QUALITY
LEADERSHIP FORUM
VIRTUAL SERIES

How Fatigue Impacts Performance and Quality

Thursday, Oct. 15, 2026 | 1:00 – 2:00 p.m. Eastern

Presenter

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Overview

Fatigue Introduction

Consequences of Fatigue

Fatigue in Industry

Fatigue at NASA

Fatigue Countermeasures

Resources

What Is Fatigue?

"Fatigue is a physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase or workload — which includes mental and/or physical activity — that can impair ... alertness and ability to safely operate an aircraft or perform safety-related duties."

- International Civil Aviation Organization




ACUTE SLEEP LOSS
Performance steadily degrades after 16 hours awake
Performance after 20 hours awake is similar to performance with a Blood Alcohol Content of 0.08%


CUMULATIVE SLEEP LOSS
One week of four hours sleep or 10 days of six hours sleep is equal to performance after one night of total sleep loss
Individuals cannot recognize performance impairment when chronically sleep deprived

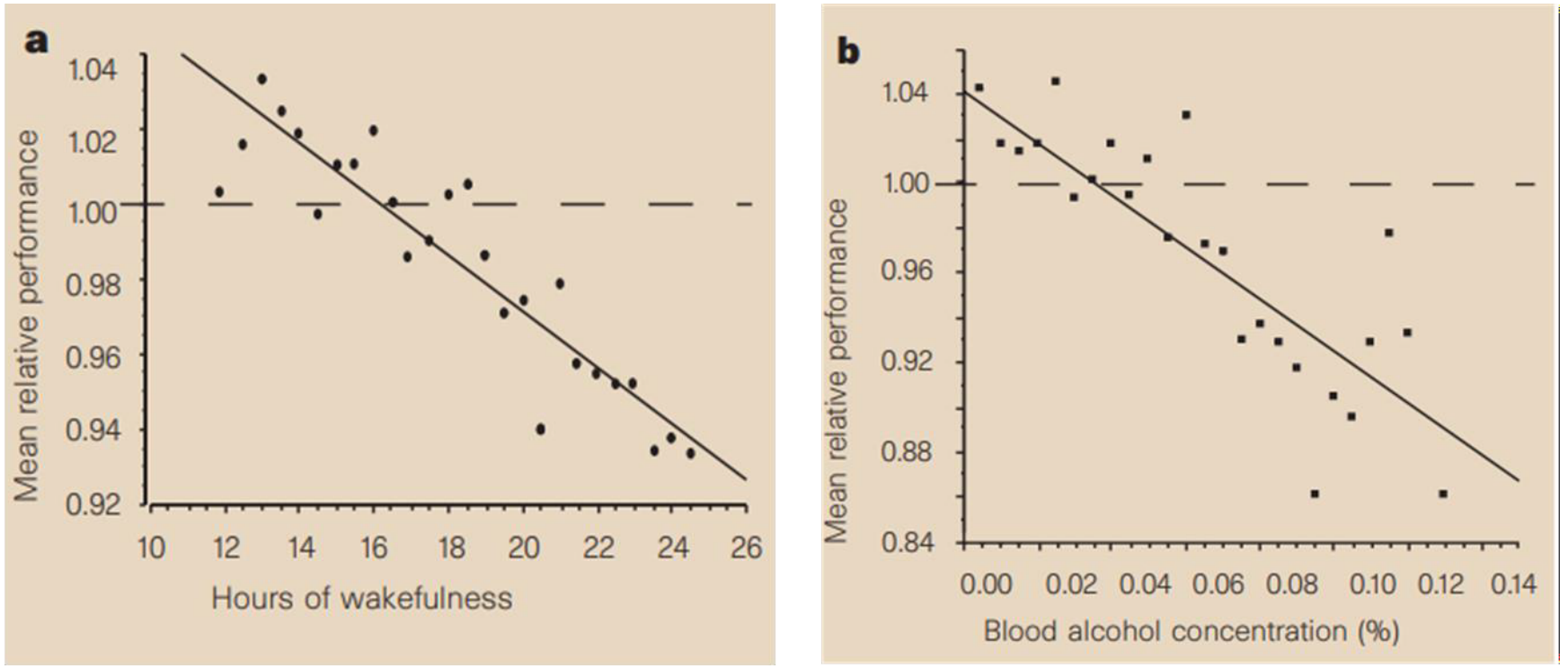

CIRCADIAN MISALIGNMENT
Performance fluctuates relative to one's internal clock
Performance is at its worst when the circadian rhythm is promoting sleep
Light resets the internal clock


POOR SLEEP QUALITY
Sleep quality is affected by
Personal factors like age, sleep disorders, alcohol, and drug and caffeine consumption
Environmental factors like noise, temperature and light

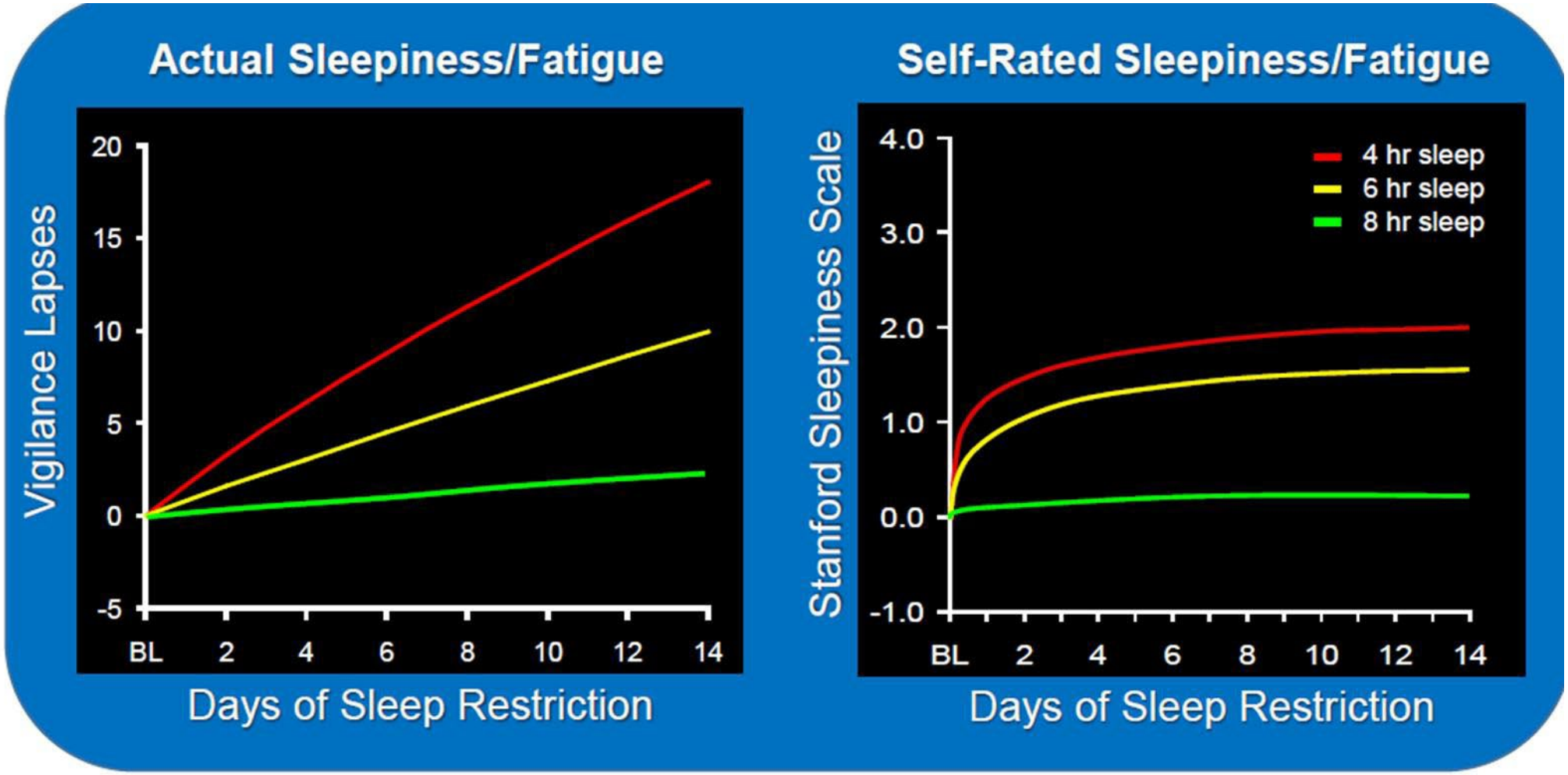
Sleep Loss and Intoxication have the same negative performance effects

- Eye-hand coord task
- 24 hours awake: roughly =

BAC .10%



Dawson, D., Reid, K. Fatigue, alcohol and performance impairment. *Nature* **388**, 235 (1997). https://doi.org/10.1038/40775



Van Dongen HPA et al. (2003). The cumulative cost of additional wakefulness: Dose-response effects on neurobehavioral functions and sleep physiology from chronic sleep restriction and total sleep deprivation. Sleep, 28: 117-126.





[redacted]

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Cant seem to sleep. Let's see if the bright light of my phone containing all the information in the entire world held inches away from my face for the next 15 minutes manages to lull me into a peaceful slumber.

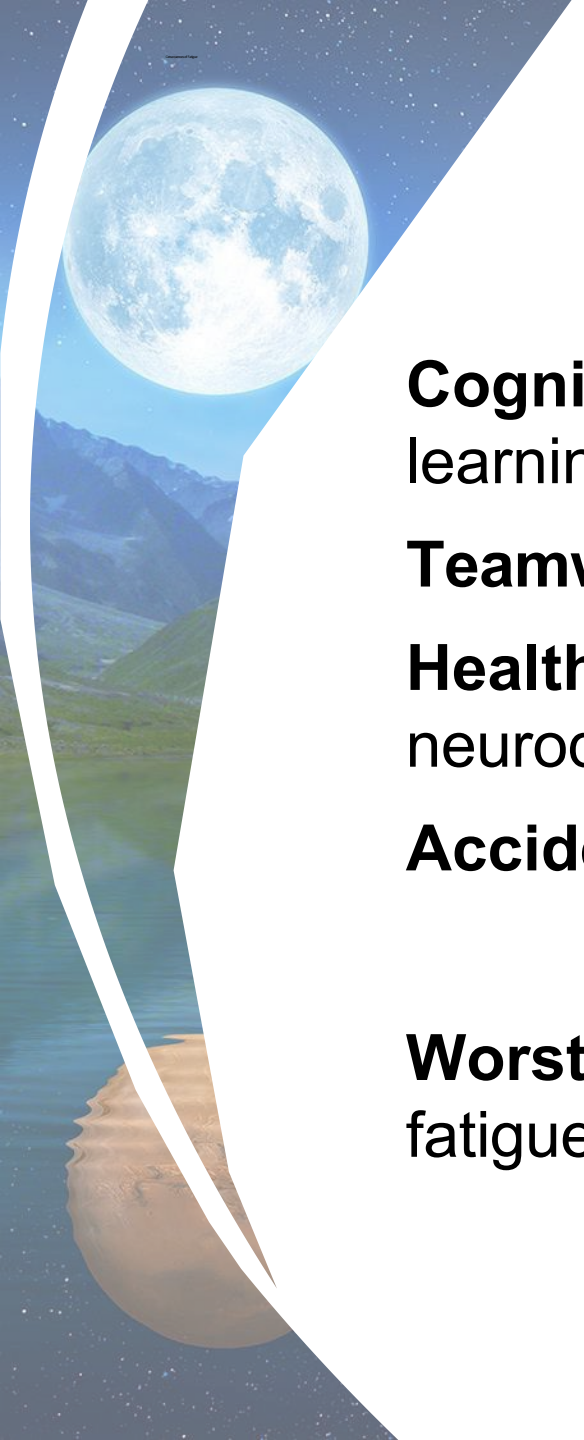
Tired

vs

Sleepy

vs

Fatigued



Consequences of Fatigue

Cognitive Performance: reaction time, calculations, memory and learning, decision-making, information processing, and risk-taking

Teamwork: mood, ability to communicate, and emotional regulation

Health: metabolic diseases, cardiovascular diseases, neurodegenerative diseases, mental health, obesity, and cancer

Accidents: errors, injuries, and fatalities

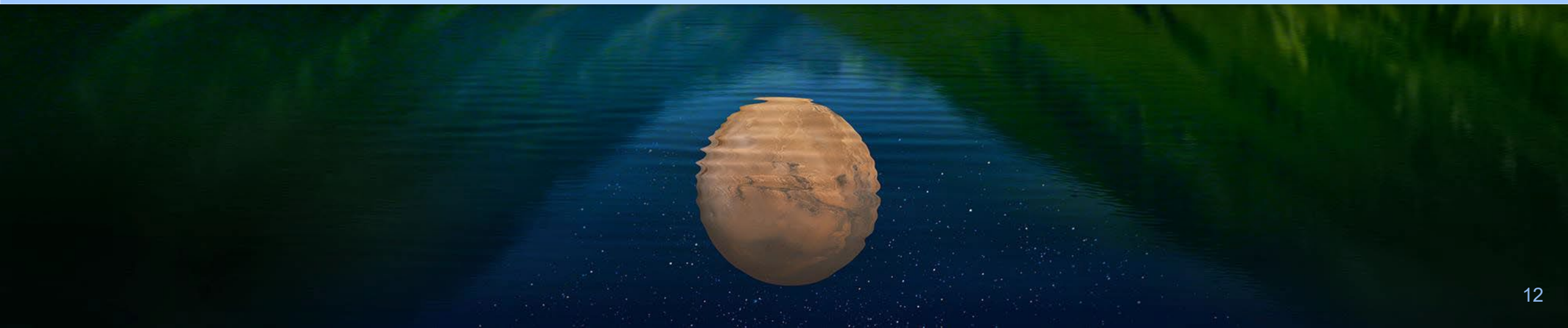
Worst of all: we cannot judge our own level of fatigue when we are fatigued


IT'S FINE, I'M FINE
EVERYTHING'S FINE


THIS LITTLE LIGHT OF MINE
I'M GONNA LET IT SHINE
Adobe Stock | #174685182



Fatigue in Industry



Fatigue-Related Catastrophes

- Twenty percent of fatal motor vehicle crashes and aviation accidents
- Chernobyl
- Three Mile Island
- Exxon Valdez
- US Navy Ship Collision



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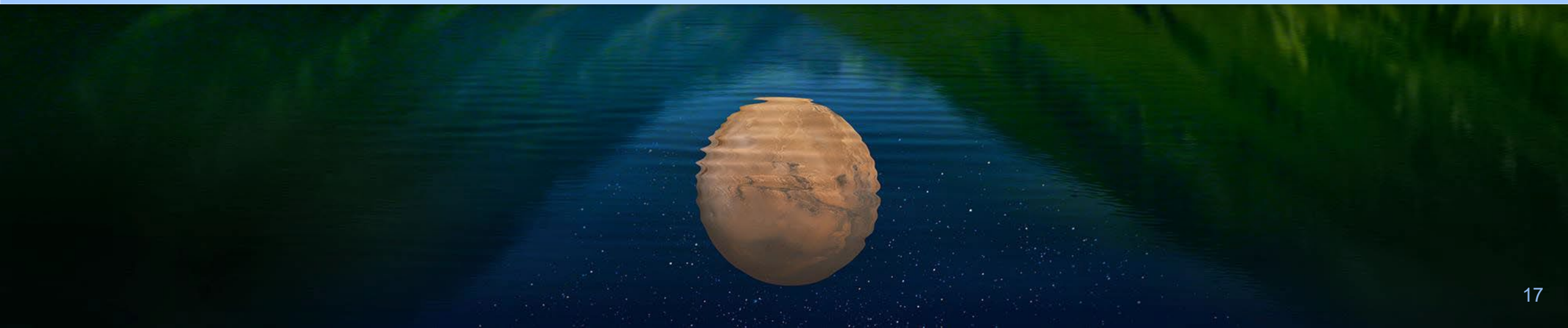
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Fatigue at NASA



"The willingness of NASA employees, in general, to work excessive hours, while admirable, raises serious questions when it jeopardizes job performance, particularly when critical management decisions are at stake."



The report of the Presidential Commission on the Space Shuttle Challenger Accident

Safety Culture Survey Examples

"I was working on a project that required long hours overnight. I voiced a safety concern associated to the lack of a Fatigue Management Process (e.g., scheduling breaks, educating people on the risks associated to lack of sleep, etc...) and the Team Lead wanted to remove me from the team."

"When I voiced safety concerns associated to fatigue, I had to discuss the issue with the ombudsman. We got some change, but at a very high emotional cost."

"People are invariably asked to spend too many hours over and above their "regular week" to meet objectives especially during flight project testing. Fatigue is a serious challenge."

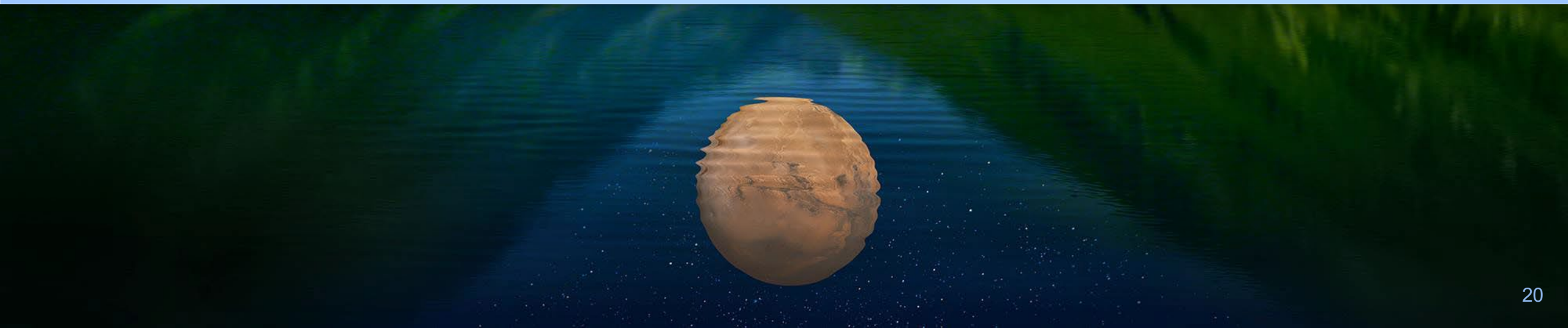
"Fatigue and burnout are a constant worry."

"There are many instances that I have witnessed where project management pressures teams to try to meet impossible schedules/ deliveries…One of the most recurring safety issues that I witness is overwork/ fatigue of employees who are handling/ testing flight hardware (and have to drive to/ from work after 10-16 hour days)…we have a continual issue with under staffing projects and then just expecting the team on the floor to "make it happen"."





Fatigue Countermeasures



Fatigue Countermeasures

Policy: NPR 1800.1E provides guidance on schedule limitations for NASA workers; additional Fatigue Risk Management policies may need to be created

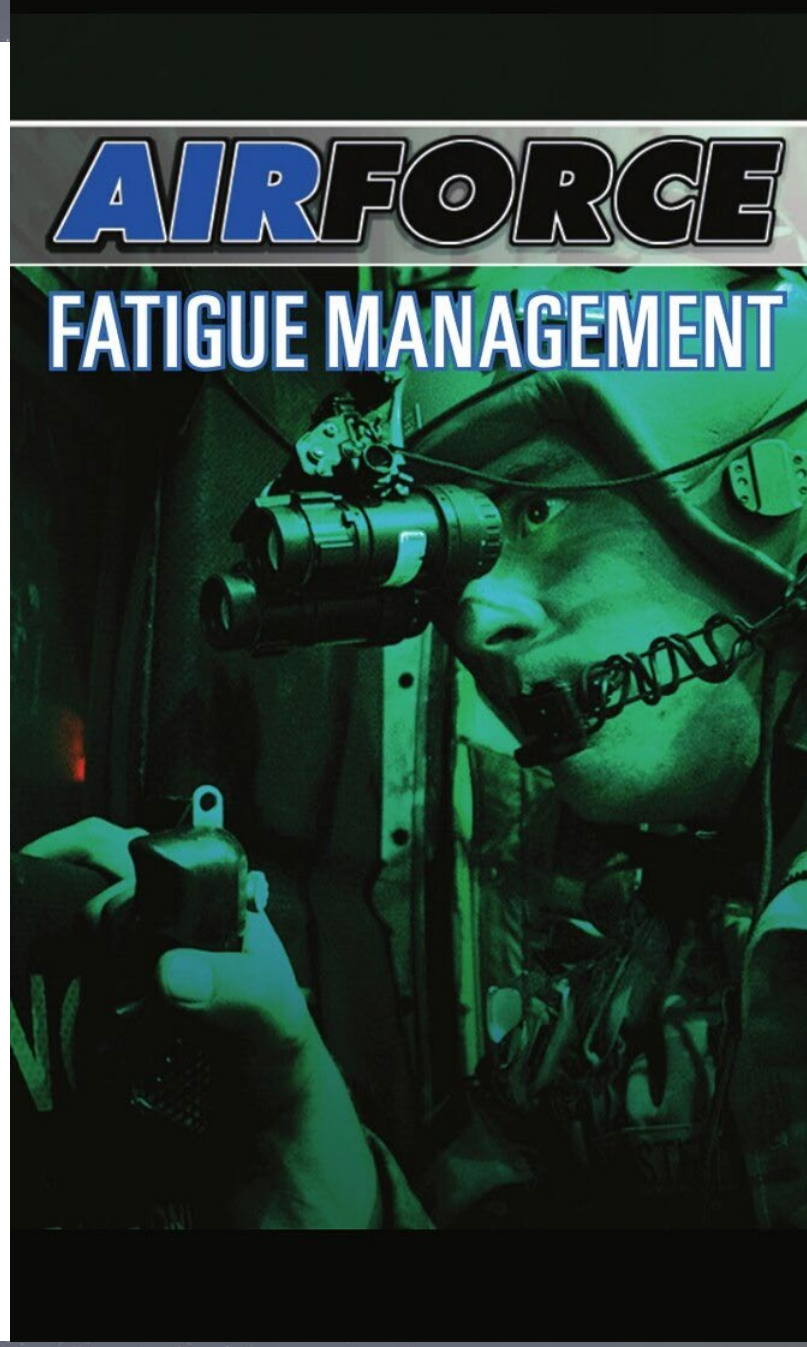
Continuous Monitoring: Employees working non-traditional schedules should be monitored to ensure that policies, scheduling practices and training are effective in mitigating fatigue

Training: Employees must be provided with Fatigue Risk Management training

Reporting: Employees should be provided with a mechanism for reporting fatigue

Non-Punitive: Employees should not be punished in any way for reporting fatigue

Dual Responsibility: Employers have a responsibility to practice these core fatigue risk management principles; employees have a responsibility to use the tools and countermeasures provided to them





Listen/Look for:

- ❑ Issues associated with trying to maintain cost effective program
- ❑ Staffing complaints
- ❑ Repeated missed details/overlooked “small” things
- ❑ Hit a breaking point
- ❑ Decreased productivity/performance
- ❑ Cumulative fatigue

Table 1. Physical, mental, and emotional fatigue symptoms

Physical Symptoms	Mental Symptoms	Emotional Symptoms
• Slowed reaction time • Lack of energy, weakness, or light headedness • Repeated yawning • Heavy eyelids • Eye rubbing • Nodding off or head bobbing • Microsleeps • Headaches, nausea, or upset stomach	• Difficulty concentrating on tasks • Lapses in attention • Failure to communicate important information • Failure to anticipate events or actions • Making mistakes even on well-practiced tasks • Forgetfulness • Difficulty thinking clearly • Poor decision making	• More quiet or withdrawn than normal • Lack of motivation to do the task well • Irritable or grumpy with colleagues, family, or friends • Low morale • Heightened emotional sensitivity

FAA Research: Avers and Johnson, 2011



Shift-Work Recommendations

- Twelve-hour shift maximum
- Avoid more than three successive night shifts
- Rotate shifts forward
- Allow minimum of 10 hours between shifts during high-tempo mission operations when stable schedules cannot be accommodated
- Limit overtime to maximum of 16 hours
- Plan regular breaks
- Avoid circadian misalignment



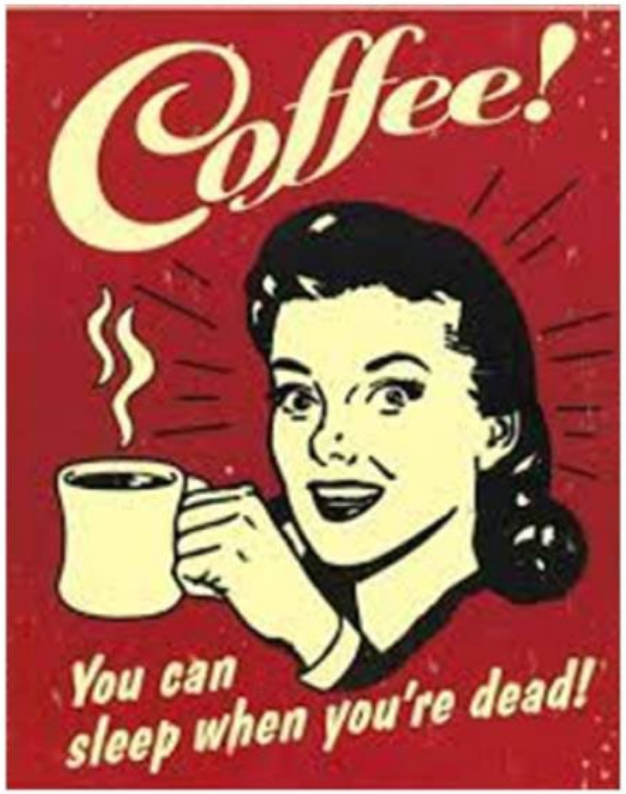


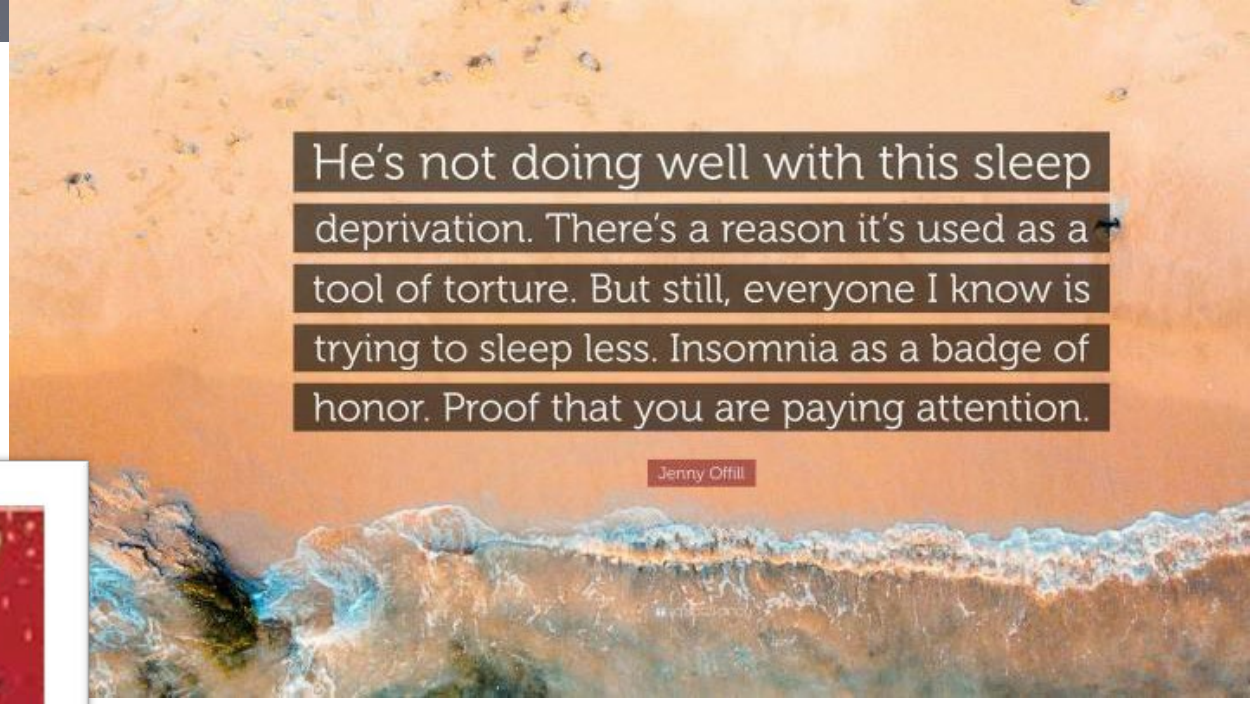
Countermeasures

- ❑ Caffeine
- ❑ Naps
- ❑ Specialized lighting
- ❑ Sleep shifting schedules
- ❑ Teamwork
- ❑ Find ways to fight fatigue
- ❑ Recognize the causes and the consequences
- ❑ Create an atmosphere where individuals can share concerns

The wrong message:



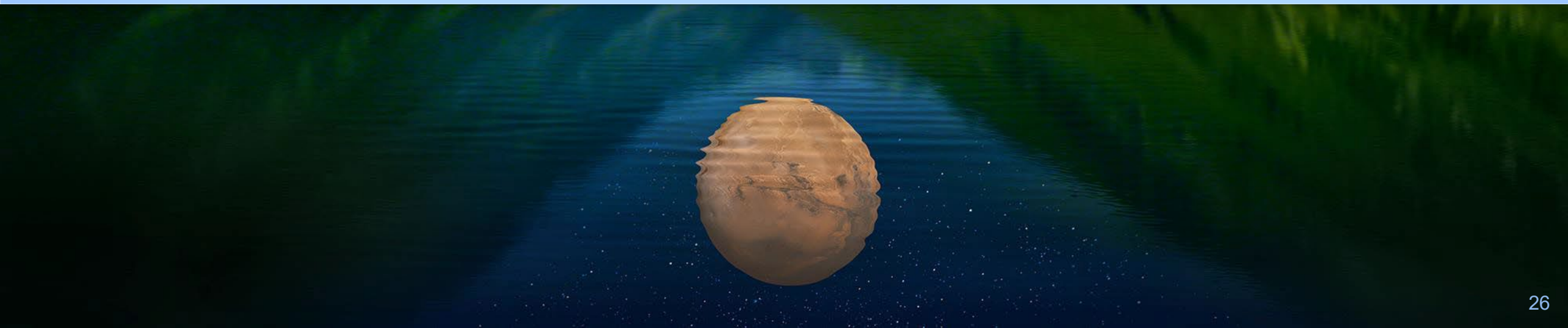








Fatigue Resources



Resources



Apps:

CBT-i

Sleep Cycle

HEADSPACE

Websites:

AASM American Academy of SLEEP MEDICINE (www.aasm.org)

National Sleep Foundation (www.thensf.org)

WOOLCOCK LEADERS IN BREATHING & SLEEP RESEARCH (www.woolcock.org.au)

NASA Safety Center Resources



Employees Seem Fatigued?

https://nsc.nasa.gov/news/detail/employees-seem-fatigued

We've all had our fair share of days where we feel a little tired, worn out or low energy, but as a manager or supervisor, it's important that you understand the causes and consequences of fatigue so that you can help keep employees alert while at work. Minimizing fatigue is essential for a safe and healthy workforce.

Understanding Fatigue Causes, Consequences and Countermeasures — for Managers

https://nsc.nasa.gov/news/detail/understanding-fatigue-causes-consequences-and-countermeasures-for-managers

Fatigue can be caused by everything from sleep loss to circadian misalignment to poor sleep quality, and it may have a significant impact on a person's health and ability to work productively and safely. As a supervisor, learn to recognize the causes and consequences of fatigue in your employees.

Understanding Fatigue Causes, Consequences and Countermeasures — for Employees

https://nsc.nasa.gov/features/detail/understanding-fatigue-causes-consequences-and-countermeasures-for-employees

Fatigue can be caused by everything from sleep loss to circadian misalignment to sleep quality, and it may have a significant impact on your health and ability to work productively and safely. By recognizing the signs of fatigue in yourself and others and developing positive sleep patterns, you can do your part to help prevent worst-case scenarios.

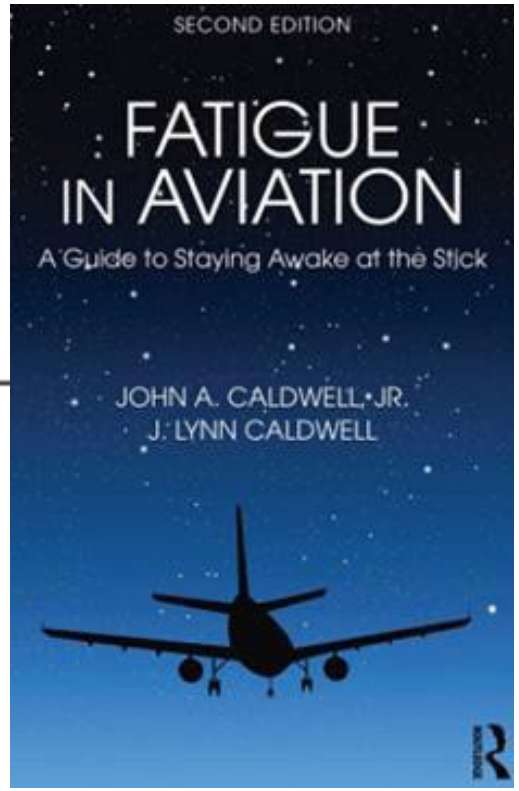


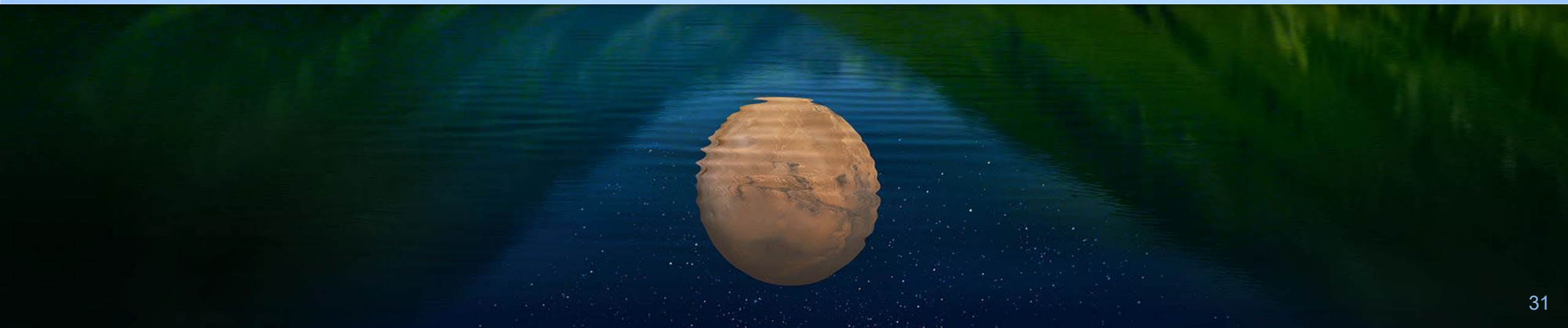
Table 10.1 Sleep habits that lead to better sleep

- Stick to a consistent wakeup and bedtime every day of the week;
- use the bedroom only for sleep and sex;
- resolve daily dilemmas outside of the bedroom;
- establish a bedtime routine;
- establish an aerobic exercise routine and stick to it;
- create a quiet and comfortable sleep environment;
- don't be a clock watcher;
- avoid the use of mobile phones and computers close to bedtime;
- don't consume caffeine within four hours of bedtime;
- don't use alcohol as a sleep aid;
- don't take naps during the day (if you have trouble sleeping at night);
- don't smoke cigarettes immediately before bedtime;
- get out of bed and go to another room if sleep doesn't come in 30 minutes.


Go to Sleep
Sleep is the only true cure for fatigue
Fatigue tolerance occurs when we become used to, and may not recognize, decreased cognitive performance



QUESTIONS?



References



1. NPR 1800.1E, NASA Occupational Health Procedures
2. United States Government Accountability Office Report to the Committee on Armed Services, House of Representatives, *Navy Readiness: Additional Efforts Are Needed to Manage Fatigue, Reduce Crewing Shortfalls, and Implement Training*, May 2021
3. Dawson, D., Reid, K. Fatigue, alcohol and performance impairment. *Nature* **388**, 235 (1997).
4. Van Dongen HPA et al. (2003). The cumulative cost of additional wakefulness: Dose-response effects on neurobehavioral functions and sleep physiology from chronic sleep restriction and total sleep deprivation. Sleep, 28: 117-126.

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THANK YOU!

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- Dec. 2, 2026 – QLF Virtual Series: IMAP Lessons Learned

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