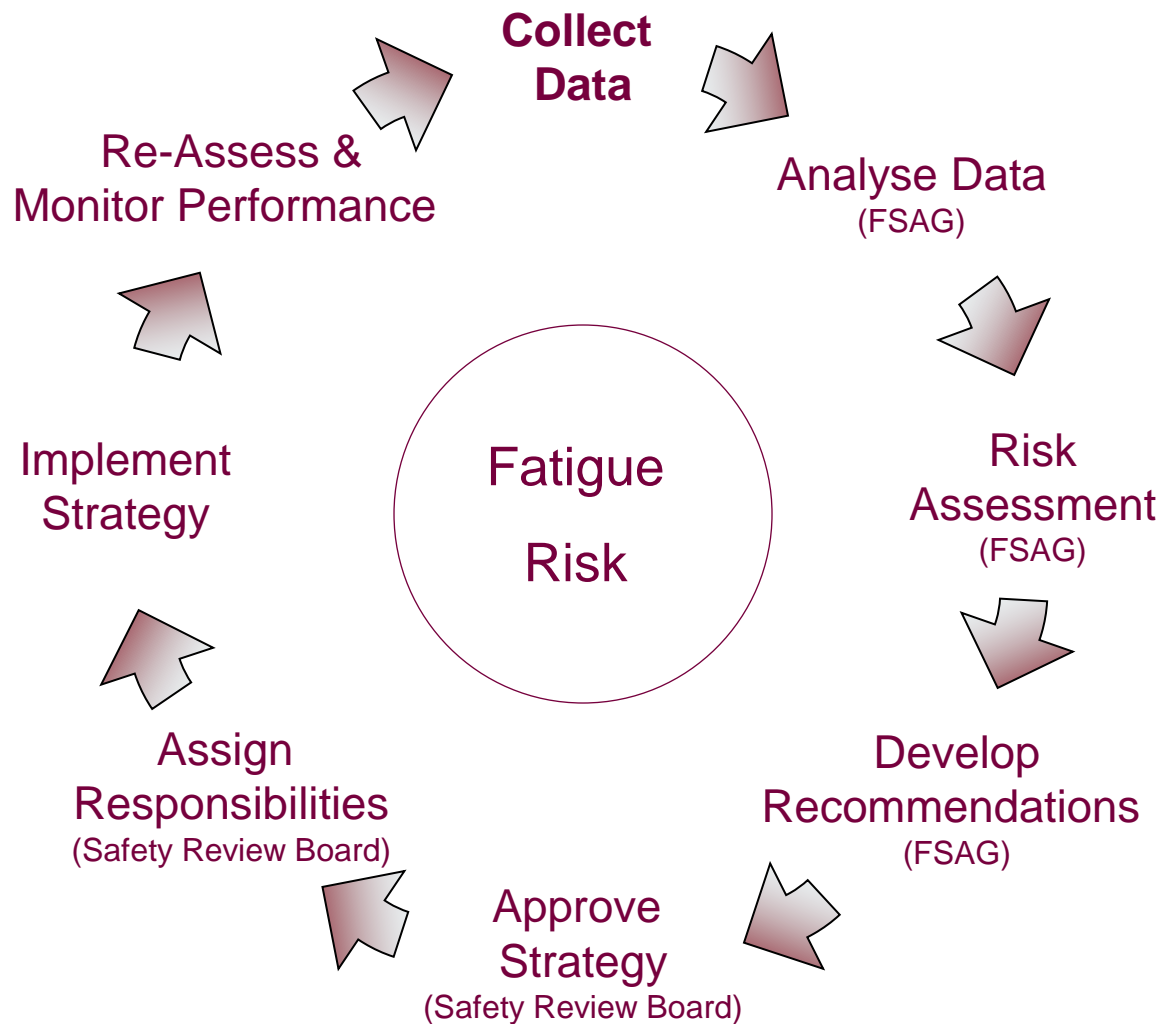


## Step 10: Collect more Data – Continue to Improve

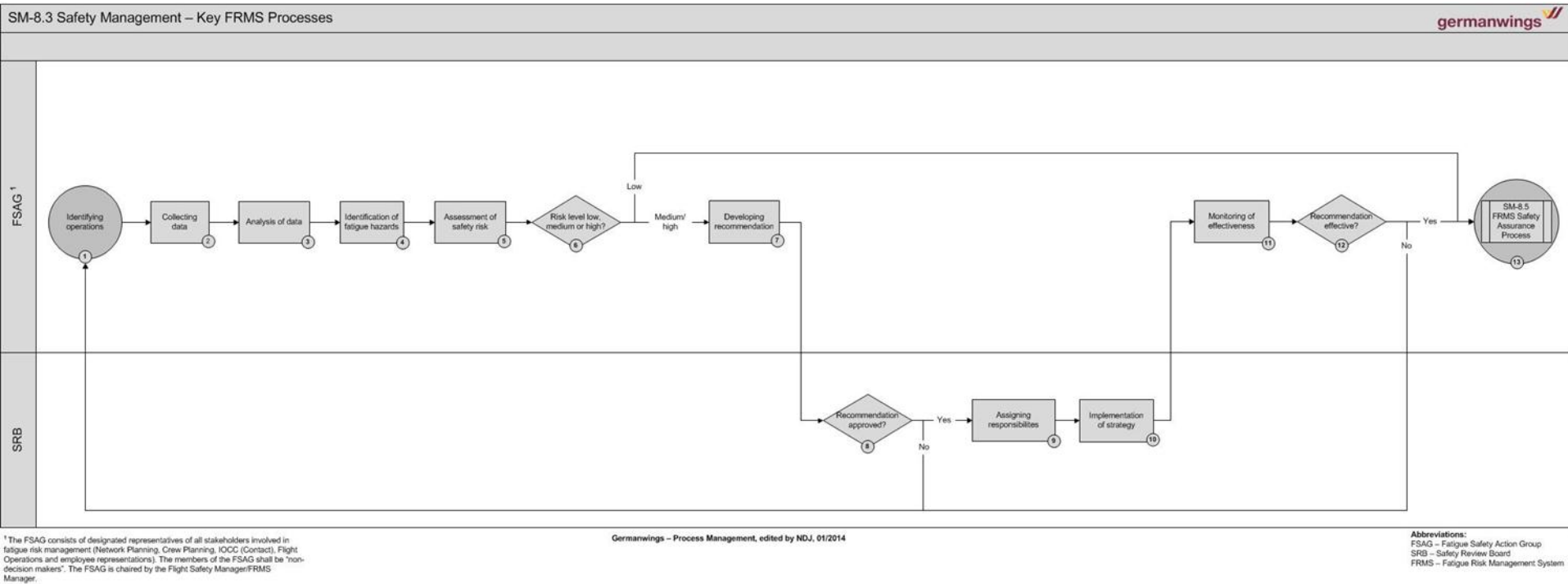
- Organisational experience & learning: (Safety assurance process)
  - Monitor performance and re-evaluate
  - Identify unintended consequences
  - Identify emerging hazards
  - Surveys
  - Studies
- 
- Change Management:
  - New schedules (summer / winter schedule)
  - New operations (new routes, new area of ops, new aircraft type)
  - New management
  - New airline strategy

**Experience:** Implementing an FRMS is easy, maintaining an FRMS is hard

# FRMS Management Cycle



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# Benefits after FRMS implementation

- We know what we are doing (!)
- Identified specific causes of fatigue and assessed fatigue risks
- Scientific based effective fatigue mitigation measures in place, tailored to our specific flight operations
- Measurable reduction of fatigue risk (performance, reports, incidents)
- We fulfil our organisational responsibilities to control fatigue risk
- Our crew members have tools and knowledge to fulfil their responsibility, based on scientific studies
- No loss in crew productivity
- Today we have the competences for FRM approval

## Part II:

What is required to achieve consistent safety beyond prescriptive FTLs



# Definition of Fatigue in Aviation

Fatigue in aviation has been defined by ICAO as:

## Symptoms

A physiological **state of reduced mental** or physical **performance capability**

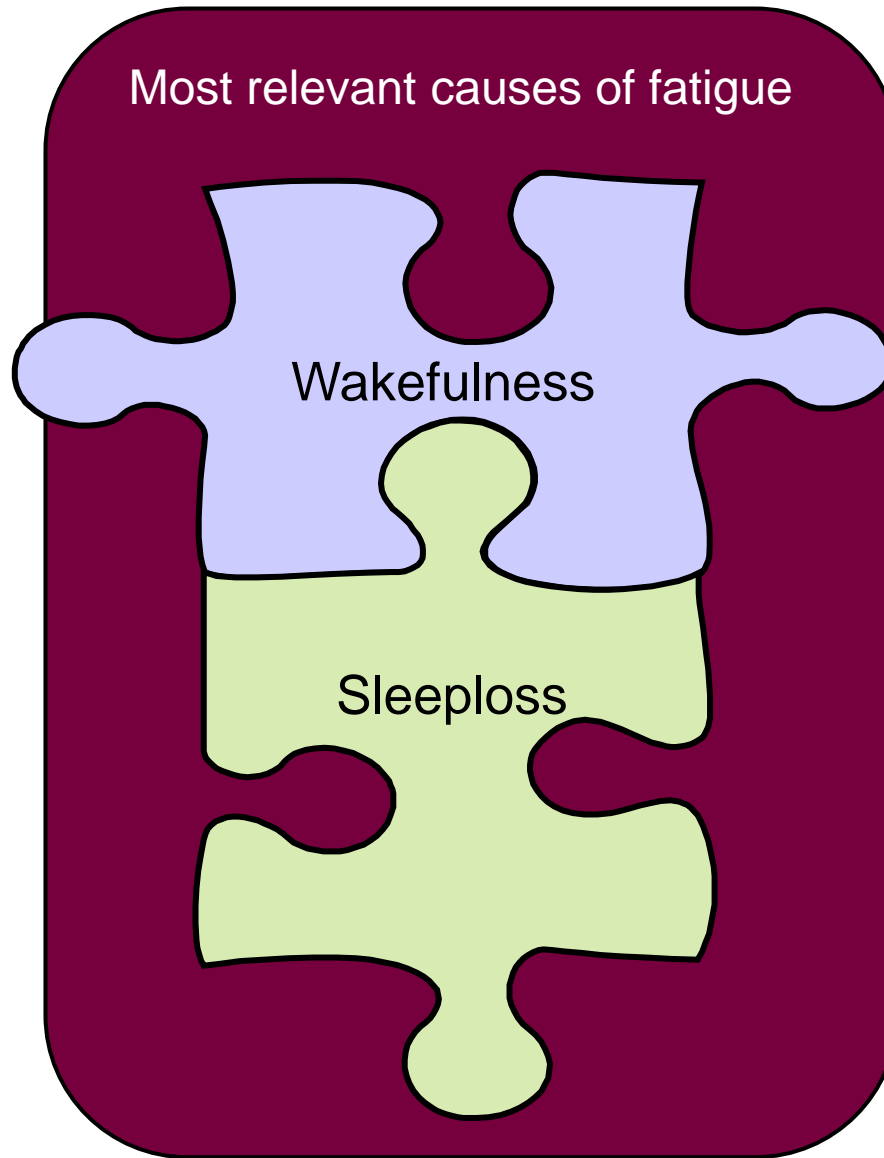
## Causes

resulting from **sleep loss** or **extended wakefulness**, **circadian phase**, or **workload** (mental and/or physical activity)

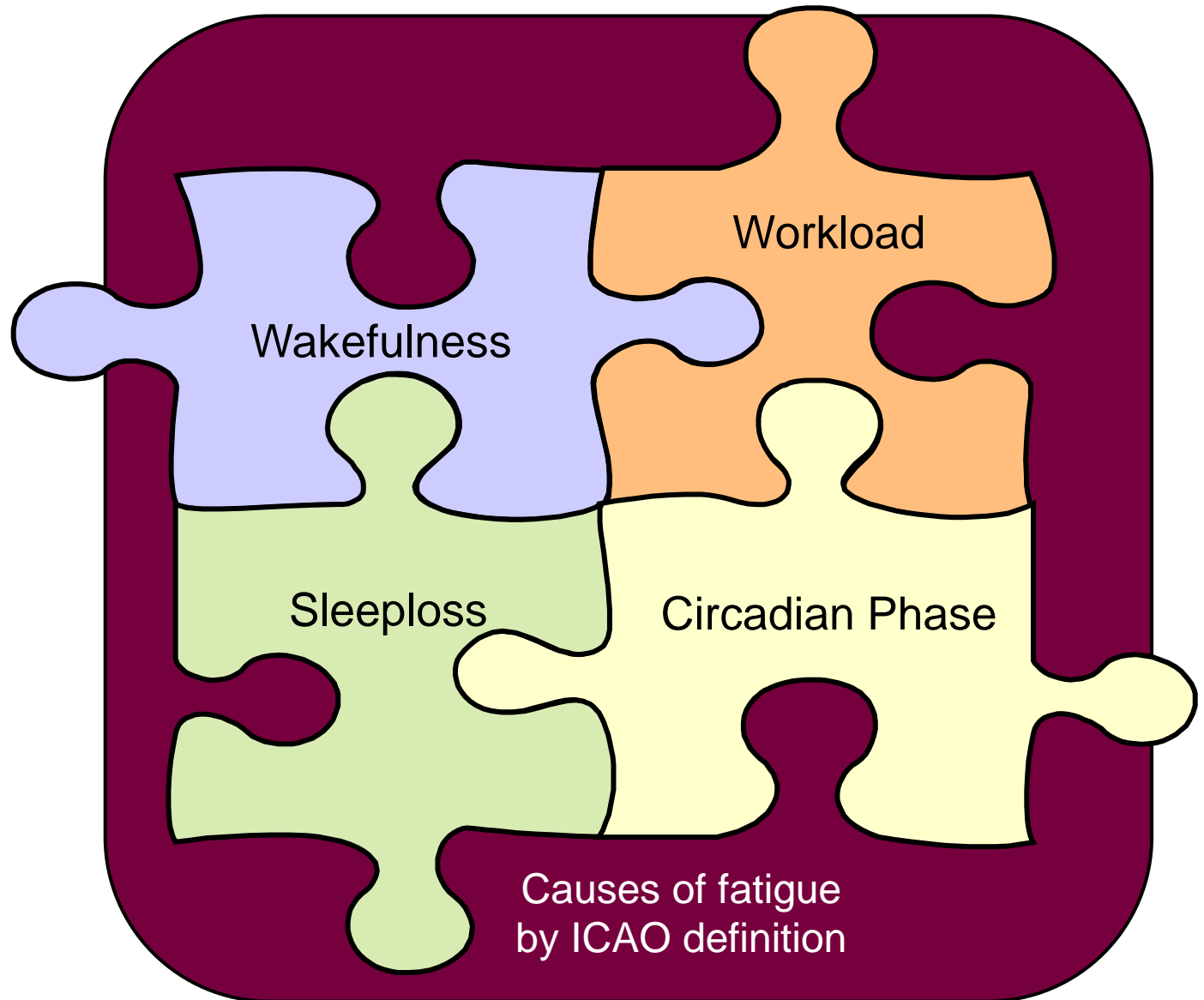
## Consequences

that can **impair** a crew member's alertness and ability to **safely operate an aircraft** or perform safety related duties.

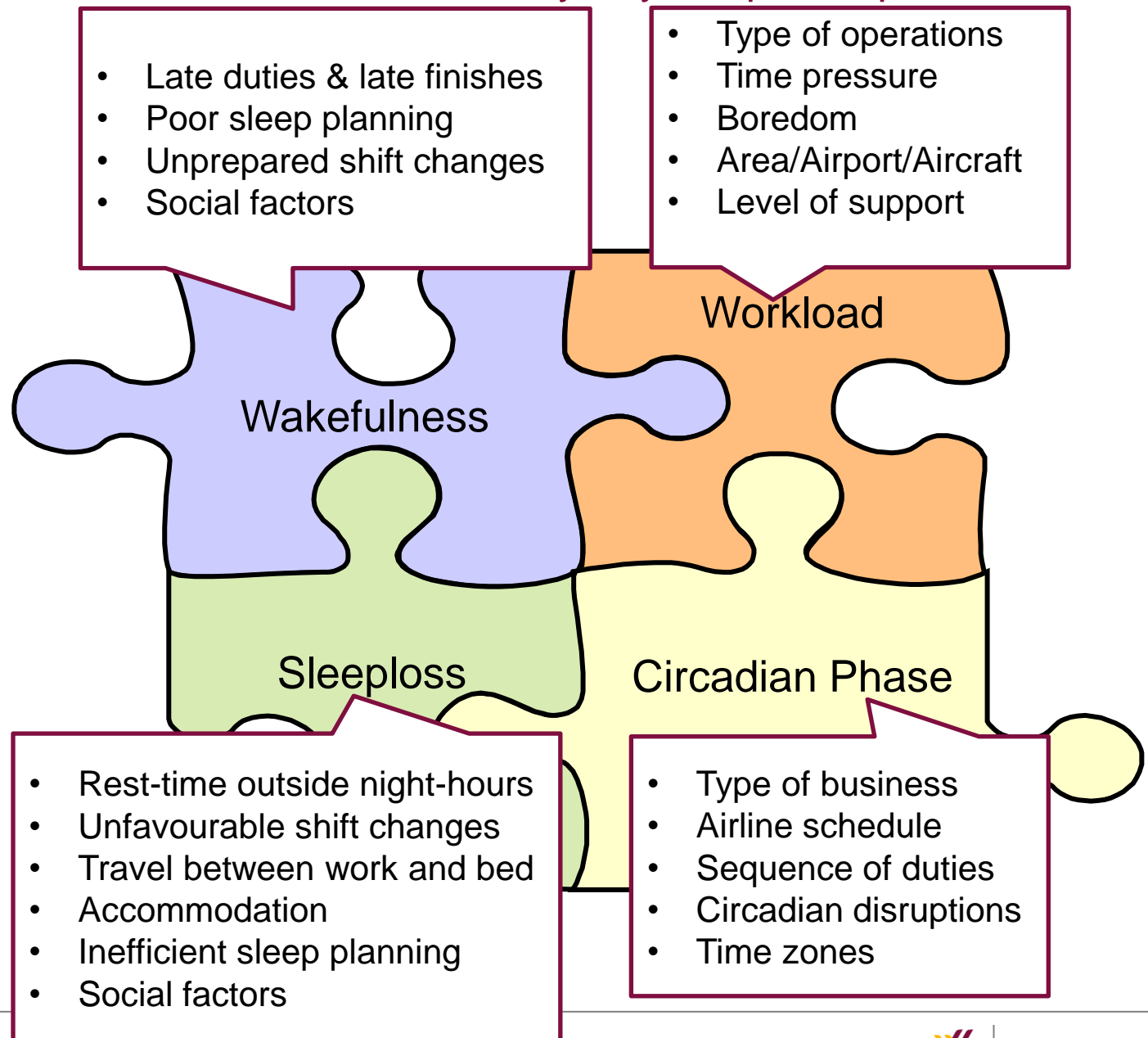
# What is required to achieve consistent safety beyond prescriptive FTLs?



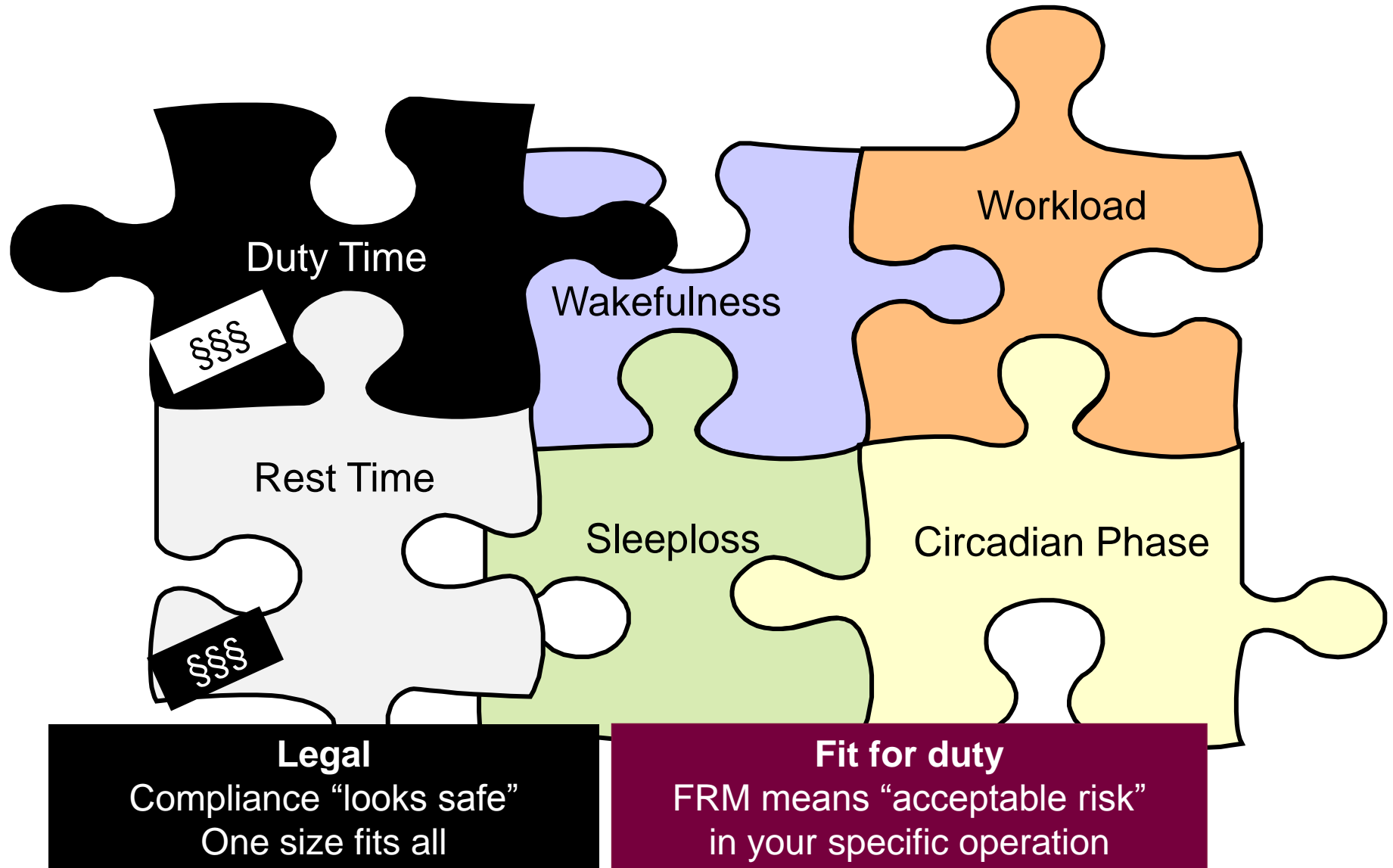
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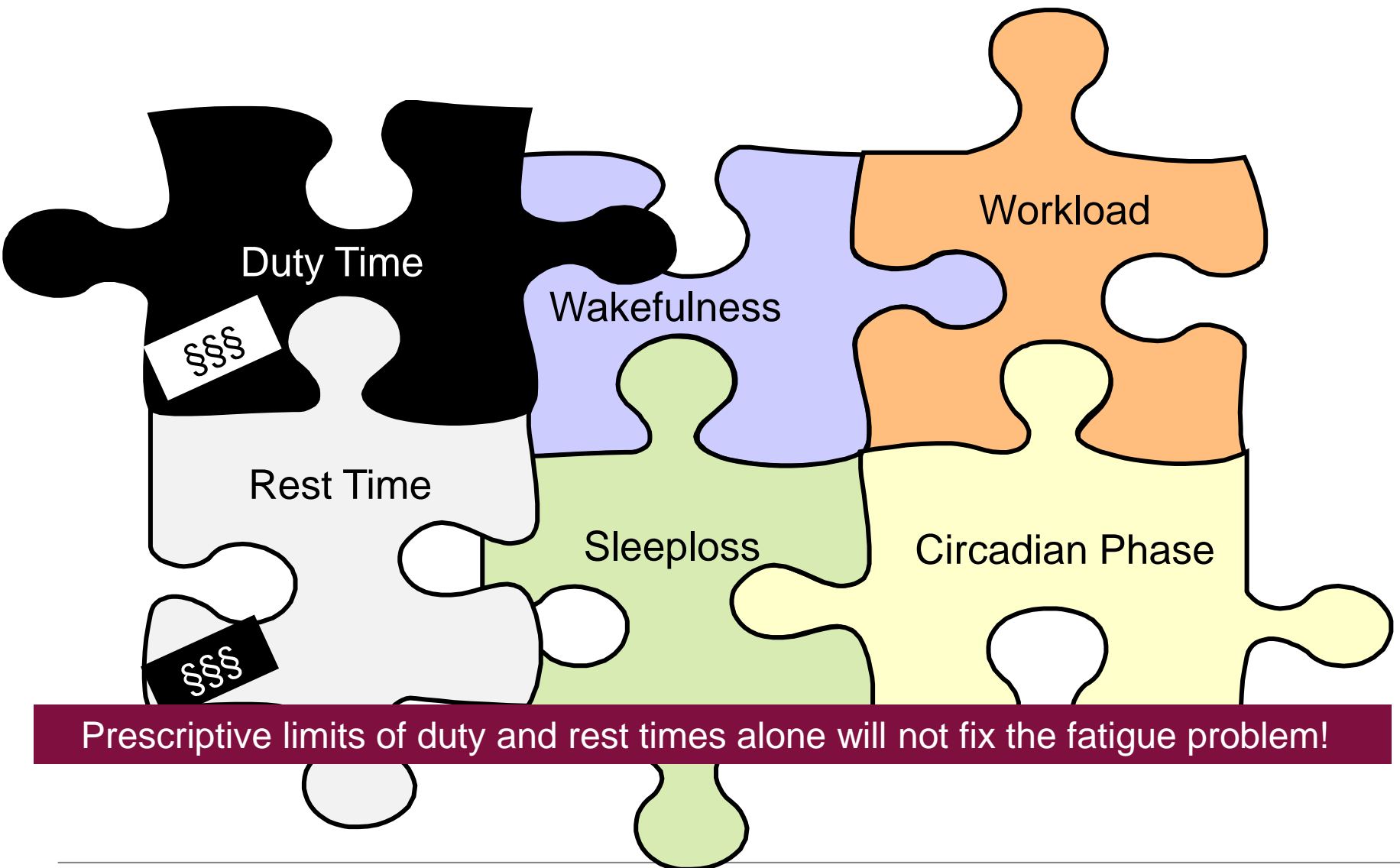
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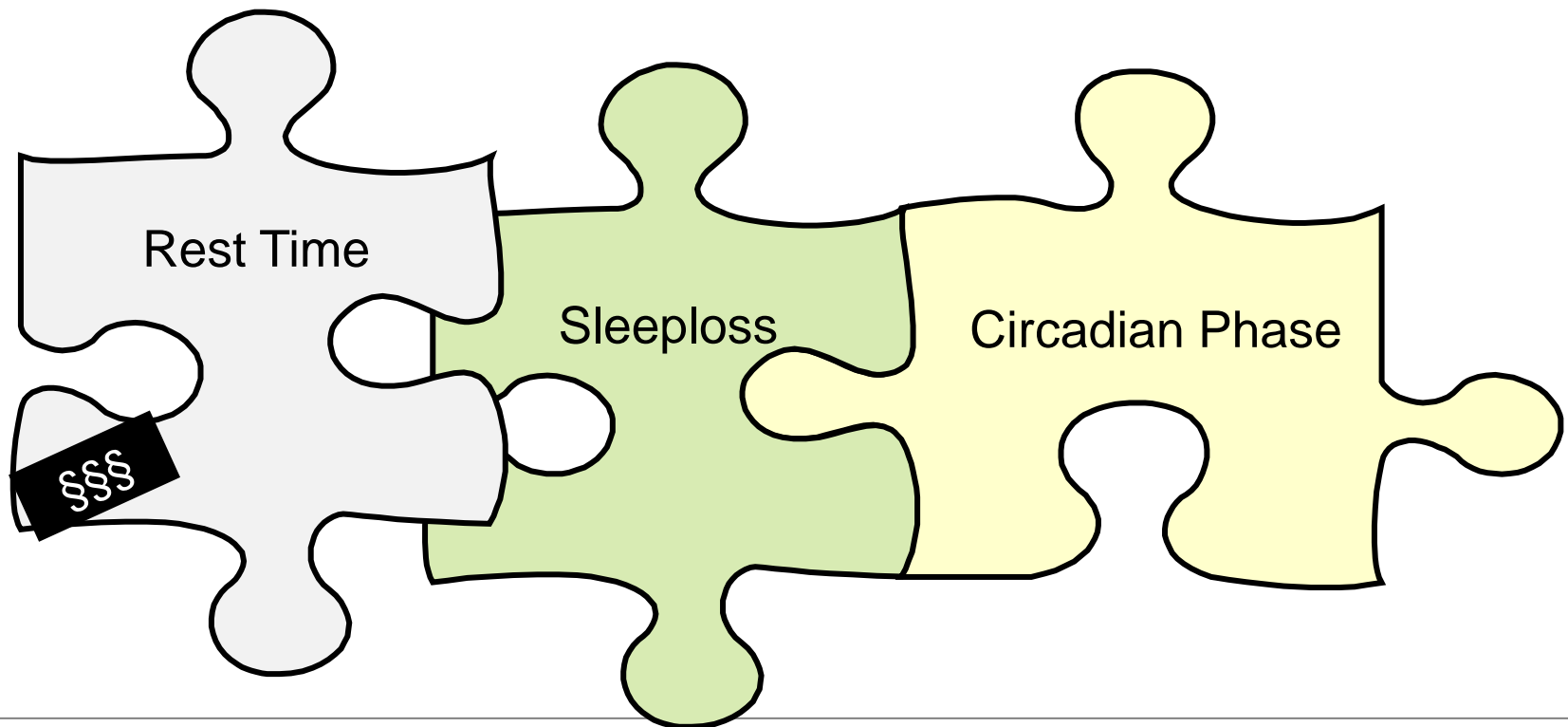


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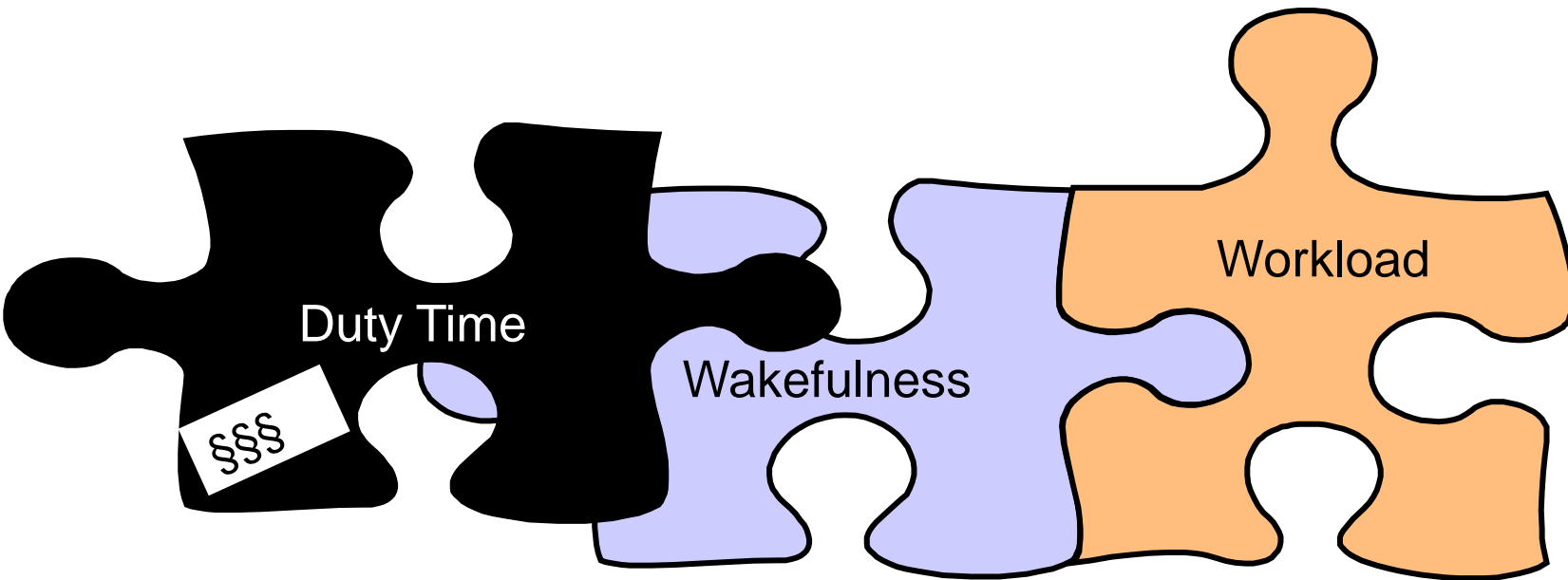
Prescriptive rest times are assumed to be equally effective at any time of day, regardless of the circadian phase

Rest time is not equivalent to sleep-time (!)

Cumulative loss of (night-) sleep over consecutive days is not considered by FTLs.



# What is required to achieve consistent safety beyond prescriptive FTLs?

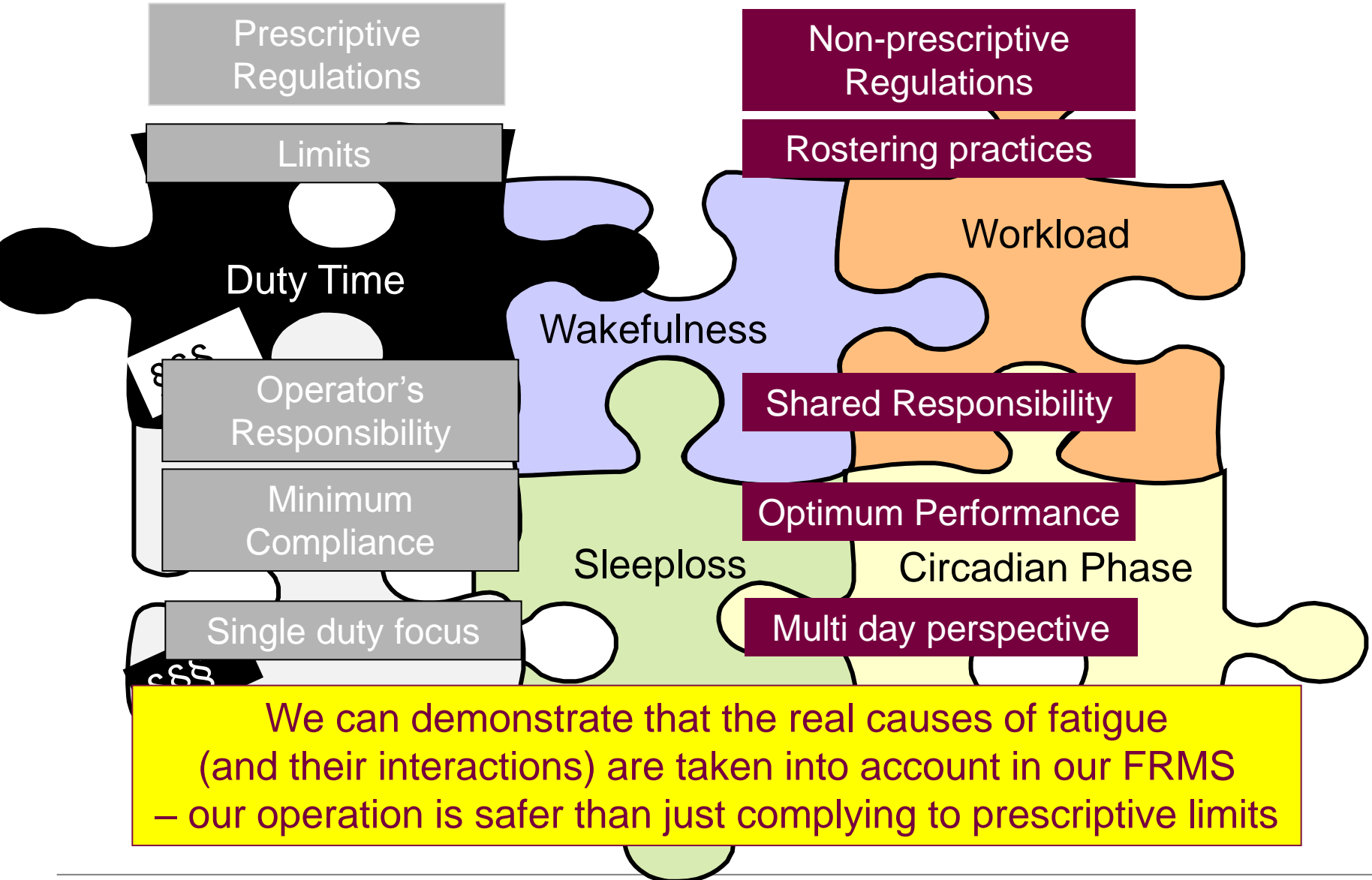


Prescriptive duty time limits primarily assume duty-time causes fatigue

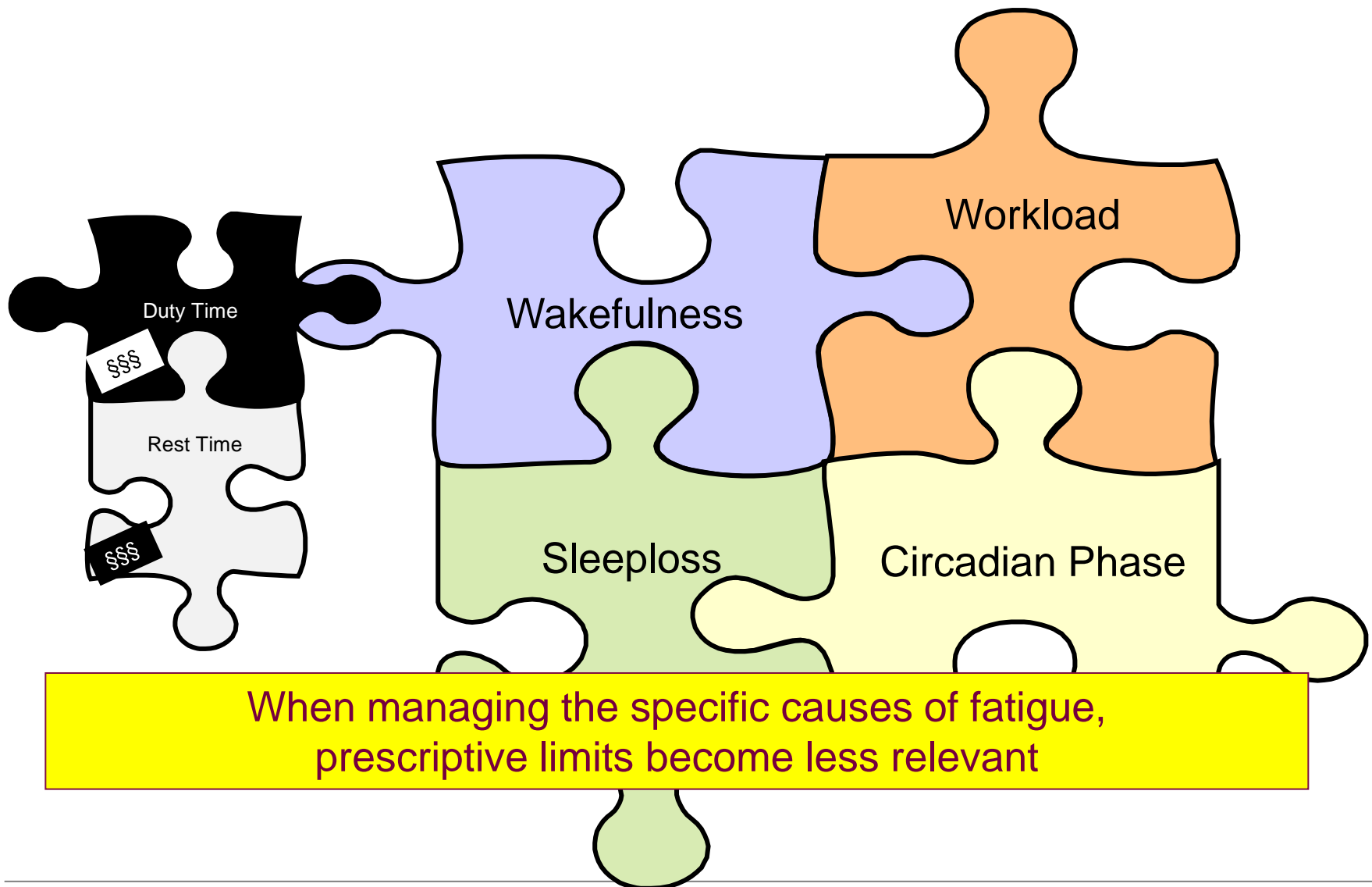
Time since awake is not covered by FTLs (time of day is relevant)

Workload is rarely taken into account.

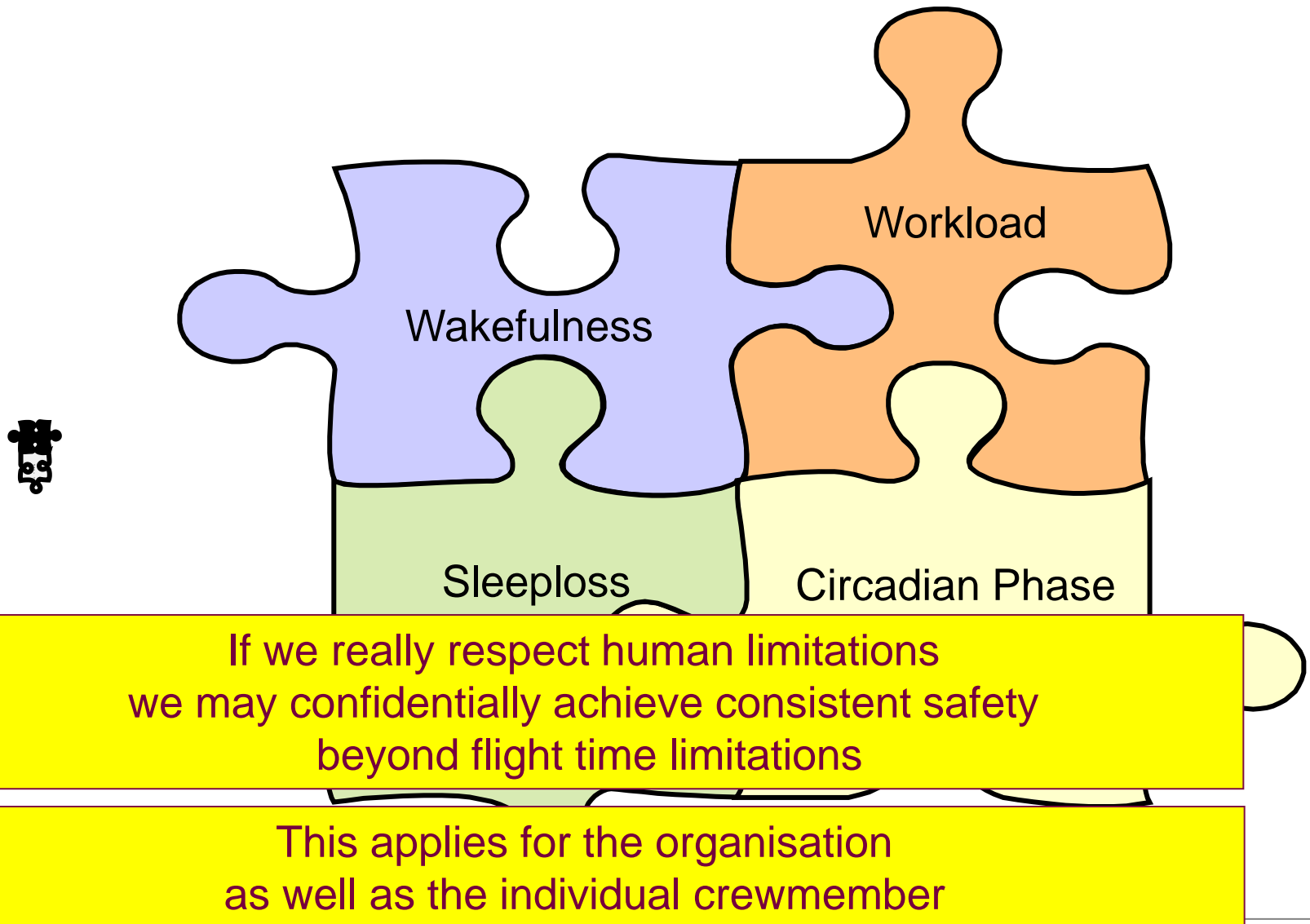
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Be alert – be safe!



Thank you for your attention

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