

Fatigue Risk Management



By: Capt. Hesham Hamy



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How many hours did you sleep last night?

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First Aviator Transatlantic

"The nose is down, the wing low, the plane is diving and turning. I've been asleep with open eyes..."

I kick left rudder and pull the stick back... My eyes jump to the altimeter...

I'm at 1600 feet.

The turn-indicator leans over the left - the airspeed drops - the ball rolls quickly to the side...My plane is getting out of control!"



(First non- stop Transatlantic flight - May 1927 NYC-PAR)

Charles Lindbergh

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TELL
us
about
You!

- Your Name
- Title
- What you aim to get from this session

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Instructors

Capt Hesham Hamy

Masters Degree (Aviation Safety) – University of Newcastle, Australia

Current PhD Student (Psychological Safety and Leadership Styles in Aviation)

Type Rating Instructor / Examiner (Bell 206/212/412 Helicopters)

Aviation Safety Management Principal Consultant

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Housekeeping



Punctuality



Phones



More Importantly NO SLEEPING



Participation



No Smoking

Participation

More Importantly NO SLEEPING

Participation

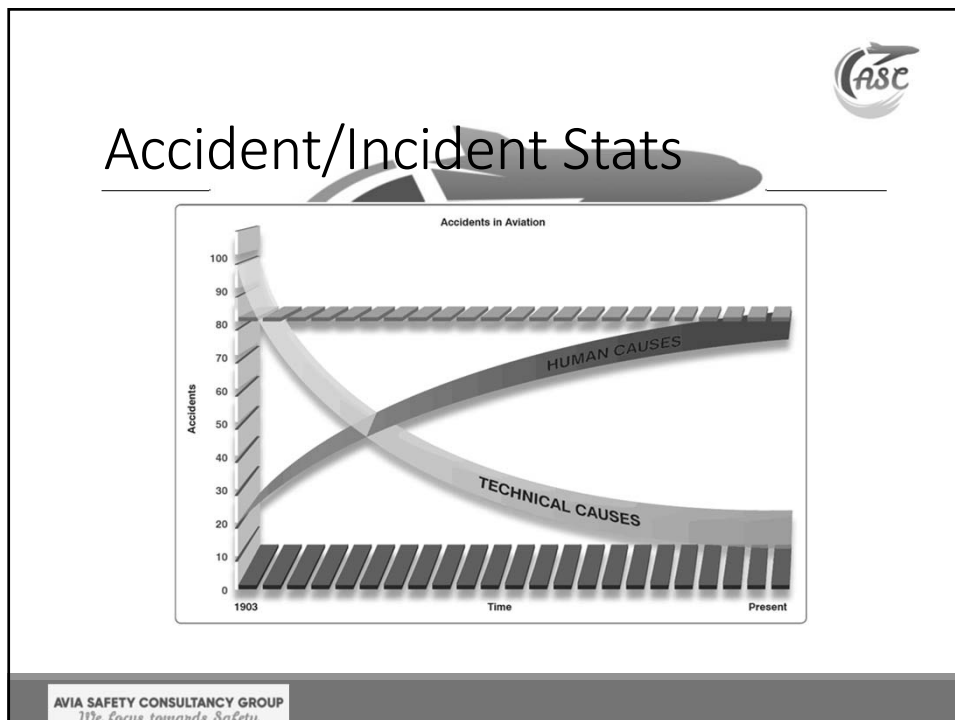
No Smoking

More Importantly NO SLEEPING

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Introduction

Human Fatigue and Disasters

- BP Texas City Refinery (2007) – killed 15 people and injured over 180
 - Board Operator worked 12 hour shifts for 29 consecutive days
- Nuclear release of the Three Mile Island and Chernobyl Accidents
 - Human errors in recognition at early morning hours (0400-0600)
- Exxon Valdez Ship Accident
 - Grounded entailing fatigue, workload, reduced crew size
 - Insufficient rest



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Fatigue Statistics

Significant risks for deaths and injuries:

- 360,000 worldwide workplace fatalities / year
- 960,000 workplace injuries / day
- 20 % related to fatigue (over 190,000 injuries per day)
- 50,000-100,000 patients died annually due to medical malpractice

Nearly 23% of US population suffers significant sleep problems – highest rate in world, while Europe – 19% reported working 2 hours between (0100-0500)

Nighttime workers are 3X more likely to be injured compared to daytime workers

Jobs with overtime are over associated with 60% higher injury rate

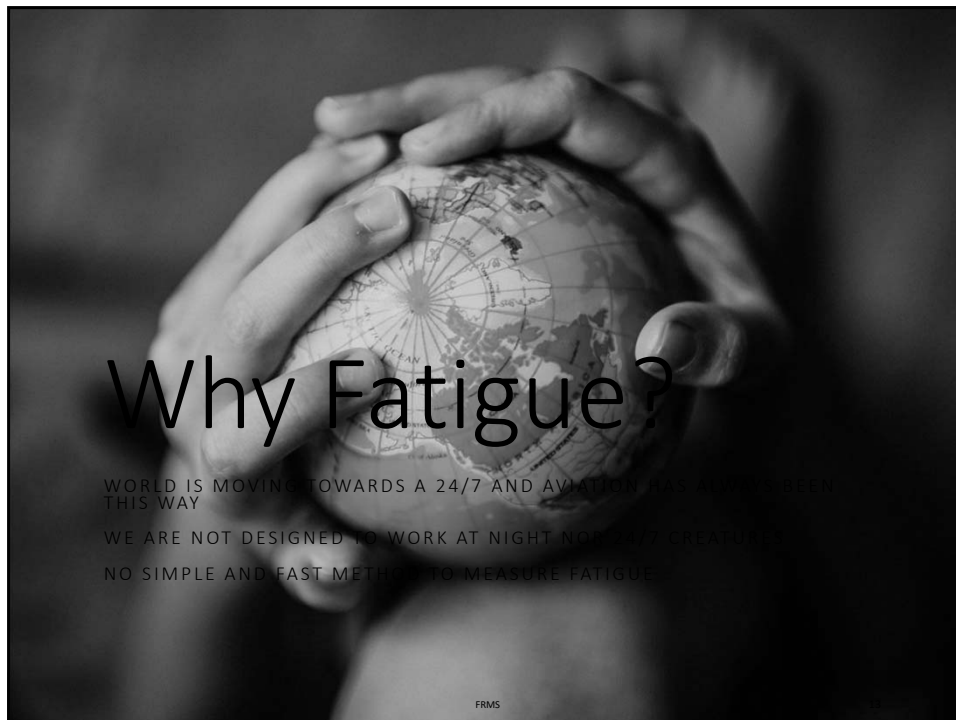
Working 12 hour shifts 37% higher injuries

Working more than 60 hours 23% increase in injuries

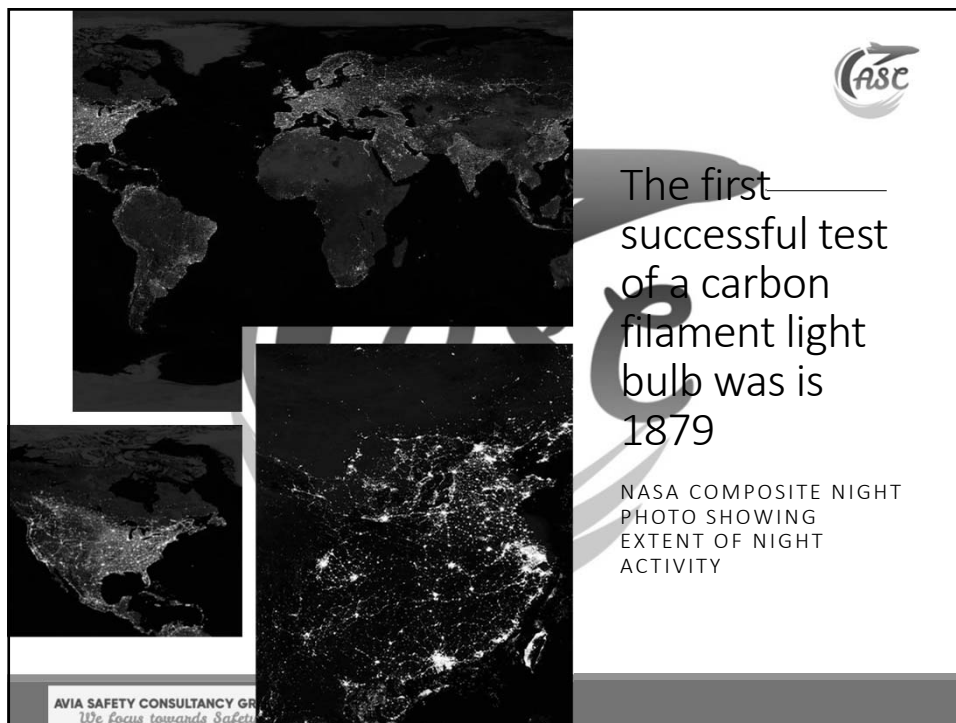
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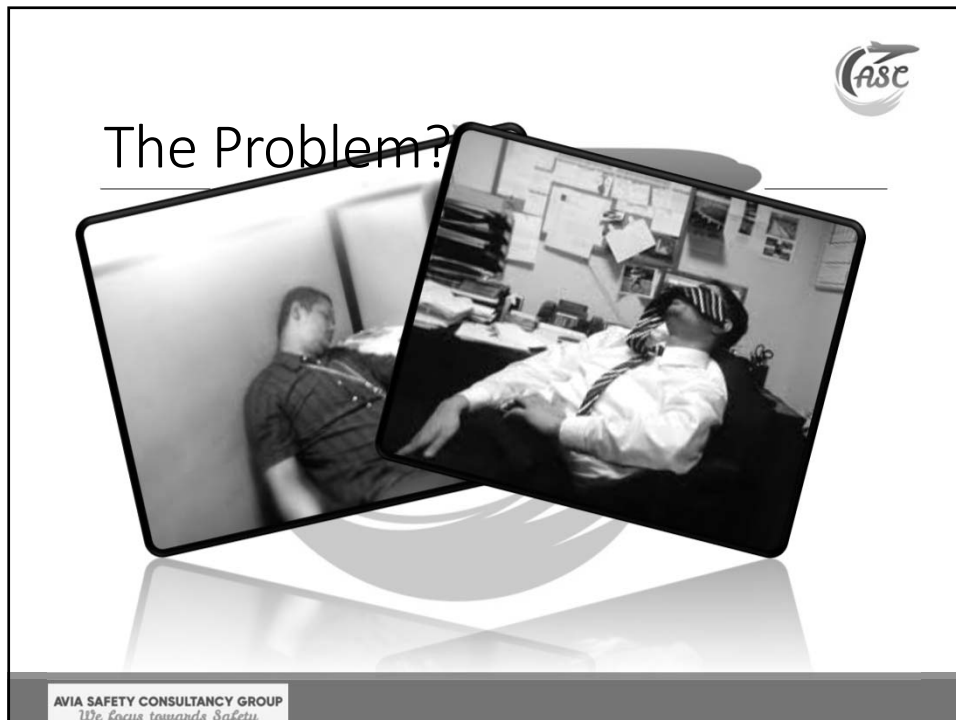
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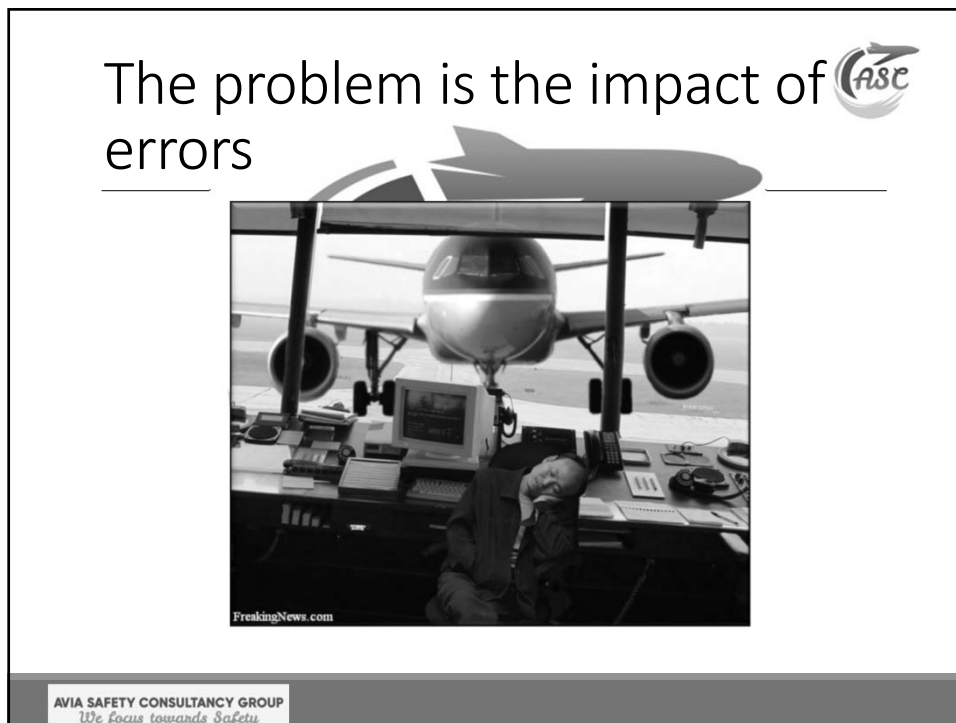
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Sales Required to Cover Losses

Yearly Incident Costs	Profit Margins				
	1%	2%	3%	4%	5%
\$1,000	100,000	50,000	33,000	25,000	20,000
\$5,000	500,000	250,000	167,000	125,000	100,000
\$10,000	1,000,000	500,000	333,000	250,000	200,000
\$25,000	2,500,000	1,250,000	833,000	625,000	500,000
\$50,000	5,000,000	2,500,000	1,667,000	1,250,000	1,000,000
\$100,000	10,000,000	5,000,000	3,333,000	2,500,000	2,000,000
\$150,000	15,000,000	7,500,000	5,000,000	3,750,000	3,000,000
\$200,000	20,000,000	10,000,000	6,666,000	5,000,000	4,000,000

Bird, Frank, George L. Germaine, Loss of Control Management: Practical Loss Control Leadership

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Real world numbers

1 hard landing results in damaged nose gear and propeller
 Repair required and the engine needs to be tested (possible overhaul)
 Insured Costs = \$55,000
 Uninsured Costs = \$75,000



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Fatigue Related Mishaps

1993: American International Flight 808

"...probable cause of this accident was the impaired judgment, decision-making, and flying abilities of the captain and flight crew due to the effects of fatigue."

1997: Korean Air Flight 801

"...probable cause of this accident was the captain's failure to adequately brief and execute the non-precision approach and the first officer's and flight engineer's failure to effectively monitor and cross-check the approach. Contributing to these failures were the captain's fatigue."

1999: American Airlines Flight 1420

"...probable causes of this accident were the flight crew's failure to discontinue the approach...and failure to ensure that the spoilers had extended after touchdown. Contributing to the accident was the flight crew's impaired performance resulting from fatigue..."

FedEx Flight 1478

"...probable cause of the accident was the captain's and first officer's failure to establish and maintain a proper glide path during the night visual approach to landing. Contributing to the accident was a combination of the captain's and first officer's fatigue..."

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Dead tired: San Bernadino Learjet 35

"On 24 October 2004 a Med Flight Air Ambulance Bombardier Learjet 35A crashed into high ground while following an air traffic control clearance after take-off from San Bernardino airport, California. All five people on board were killed.

The air traffic control officer was warned twice by his minimum safe altitude warning system that the aircraft was in danger, but ignored it.

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Dead tired: San Bernadino Learjet 35



Flightcrew fatigue was cited as a factor in that accident but, after the report came out, National Transportation Safety Board members criticized the absence of recommendations concerning controller fatigue, despite the fact **the duty ATCO had -**

"worked an 8h shift the day before the accident, and returned 7.5h later, without any sleep, to work through the midnight shift".

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Safety Board Aviation Fatigue Recommendations



- 32 aviation recommendations since 1972
- On Most Wanted List since 1990
- Most recommendations concern flight and duty time regulations and policies

Recent accidents highlight the need for comprehensive fatigue management efforts

Source NTSB

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The Aviation Industry



- A challenging & dynamic industry with many risks ...
- Every take-off and landing is a risk ...

So how do we respond to these challenges....

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Fatigue is a Risk State

“People have difficulty believing that humans can make a fatigue-related error while performing an over-learned task under highly-motivated (even life-threatening) conditions. But it happens because fatigue is a risk state that degrades behavioral efficiency.”

-Dr. David Dinges, University of Pennsylvania School of Medicine



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Over the years

- Many accidents
- Many injuries & fatalities
- Loss of equipment
- Increase in insurance cost
- Loss of reputation
- Loss of credibility
- Loss of revenue



We need to learn from accidents.

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Chelsey
“Sully”
Sullenberger
speaks about
the
importance
of adequate
rest

The events of 15th January, 2009.

Captain Chelsey “Sully” Sullenberger became an instant hero when he successfully ditched US Airways Flight 1549 into New York’s Hudson River after both engines failed due to bird strikes. All 155 passengers and crew survived what has been called the Miracle on the Hudson.

Just a few days after the miracle, Sullenberger told ABC news that proper rest leading up to the incident was a key facilitator into the successful ditching:

“I’m convinced that had we [Sullenberger and First Officer Jeffrey Skiles] been tired, had we not gotten sufficient rest the night before, we could not have performed at the same level.”

“The fact that we got so much right so quickly under that sudden stress is a testament [to] the fact that we had a chance to get sufficient rest.”

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Module Objectives

What is fatigue	Fatigue Hazards	Effects of Fatigue
Impact of fatigue in the workplace	Causes of fatigue	Factors that increase the impact of fatigue
Managing Fatigue risks	Dealing with fatigue	Fatigue risk management systems FRMS

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What does Fatigue mean to you? Share your experiences.

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Fatigue (ICAO Definition)

"... A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety related duties."

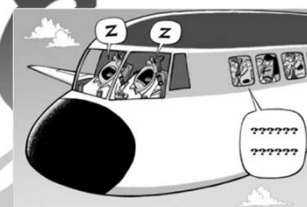
"Fatigue" vs. "Tired"

There is a difference !!



FRMS Definition (IATA/ICAO)

"A data-driven means of continuously monitoring and managing fatigue-related safety risks, based upon scientific principles and knowledge as well as operational experience, that aims to ensure relevant personnel are performing at adequate levels of alertness."



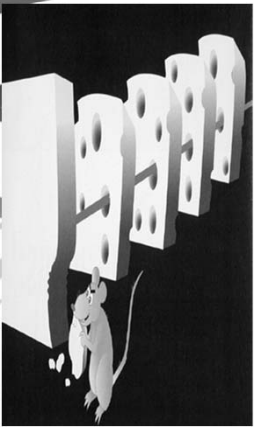


Why move to FRMS?

Prescribed limitations provide only "one slice of cheese"

FRMS provides more Defence barriers

Swiss Cheese model



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Why is Fatigue Getting so Much Attention?



All aspects of a carrier's operation are affected

- Headcount;
- Crew Utilization;
- Equipment Utilization;
- Network Planning;
- Scheduling.

- Fatigue Management= Additional Constraints

- Increasing operating costs with sick crews.

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What is Fatigue?

- ☐ A state of physical or mental weariness that results in reduced alertness;
- ☐ The result of a lack of adequate sleep;
- ☐ A sleep debt that accumulates until paid off with adequate sleep.

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Carefully scanning the overhead panel while the co-pilot checks the windshield heat, the Captain is ever alert to any danger. At 0400 one can't be too careful

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What are some conditions that make you feel particularly tired or fatigued at work?

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Causes of Fatigue

Fatigue can be the result of a variety of factors:

- The body's natural rhythms;
- Work schedule;
- Type of task;
- Work environment;
- Non work-related issues.

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Fatigue Hazards

Fatigue usually results in impaired standards of operation with increased likelihood of error. e.g.:

- Increased reaction time;
- Reduced attentiveness;
- Impaired memory;
- Withdrawn mood.



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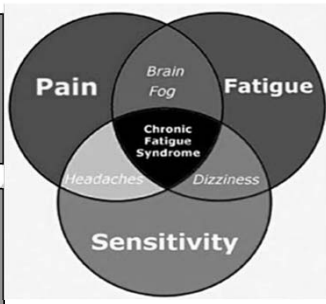
Chronic Fatigue Syndrome

No single test to confirm a diagnosis of chronic fatigue syndrome;

Symptoms of chronic fatigue syndrome can mimic any other health problems;

Doctor must rule out a number of other illnesses before diagnosing chronic fatigue syndrome.

- Sleep disorders
- Medical problems
- Mental health issues



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Chronic Fatigue Syndrome

Unexplained, persistent fatigue for six months or more, along with at least four of the following signs and symptoms:

- Loss of memory or concentration.
- Sore throat.
- Enlarged lymph nodes in your neck or armpits.
- Unexplained muscle pain.
- Pain that moves from one joint to another without swelling or redness.
- Headache of a new type, pattern or severity.
- Unrefreshing sleep.
- Extreme exhaustion lasting more than 24 hours after physical or mental exercise.

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The Body Clock

Known as circadian rhythms

Operates on a 24-hour cycle

Makes you sleepy when it's dark and awake when it's light

Controls a variety of body functions:

- Sleepiness
- Digestion
- Hormone production
- Body temperature



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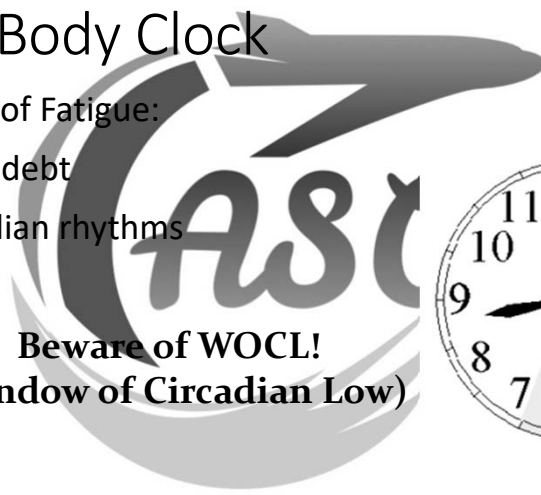
The Body Clock

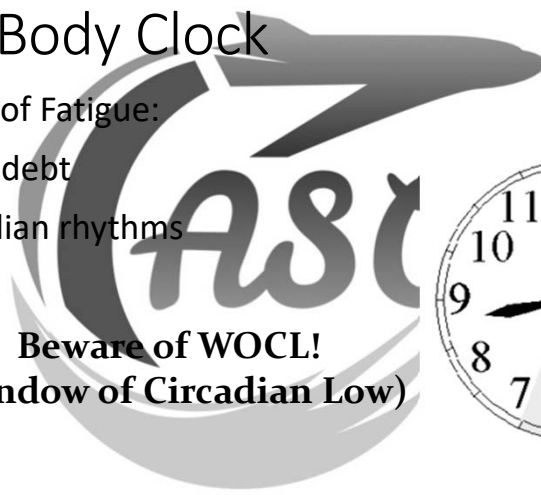
Causes of Fatigue:

- ☐ Sleep debt
- ☐ Circadian rhythms

Beware of WOCL!
(Window of Circadian Low)





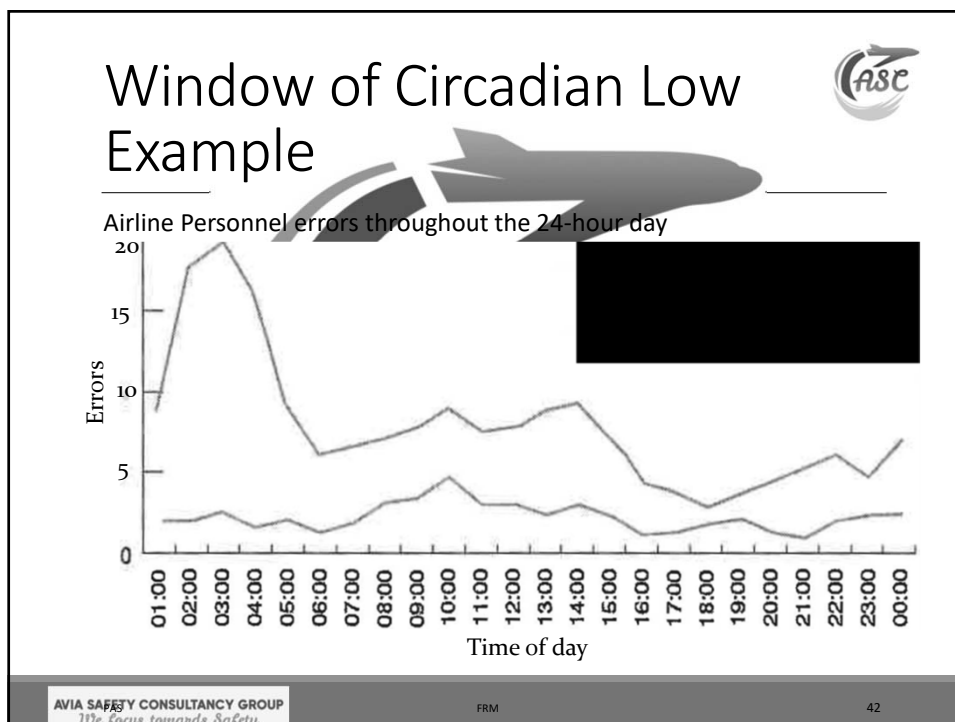


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Tips for dealing with the WOCL



- If possible, avoid the most critical tasks during the WOCL;
- If you can, keep the lights bright & temperature slightly cool;
- Try to avoid monotonous or tedious tasks;
- Stretch, walk around get some fresh air;
- If you can take a brief nap;
- Use caffeine carefully.

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Factors that Increase the Impact of Fatigue



Lowligh

Passive activities

Boring or monotonous tasks

Warm temperature

How tired are you?
Epworth sleepiness scale

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Epworth sleepiness scale

Developed by Dr. Murray Johns of Epworth Hospital in Melbourne



How likely are you to doze off or fall asleep in the following situations, in contrast to just feeling tired? This refers to your usual way of life over recent times. Even if you have not some of these things recently, try to work out how they would have affected you. Use the following scale to choose the most appropriate number for each situation:

No chance of dozing 0	Slight chance of dozing 1	Moderate chance of dozing 2	High chance of dozing 3
--------------------------	------------------------------	--------------------------------	----------------------------

Situation

1. Sitting and reading
2. Watching TV
3. Sitting inactive in a public place (e.g. a theatre or a meeting)
4. As a passenger In a car for an hour without a break
5. Lying down to rest in the afternoon when circumstances permit Sitting and talking to someone
6. Sitting quietly after a lunch without alcohol
7. In a car, while stopped for a few minutes In traffic

Chance of dozing

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How likely are you to doze off or fall asleep in the following situations, in contrast to just feeling tired? This refers to your usual way of life over recent times.

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Results



**1-6. Congratulations,
you are getting enough
sleep!**



**7 -8. your score is
average**



**9 and up, seek the
advice of a sleep
specialist without delay.**

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Sleep

Most people need between 7 and 9 hours per day.

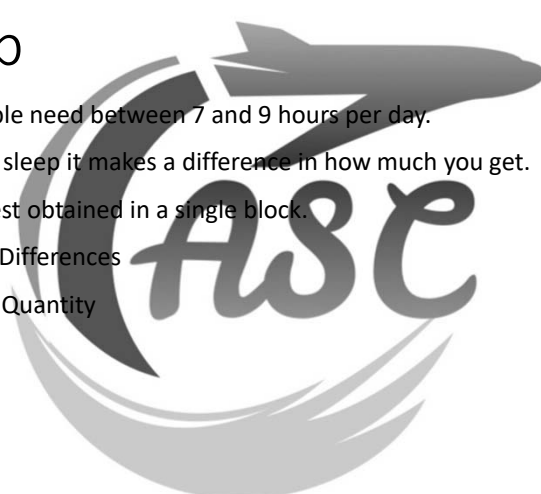
When you sleep it makes a difference in how much you get.

Sleep is best obtained in a single block.

Individual Differences

Quality Vs Quantity





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The Impact of Fatigue in the Workplace

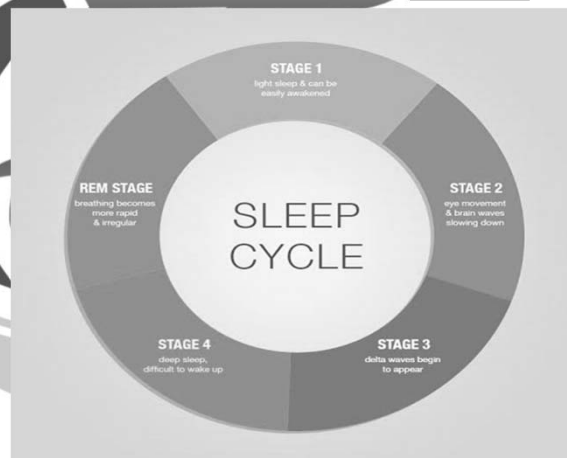


Myth	Reality
5 or 6 hours sleep a night is generally enough	Very few people can manage on this amount of sleep without being seriously affected.
Daytime sleep is just as good as nighttime sleep	Shift workers who have to sleep during the day generally get lower-quality sleep, & less of it.
We can judge how fatigued we are actually	Studies have shown that fatigued people often don't realize that their abilities are impaired by fatigue.
We need less sleep as we get older.	We still need the same amount of sleep, but our sleep becomes more fragmented, & we tend to wake up earlier.

Sleep Cycles



When you sleep, you cycle through five different sleep stages.





REM sleep

- Busy brain and paralyzed body.
- Brainwave activity looks similar to waking activity.
- The body can't move.
- Electric signals from brain do not get through spinal cord.
- People awoken from REM recall vivid dreaming.
- Brief paralysis sometimes experienced after waking up.
- Brain repairs itself during REM sleep.

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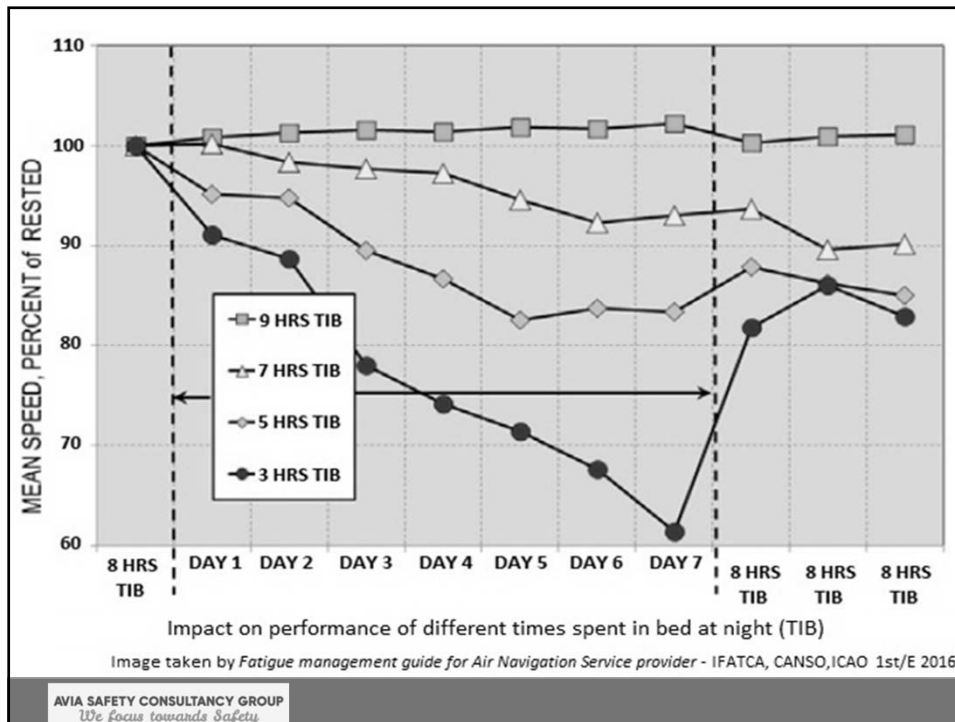


How many hours of sleep (on average) do you sleep daily?

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A Serious Safety Hazard

When you're fatigued:

- ☐ Your reaction time is slower;
- ☐ You have trouble concentrating or remembering things;
- ☐ You may have difficulty communicating clearly with co-workers;
- ☐ You may fall asleep on the job;
- ☐ There's a greater risk you'll make a safety-critical mistake.

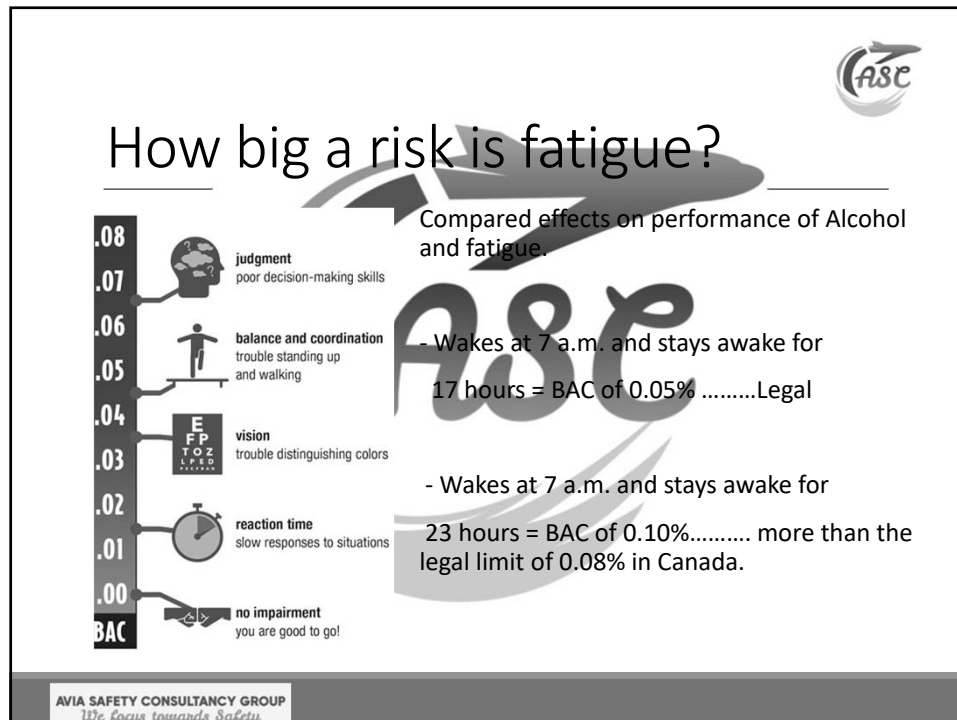
Being fatigued can make you a risk to yourself, your co-workers, and the public!

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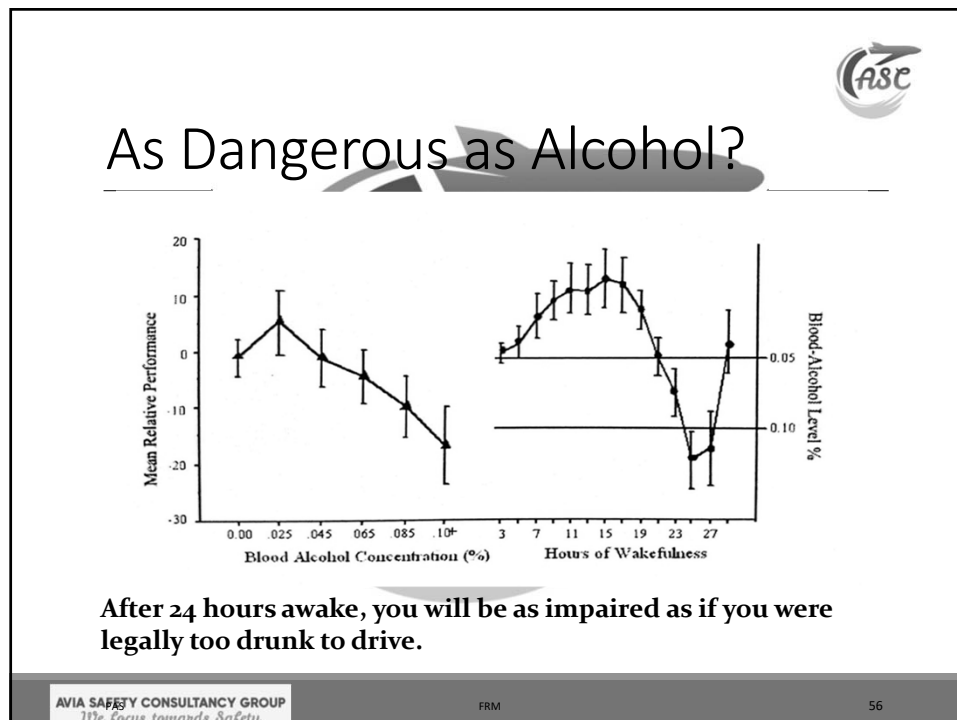
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Effects of Fatigue

Effects of fatigue	
Performance category	Effects
Attention: reduced	Leave out steps in tasks
	Preoccupation with single tasks or steps
	Tunnel vision, less likely to notice the unexpected
	Less aware of poor performance
	Concentration requires more effort
Memory: diminished	Poor memory for tasks completed or underway
	Forget to perform task steps
	Revert to 'old habits'
	More likely to forget to return to interrupted tasks
Mood: withdrawn	Reduced Communication
	More irritable, frustrated by minor difficulties
	Temptation to shortcut tasks
Reaction time: increased	Slower to notice problem
	Less smooth control of equipment or vehicles

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Types of Fatigue

Two common types of fatigue-related errors

- ☐ Memory failures;
- ☐ Failure to notice defects or problems.

Fatigue is one of the major causes of human error

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Consequences for Health

Fatigue has an impact outside work.

Studies have found that shift workers are more likely to suffer from:

- Irritability, stress, anxiety, and depression
- Gastrointestinal problems
- Cardiovascular illnesses
- Reproductive problems

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Shift and fatigue

How is sleep-wake cycle defined?

Circadian body clock
(or circadian rhythm)

Light-stimulated electric signals from eyes to brain, to keep body synchronized with day/night cycle.

Sleep homeostatic (Stability) process

Need for sleep increases as time spent awake passes.
Adenosine is created during the day, leading to sleepiness.

WOCL

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Workload and fatigue

Three main aspects of workload:

1. Nature and amount of work to be done (including time on task, task difficulty and complexity, and work intensity).
2. Time constraints.
3. Factors relating to the performance capacity of an individual (for example experience, skill level, effort, sleep history, and circadian phase).

High and low workload can contribute to fatigue.

Also, think about continuous changes in tasks, technology & rules

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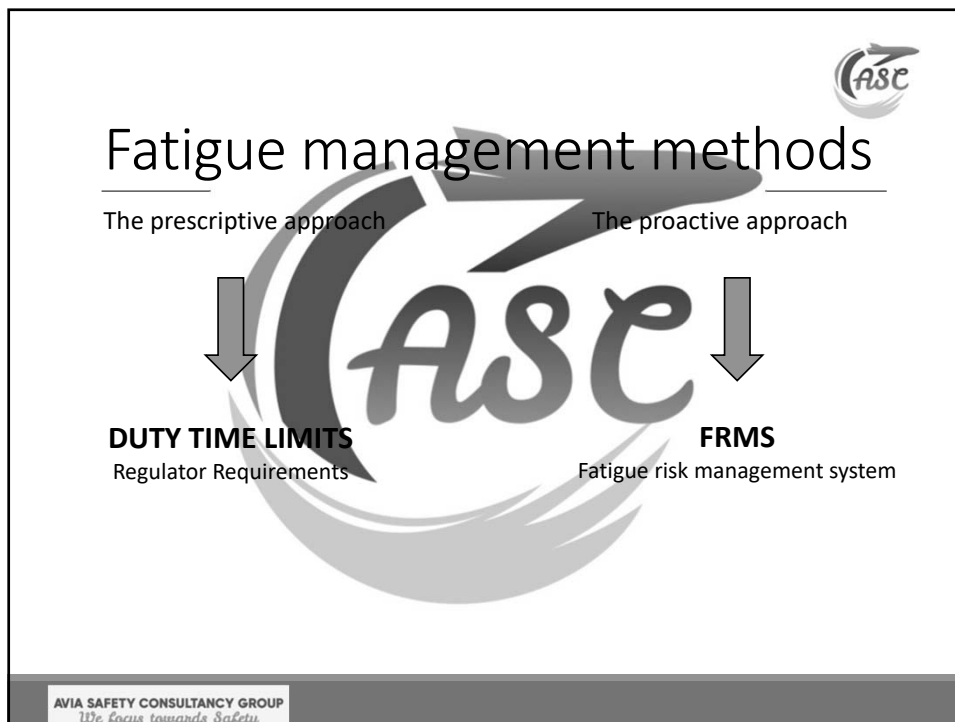


How important and valuable do you feel in implementing FRM in your organization?

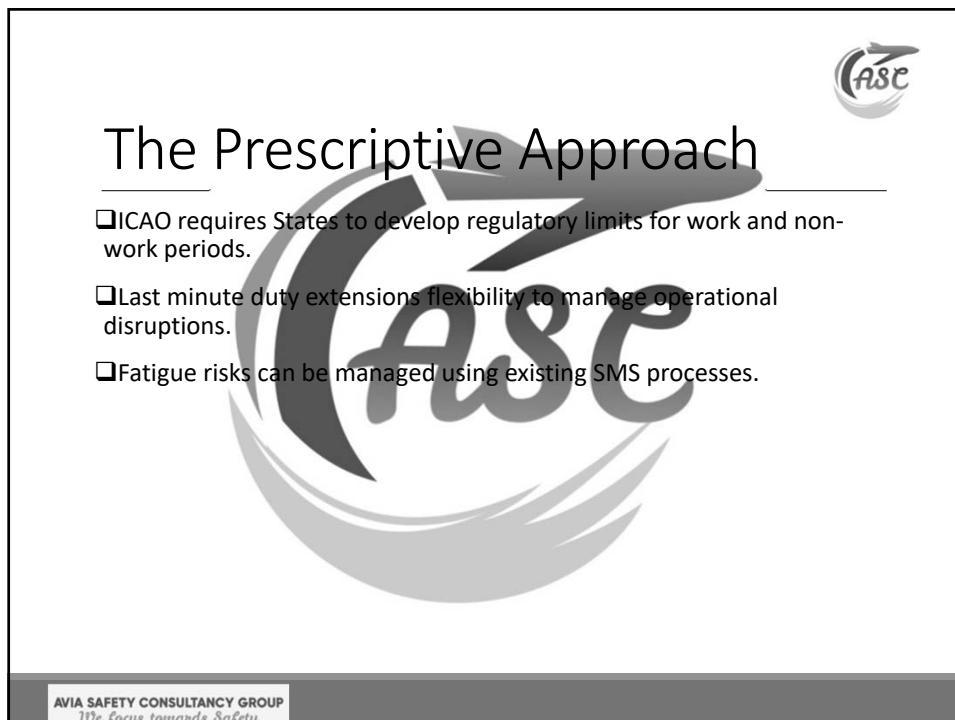
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The Prescriptive Approach How to?



- ☐ Comply with prescribed limits (social regulations can unintentionally help the fatigue management process)
- ☐ Use scientific principles in rostering (Be aware of Circadian rhythms, WOCL)
- ☐ Use caution while assigning unscheduled shifts

For example: ATCOs should be careful when swapping shifts

The Prescriptive Approach



Staying within prescribed limits may
not be enough to manage fatigue.



Why a FRMS?

With a prescriptive approach, fatigue is one of the possible hazards that the SMS should consider

but

data-driven evidence related to fatigue is not specifically and actively collected unless a fatigue issue has been identified by the SMS.

The Operator then reacts only when a fatigue hazard is identified.

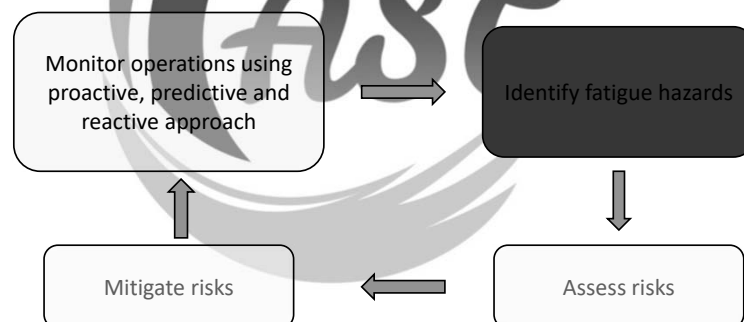
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FRM Process

Using a FRMS, the Operator must additionally identify and assess potential fatigue risks prior to conducting operations, as well as identifying and assessing actual fatigue risks proactively during operations.



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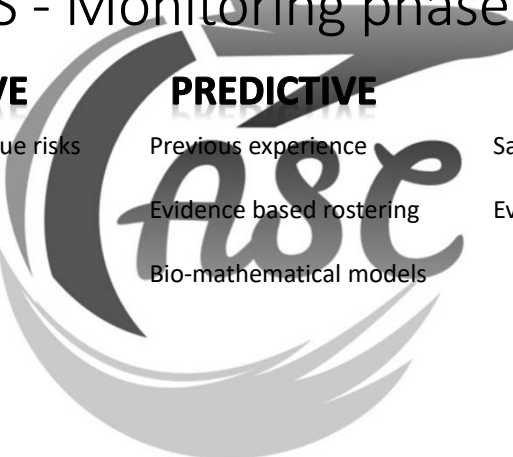
FRMS - Monitoring phase

Three ways of hazard identification:

- Proactive: Measuring fatigue levels in normal day-to-day operations
- Predictive: Examining scheduled rosters - the fatigue management way
- Reactive: Assessing the contributions of fatigue to safety reports/events

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FRMS - Monitoring phase

PROACTIVE	PREDICTIVE	REACTIVE
Self reported fatigue risks	Previous experience	Safety reports
Fatigue surveys	Evidence based rostering	Event investigations
Safety databases	Bio-mathematical models	
Scientific studies		
Sleep monitoring		

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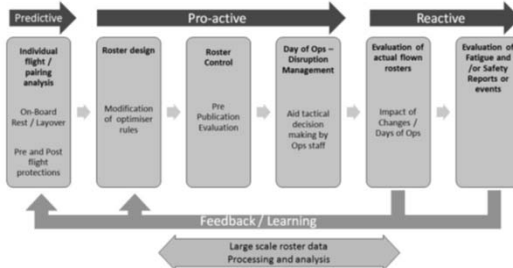
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Bio Mathematical Fatigue Models



Optional Tool for Fatigue Risk Hazard Management

Potential Use of a Biomathematical Model



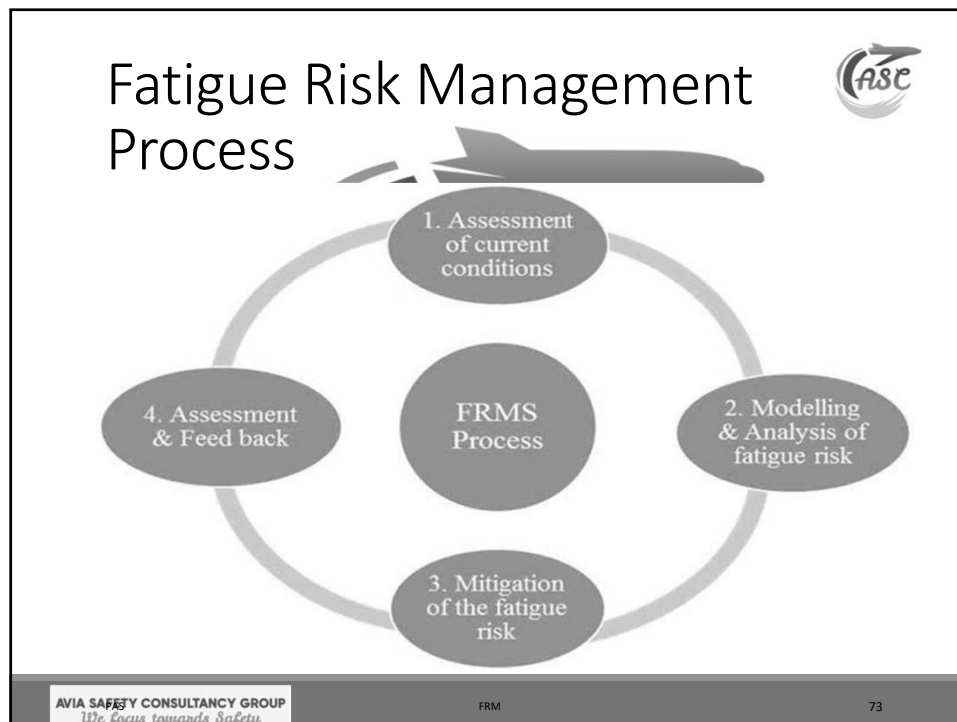
- ☐ A model is not an FRMS.
- ☐ An optimizer used in conjunction with a model does not constitute an FRMS.
- ☐ A model should not be used by individuals, operators or regulators as a go/no-go decision making tool.
- ☐ The output of a model does not necessarily correlate to a safety risk.
- ☐ Model outputs represent the population average and may not be accurate for specific individuals.
- ☐ Model sleep predictions may not reflect actual sleep which is fundamental to the validity of its output.

Fatigue Risk Management



A Fatigue Risk Management system involves:

- ☐ Policies/responsibilities;
- ☐ Risk assessment;
- ☐ Hazard controls/action plans;
- ☐ Training and education;
- ☐ Ongoing review and improvement.



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Who do you think we should base the responsibility of managing FRM on?

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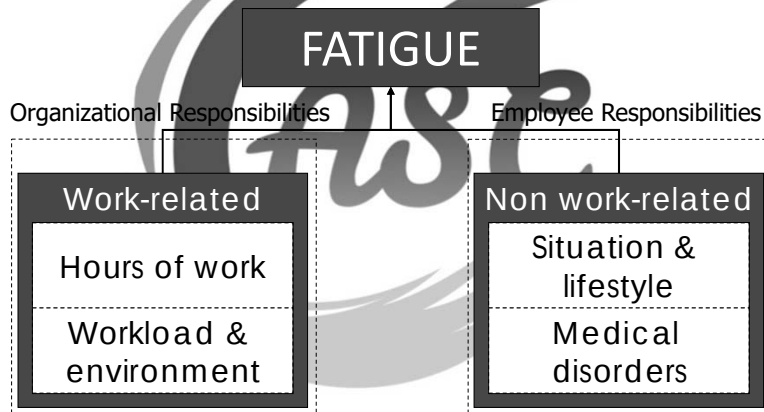
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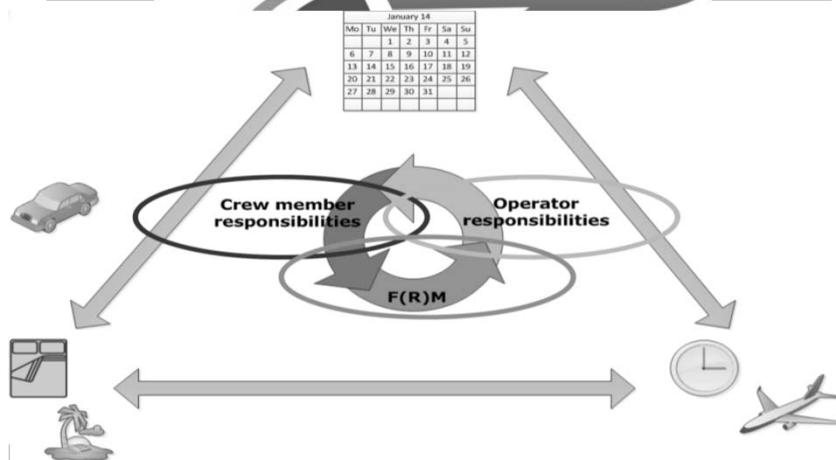
74

Joint Responsibilities for Fatigue



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Shared Responsibilities



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Joint Responsibilities for Fatigue



Are we the best judges of our level of fatigue?

Ask yourself these questions before starting work:

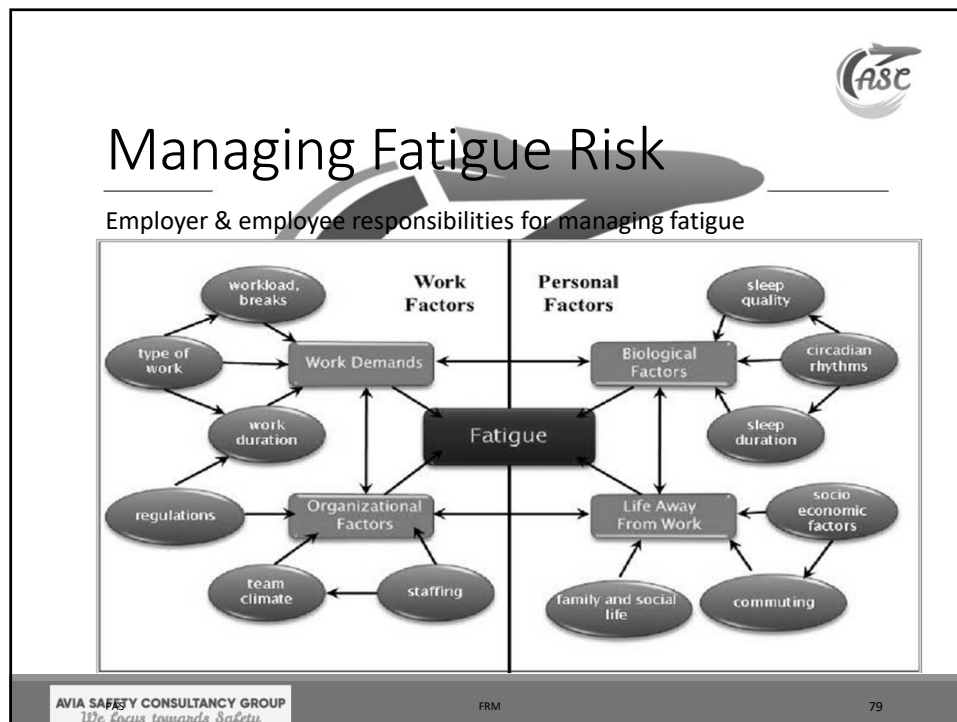
- How much sleep have I been getting over the last few nights?
- How long have I been awake?
- Will I be working at a time when I would rather be sleeping?
- Have I had good-quality sleep?

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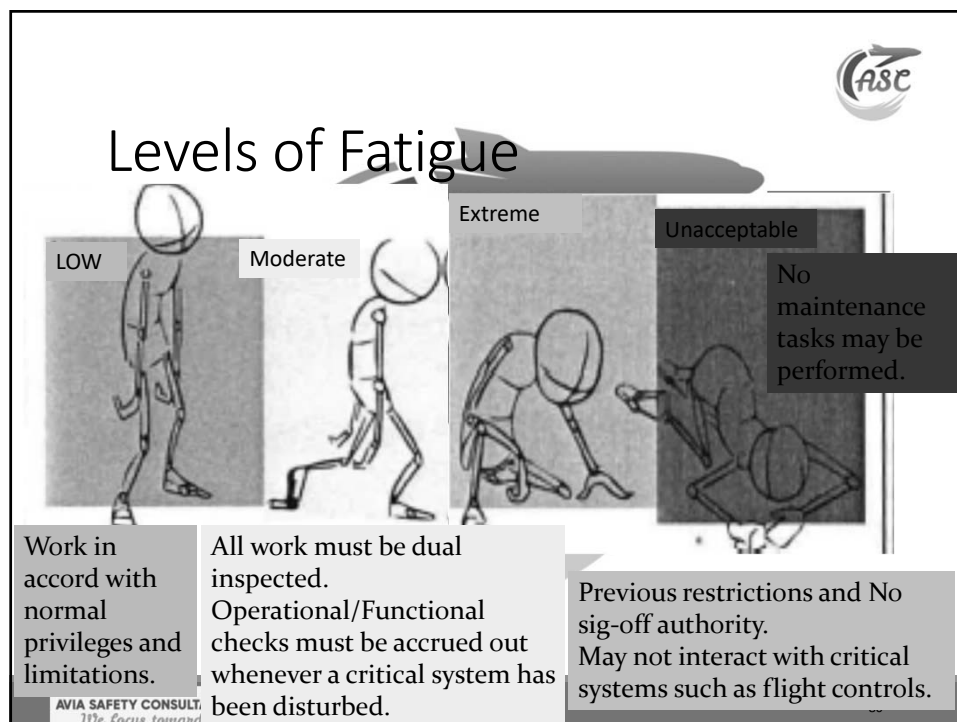
Operator Responsibilities



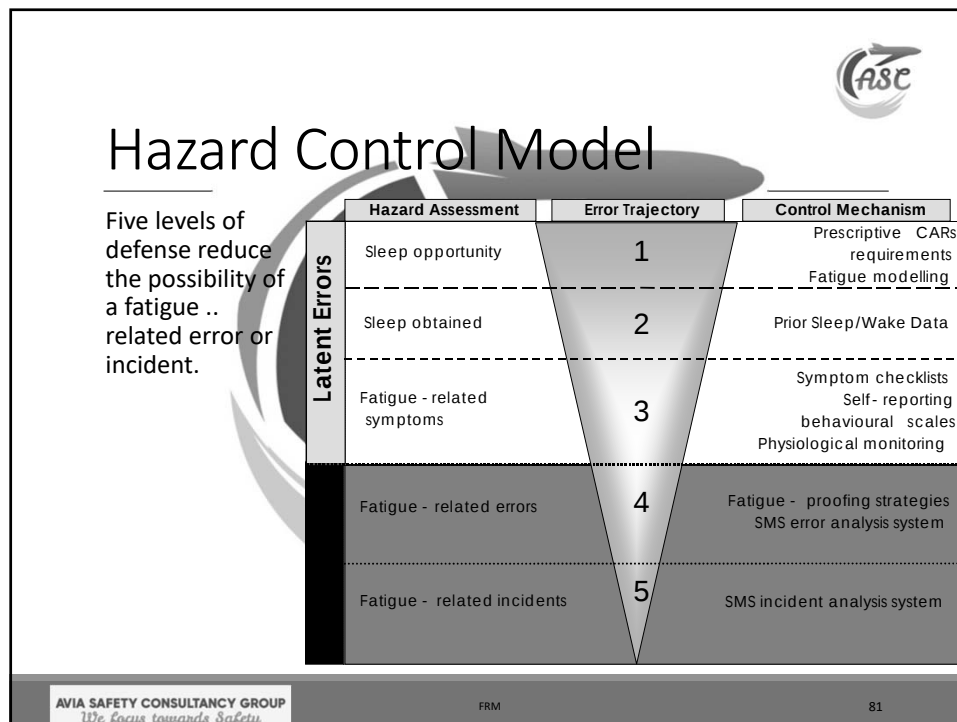
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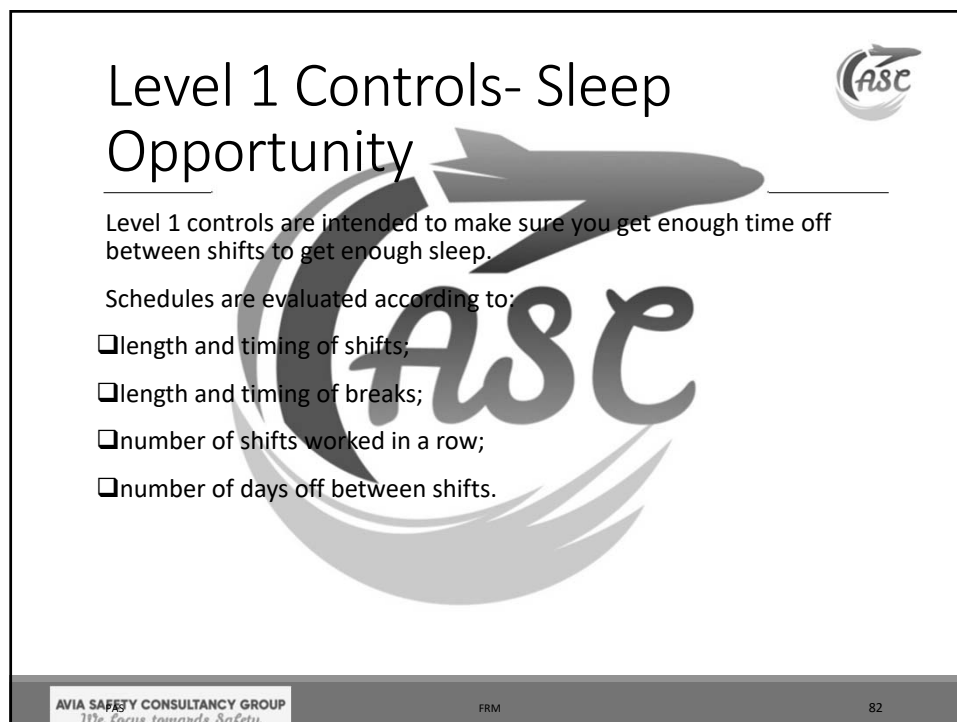
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Level 1 Controls- Sleep Opportunity

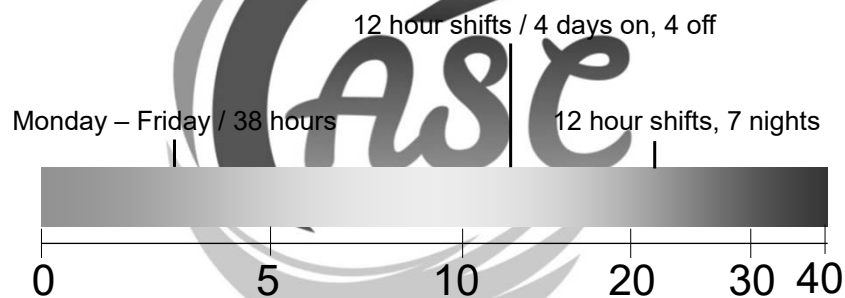


Fatigue Likelihood Scoring Matrix for Work Schedules

	0 points	1 point	2 points	4 points	8 points
a) Total hours per 7 days	≤ 36 hours	36.1 – 43.9	44 – 47.9	48 – 54.9	55+
b) Maximum shift duration	≤ 8 hours	8.1 – 9.9	10 – 11.9	12 – 13.9	≥ 14
c) Minimum short break duration	≥ 16 hours	15.9 – 13	12.9 – 10	9.9 – 8	≤ 8
d) Maximum night work per 7 days	0 hours	0.1 – 8	8.1 – 16	16.1 – 24	≥ 24
e) Long break frequency	≥ 1 in 7 days	≤ 1 in 7 days	≤ 1 in 14 days	≤ 1 in 21 days	≤ 1 in 28 days

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Level 1 Controls- Sleep Opportunity



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Level 2 Controls - Sleep Obtained



Level 2 controls are intended to determine whether employees actually got the sleep they needed:

- ☐ Identifies employees who fail to get sufficient sleep;
- ☐ Provides a procedure to report fatigue to a supervisor or manager;
- ☐ Outlines clear steps to take when an employee makes a fatigue report.

Level 2 Controls – Fatigue likelihood score



Prior sleep factor	Threshold value	Score
X (sleep in prior 24 hours)	5 hours	Add 4 points for each hour below threshold
Y (sleep in prior 48 hours)	12 hours	Add 2 points for each hour below threshold
Z (time awake since last sleep)	Y	Add 1 point for each hour of wakefulness greater than Y

A simple calculation can give you a fatigue likelihood score.

Level 2 Controls - Sample Decision Tree



Score	Action
0	No action.
1-4	Talk to supervisor and undertake approved individual countermeasures (I.e., self monitoring for symptoms, team monitoring by colleagues, task rotation.
5-10	File fatigue report with supervisor. Organize supervisory checks. Complete symptom checklist, task re-assignment
10+	File fatigue report with manager. Do not engage In risky behavior. Do not start shift until fit for work.

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Level 2 Controls - ILS Card



FRONT	BACK																														
Individual Fatigue Likelihood Assessment Step 1. Sleep in prior 24 hours <table> <tr> <td>Sleep</td> <td>≤ 2h</td> <td>3h</td> <td>4h</td> <td>5+h</td> </tr> <tr> <td>Points</td> <td>12</td> <td>8</td> <td>4</td> <td>0</td> </tr> </table> Step 2. Sleep in prior 48 hours <table> <tr> <td>Sleep</td> <td>≤ 8h</td> <td>9h</td> <td>10h</td> <td>11h</td> <td>12+h</td> </tr> <tr> <td>Points</td> <td>8</td> <td>6</td> <td>4</td> <td>2</td> <td>0</td> </tr> </table> Step 3. Hours of wake since last sleep Add one point per hour awake greater than sleep in step 2.	Sleep	≤ 2h	3h	4h	5+h	Points	12	8	4	0	Sleep	≤ 8h	9h	10h	11h	12+h	Points	8	6	4	2	0	Individual Fatigue Likelihood Assessment Step 4. Add all points together to determine your score <table> <tr> <th>Score</th> <th>Control Level</th> </tr> <tr> <td>1-4</td> <td>Self-monitoring</td> </tr> <tr> <td>5-8</td> <td>Supervisor monitoring</td> </tr> <tr> <td>9+</td> <td>Don't commence shift until fit for work</td> </tr> </table> Refer to FRMS policy for detailed explanation of controls	Score	Control Level	1-4	Self-monitoring	5-8	Supervisor monitoring	9+	Don't commence shift until fit for work
Sleep	≤ 2h	3h	4h	5+h																											
Points	12	8	4	0																											
Sleep	≤ 8h	9h	10h	11h	12+h																										
Points	8	6	4	2	0																										
Score	Control Level																														
1-4	Self-monitoring																														
5-8	Supervisor monitoring																														
9+	Don't commence shift until fit for work																														

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Level 3 Controls - Fatigue Symptoms



Level 3 controls are intended to identify employees who show signs of fatigue:

- ☐ symptoms of fatigue indicate an increased risk of fatigue-related error;
- ☐ employees should watch for symptoms in themselves and others;
- ☐ a system of reporting allows the company to take measures when the risk is considered high.

Level 4 Controls - Fatigue Proofing Strategies



- ☐ Increased supervisor/co-worker monitoring;
- ☐ Working in pairs;
- ☐ Double-check systems;
- ☐ Checklists;
- ☐ Task rotation;
- ☐ Additional breaks;
- ☐ Napping;
- ☐ Moving critical/monotonous tasks to daytime

Level 5 Controls - Errors and Incidents



Level 5 controls consist of:

- ☐ Fatigue error or incident reporting system;
- ☐ Investigation procedures to determine whether fatigue was a cause of an incident;
- ☐ Review of fatigue management controls.

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Fatigue Risk Management Systems FRMS



A fatigue risk management system (FRMS) can be part of a safety management system (SMS)



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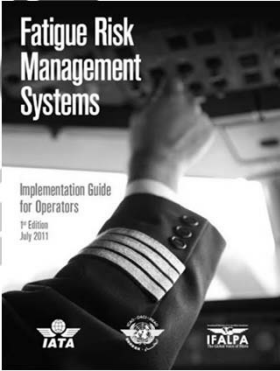
Description of the Guide

Aligned with ICAO's FRMS Manual for Regulators (Doc 9966);

Provides comprehensive implementation guidance including scientific principles

Available on-line:

- www.iata.org
- www.icao.int
- www.ifalpa.org



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Description of the Guide

- ☐ Summarizes supporting science;
- ☐ Explains the minimum requirements;
- ☐ Describes how to implement an FRMS;
- ☐ Provides operational examples of various means of compliance;
- ☐ Stresses the need for joint responsibility amongst all stakeholders.

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SMS and FRMS

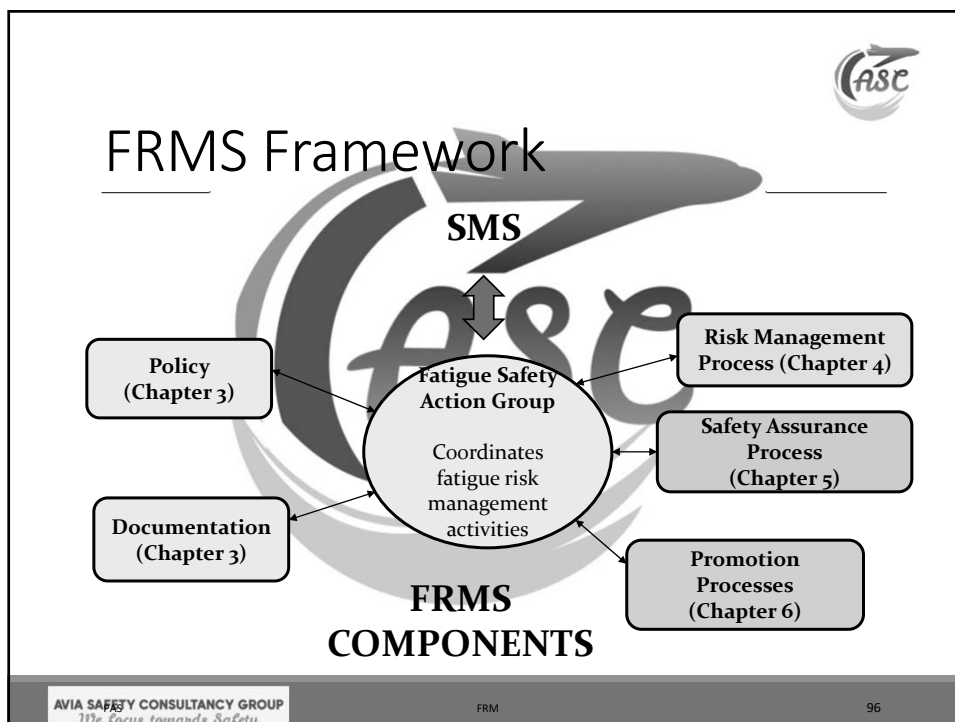
SMS	FRM
Safety policy & objectives	FRM policy & documentation
Safety risk management	Fatigue risk management process • Identification of hazards • Risk assessment • Risk mitigation • Implementation
Safety assurance	Fatigue safety assurance • Monitor effectiveness of FRM • Management of change • Continuous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

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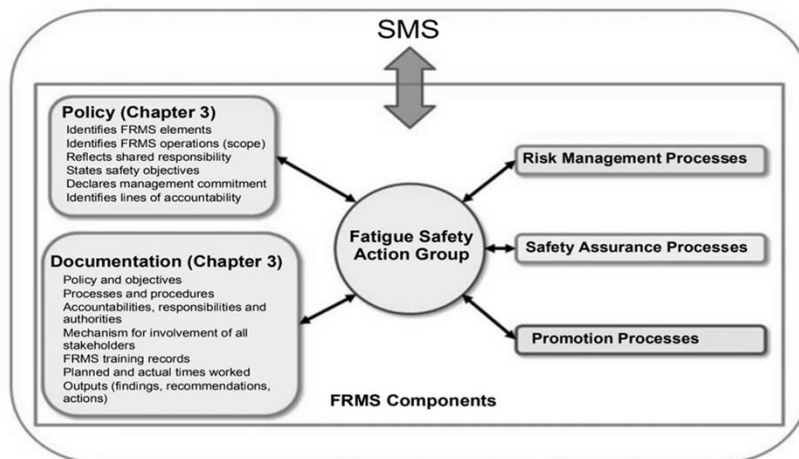
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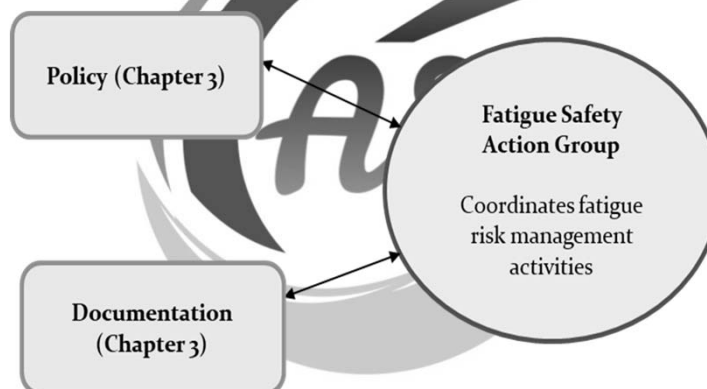


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FSAG, Policy and Documentation



Getting Started





Getting StartedCont.

Fatigue Safety Action Group (FSAG)
Participants
Role

Fatigue Policy
Signatory
Content

Supporting Documentation
Owner
Content

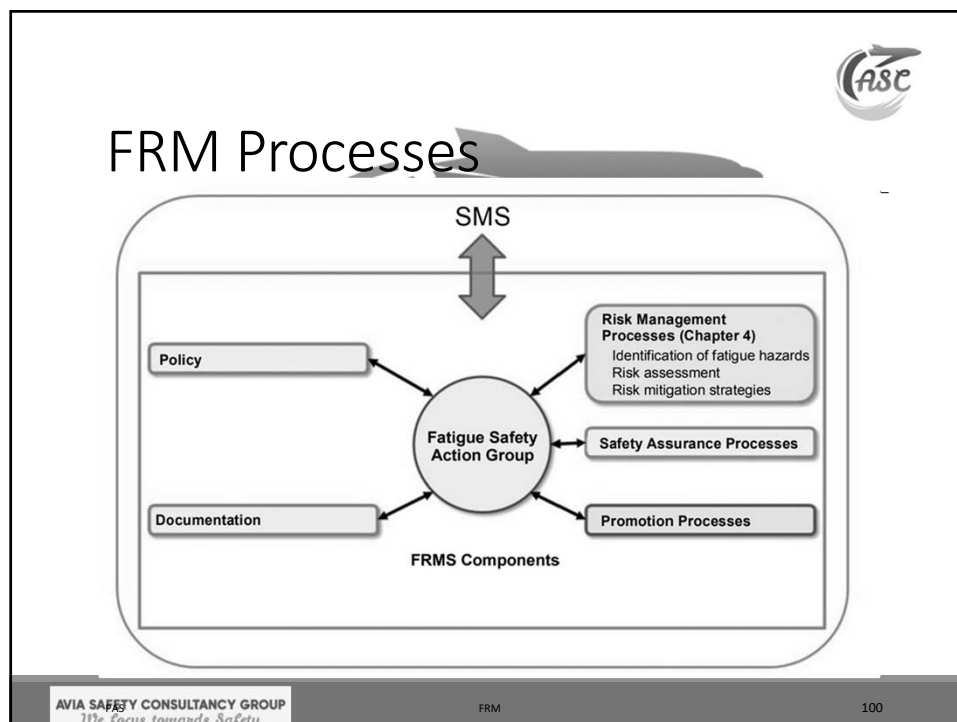


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FRMS – Risk assessment Methods



A risk assessment matrix can be used to calculate fatigue safety risk.

Safety risk is defined as the projected likelihood and severity of the outcome from an existing hazard

When managing fatigue risks, different severity classification are needed. Examples are:

- Subjective sleepiness scale (Samn-Perelli, KSS)
- Bio-mathematical models (Not to be used as a stand alone method!)
- Assessing the number of relevant fatigue factors associated with a specific duty or work pattern

Risk Mitigation

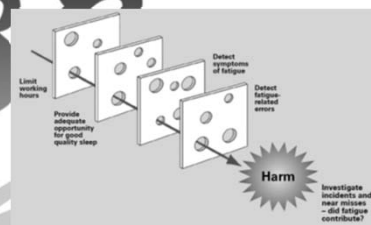


Companywide measures are sufficient to manage the majority of the risk, case-specific additional controls may be required to ensure sufficient layers of defence. For instance, these may include:

Review of sleep quality and quantity and the identification of improvement measures.

The dynamic assessment of fatigue symptoms by the individual, his peers or supervisor.

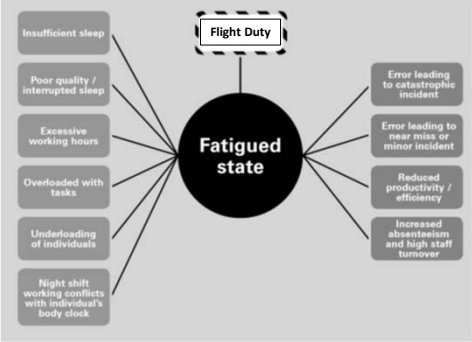
Flexible strategies for reacting to fatigue, such as exercise, short breaks or task rotation.



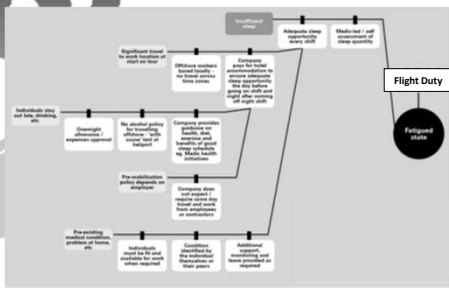


FRMS Using Bowties

The bowtie provides an easy-to-use template for an organisation to assess its fatigue management arrangements



Reduce fatigue risk to ALARP levels



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FRMS – Risk mitigation

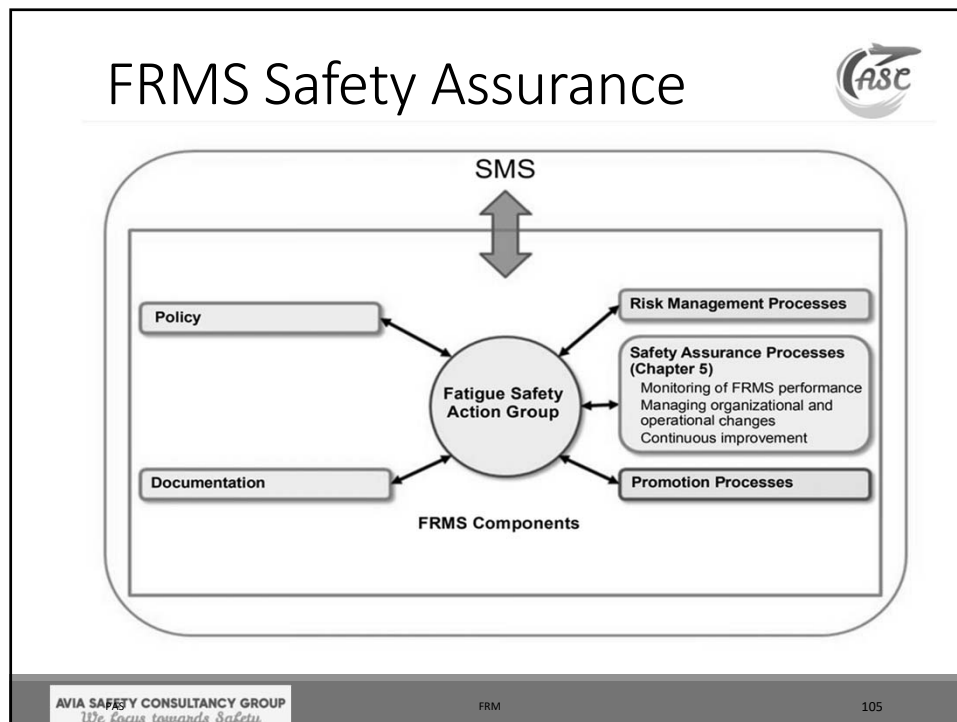
Risk assessment determines whether or not risk mitigation is required

Mitigations are costly in terms of HR, time, money

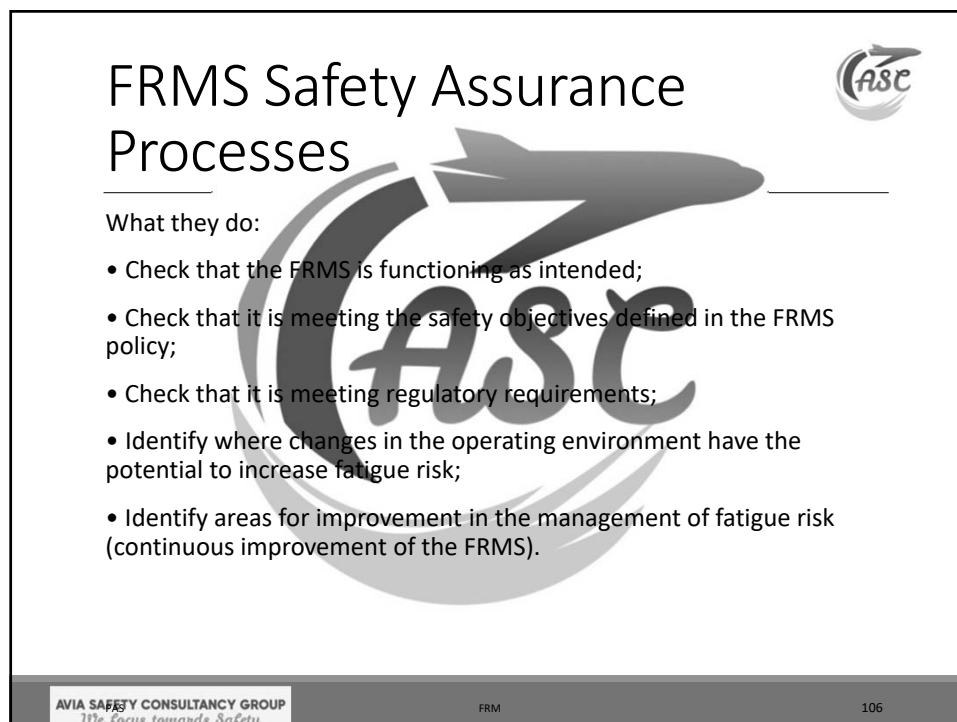
Need for a careful selections of fatigue risks to be mitigated, going beyond duty and rest times!

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FRMS Safety Assurance Processes

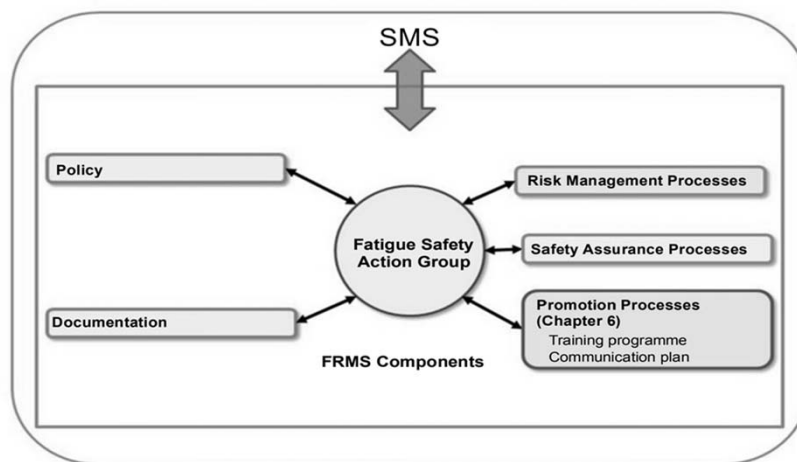


After the review, senior management and the FRMS committee should meet to review and discuss the findings and plan any potential changes to the FRMS.

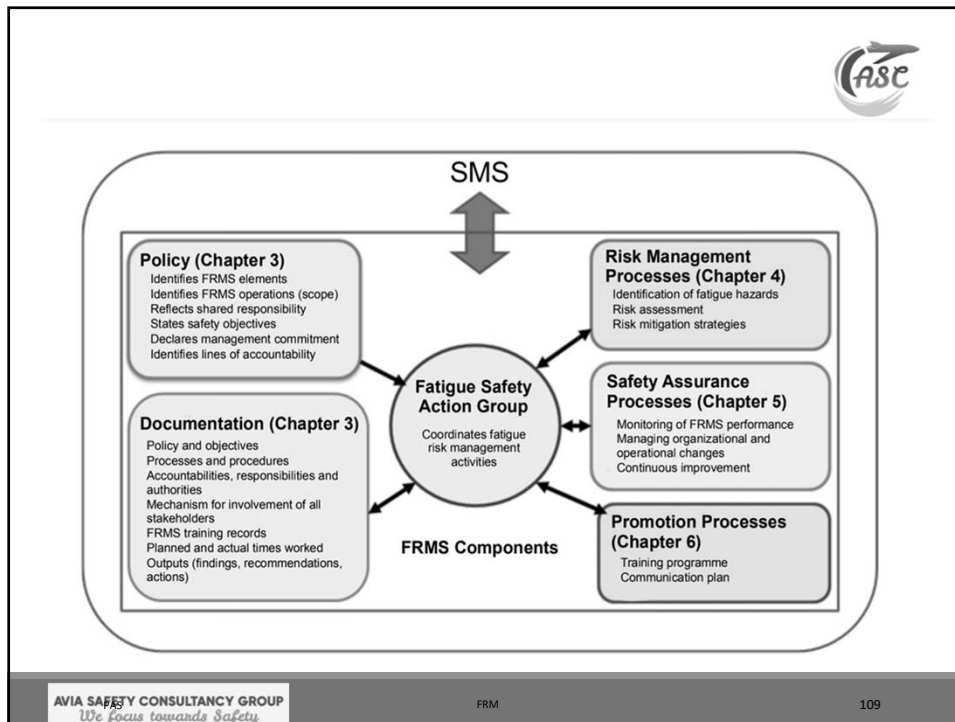
1. Policy
2. FRMS Committee (or person responsible for the FRMS)
3. Implementation Process
4. Communication and Consultation
5. Schedules and Actual Hours of Work
6. Assessment of Actual Sleep Obtained
7. Development of Training Program
8. Delivery of Training
9. Internal Audits
10. Incident and Accident Investigation

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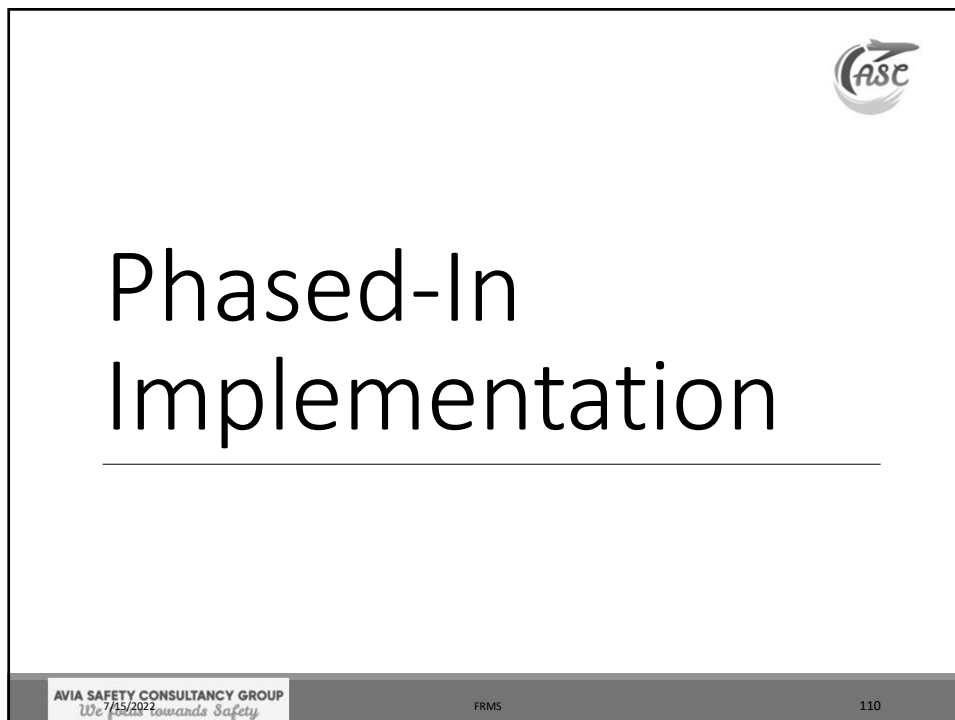
FRMS Promotion Process



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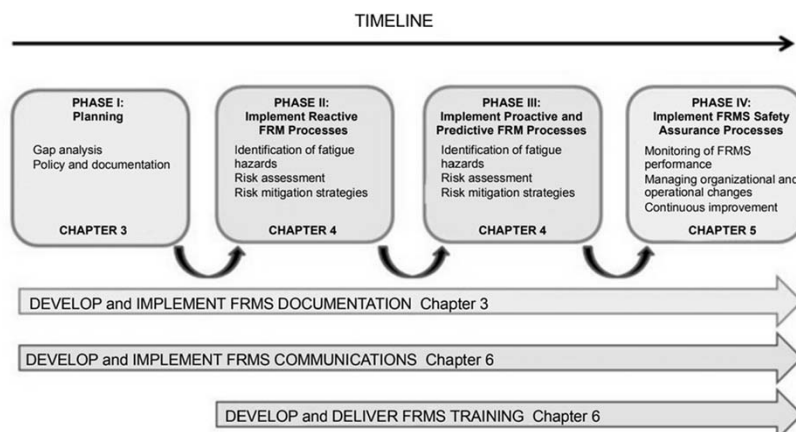
FRMS: Phased-in Implementation



- There is no 'off-the-shelf' version of an FRMS that will suit all operators ;
- An FRMS needs to be developed, understood and managed by people who have comprehensive experience in the complex operational environment to which it will apply;
- A fully functioning FRMS doesn't happen overnight;
- Implementation is necessarily accomplished in phases.

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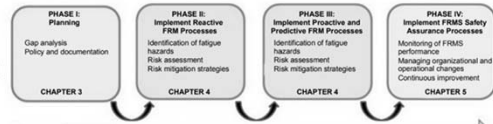
Phased Implementation



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Phase I

- Gap analysis;
- FRMS Policy Statement;
- FRMS implementation plan;
- FRMS documentation plan;
- FRMS communication plan;
- Allocation of financial and human resources;
- Fatigue Safety Action Group (or equivalent) established.



Phase II

- FRM processes based on reactive hazard identification are operational;
- FRMS documentation processes are established;
- FRMS training activities are established;
- FRMS communication processes are established;
- The operator is ready to undertake coordinated safety analyses of this first version of the FRMS ..

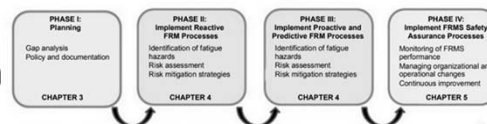


Phase III



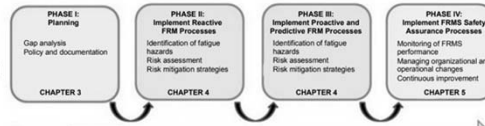
- FRM processes based on reactive, proactive, and predictive hazard identification are operational;
- FRMS documentation processes are established;
- FRMS training activities are established;
- FRMS communication processes are established;
- The operator is ready to undertake coordinated safety analyses of this version of the FRMS.

Phase IV



- Roles and responsibilities for assuring the safety performance of the FRMS are established;
- The necessary authorities and communication channels are active;
- FRMS safety performance indicators have been developed and agreed on;
- The procedures and processes for periodic evaluation of the safety performance indicators are established.

Phase IV..cont.



- Appropriate feedback is established between the FRM processes and the FRMS safety assurance processes;
- FRMS documentation processes are fully implemented;
- FRMS training processes are fully implemented;
- FRMS communication processes are fully implemented.

What FRMS is not?

- It isn't just a model
- It isn't a negotiating tool
- It isn't the job of just one party
- It isn't a set of manuals
- It isn't a cost-cutting tool
- It isn't a way to get rid of limits

THINGS THE FRMS POLICY MUST COVER - Shared responsibility

Shared responsibility of management, flight and cabin crews, and other involved personnel;

Safety objectives of the FRMS;

Signed by the **accountable executive** and communicated/endorsed to all relevant areas

THINGS THE FRMS POLICY MUST DECLARE

Management commitment to:

- effective safety **reporting**;
- provision of adequate **resources** for the FRMS;
- **continuous improvement** of the FRMS;
- Clear **lines of accountability** for management, flight and cabin crews, and all other involved
- Require **periodic review** to ensure it remains relevant and appropriate



Willingness to Report

Know how and when to report

Effective mechanism (available, not too difficult)

Trust –consequences, jeopardy, confidentiality, purpose of collection

Motivation –action, communication= “effective reporting culture”

Fatigue observed

vs Duty not completed due fatigue

vs Incident occurred with fatigue

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Example

Simple

Roster attached

To Ops integrity first

De-identified if requested

To managers for early action

FSAG review trends monthly

The image shows a 'Fatigue Report Form' from Air New Zealand. The form is titled 'Fatigue Report Form' and includes a confidentiality statement: 'Confidentiality requested (tick box)'. It has sections for 'When did it happen?', 'What happened?', 'Why did it happen?', 'What did you do?', and 'What could be done?'. The 'When did it happen?' section includes fields for 'Date/Time' and 'Location'. The 'What happened?' section includes a 'Description' field and a 'Please select one or more that apply' section with checkboxes for 'Fatigue', 'Stress', 'Lack of sleep', 'Illness', 'Alcohol/drug use', 'Workload', 'Time pressure', 'Fatigue', 'Stress', 'Lack of sleep', 'Illness', 'Alcohol/drug use', 'Workload', 'Time pressure'. The 'Why did it happen?' section includes a 'Please select one or more that apply' section with checkboxes for 'Fatigue', 'Stress', 'Lack of sleep', 'Illness', 'Alcohol/drug use', 'Workload', 'Time pressure'. The 'What did you do?' section includes a 'Please select one or more that apply' section with checkboxes for 'Fatigue', 'Stress', 'Lack of sleep', 'Illness', 'Alcohol/drug use', 'Workload', 'Time pressure'. The 'What could be done?' section includes a 'Please select one or more that apply' section with checkboxes for 'Fatigue', 'Stress', 'Lack of sleep', 'Illness', 'Alcohol/drug use', 'Workload', 'Time pressure'.

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Fatigue Report Handling

Simple form

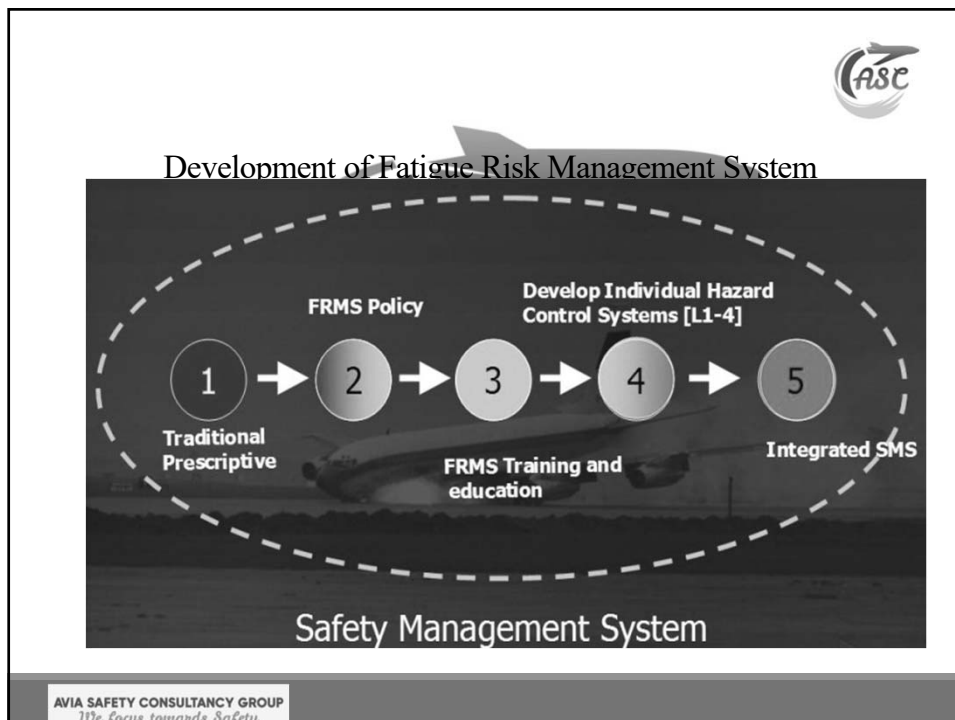
- Anonymity –important in early stages
- Manager response
- Look collectively more than individually
- Non-punitive
- Not FSAG role to “rule out” fatigue
- “Play the ball and not the player”

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Get the Sleep You Need



Set up your bedroom for sleeping

- Make it as dark as possible
- Make sure the temperature is right: 18° C to 24°C
- Move distractions to another room
- Make sure you won't be disturbed

Good Sleeping Habits



- Keep to a regular bedtime routine
- Wind down before trying to sleep
- Don't toss and turn waiting to fall asleep
- Adjust your bedtime gradually if your shift changes

Take a Nap



- Naps can supplement sleep, not replace it;
- Naps 10 minutes or longer can improve alertness, communication and mood;
- The value of a nap doesn't depend on the time of day;
- Allow 5 to 20 minutes for sleep inertia to pass.

Drink Plenty of Fluids



- Dehydration slows you down and increases feelings of sluggishness;
- Working in heat, air conditioning, or at night can be dehydrating;
- Drinking coffee, tea, soft drinks, or alcohol, and eating salty foods can make you feel thirstier;
- Adults should drink at least 2 liters of fluid a day.

Make Smart Use of Caffeine



- Has stimulant effects that can improve alertness and performance;
- Best used strategically-only when you really need help-staying awake;
- Takes 20 minutes to take effect and the effects can last up to 6 hours;
- You can develop both a dependence and a tolerance.

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Caffeine



Caffeine content of common foods/drinks

Coffee (250 mL)

Instant	65-100 mg
Drip	115-175 mg
Brewed/Espresso	80-135 mg

Tea (250 mL)

Green tea	8-30 mg
Regular	50-70 mg

Soft drinks

Coke/Pepsi (340 mL)	50 mg
Jolt (500 mL)	100 mg
Red Bull (200 mL)	80 mg

Most chocolate bars

20-40 mg

NoDoz, 1 regular strength tablet

100 mg

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Eating Right



- Maintaining blood sugar levels is key to controlling ups and downs in energy levels.
- Eating low-fat, high-protein foods can actually increase alertness.
- High-fat foods can slow you down.
- High-sugar foods can cause your blood sugar to rise and fall quickly.

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Eating Right



High Glycemic Index (GI) Foods

French fries, doughnuts, muffins, bread (white or whole grain), Cornflakes, rice (white or quick brown), cakes

Low GI Foods

Fish (canned in water), low-fat dairy (cottage cheese, yoghurt), lean meat (steak, chicken breast, lamb), pasta, All-Bran, porridge, hard boiled eggs, peanuts, lentils, fresh fruit

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Physical Exercise



- Good for your overall health
- Can help you sleep better and feel more rested
- Helps relieve stress, boost your health, strengthen your immune function, and improve muscle tone and strength
- Any activity that keeps your heart rate elevated for at least 20 minutes is good
- Preferably in the morning

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A Healthy, Balanced Life



- Get enough sleep
- Spend time with friends and family
- Enjoy time for yourself
- Stay fit and healthy

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SAFETY IS THE RESPONSIBILITY OF ALL



Fatigue makes fools of us all. It robs you of your skills and your judgment, and it blinds you to creative solutions. It's the best-conditioned athlete, not the most talented, who generally wins when the going gets tough.

Harvey Mackay

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Oops..I'm drifting off here..



*But, before I do...I just want
to wish you a Good Night!*



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Any Questions

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