



NTSB National Transportation Safety Board

Managing Fatigue to Enhance Transportation Safety: Challenges and Opportunities

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Internal Medicine Grand Rounds
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UNITED STATES CODE, TITLE 49
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SUBCHAPTER 5—GENERAL

§1181. Definitions

Section 40102(a) of this title applies to this chapter.

SUBCHAPTER 6—ORGANIZATION AND ADMINISTRATIVE

§1113. General organization

(1) ORGANIZATION.—The National Transportation Safety Board is an independent establishment of the Executive Branch of the Government.

(2) APPOINTMENT OF MEMBERS.—The Board is composed of 5 members appointed by the President, with the advice and consent of the Senate. Not more than 3 members may be appointed from the same political party. The members shall be appointed on the basis of technical qualification, professional standing, and demonstrated knowledge of accident reconstruction, safety engineering, human factors, transportation safety, or transportation regulation.

(3) TERMS OF OFFICE AND REMOVAL.—The term of office of each member is 7 years. An individual may be reappointed to fill a vacancy occurring before the expiration of the term for which the predecessor of that individual was appointed for the remainder of that term. When the term of office of a member ends, the President may appoint a successor if a successor is appointed and qualified. The President may remove a member for inefficiency, neglect of duty, or other cause.

(4) CHAIRMAN AND VICE CHAIRMAN.—The President shall designate, by and with the advice and consent of the Senate, a Chairman of the Board. The President also shall designate a Vice Chairman of the Board. The terms of both the Chairman and Vice Chairman are 2 years. When the Chairman is absent or unable to perform the duties of the office, the Vice Chairman shall perform the duties of the office.

Mission

The NTSB is charged with:

- 1) determining the probable cause of transportation accidents
- 2) making recommendations to prevent their recurrence



The NTSB is Responsible for Investigating:

**Aviation, highway, rail, marine, pipeline,
and hazardous material accidents**



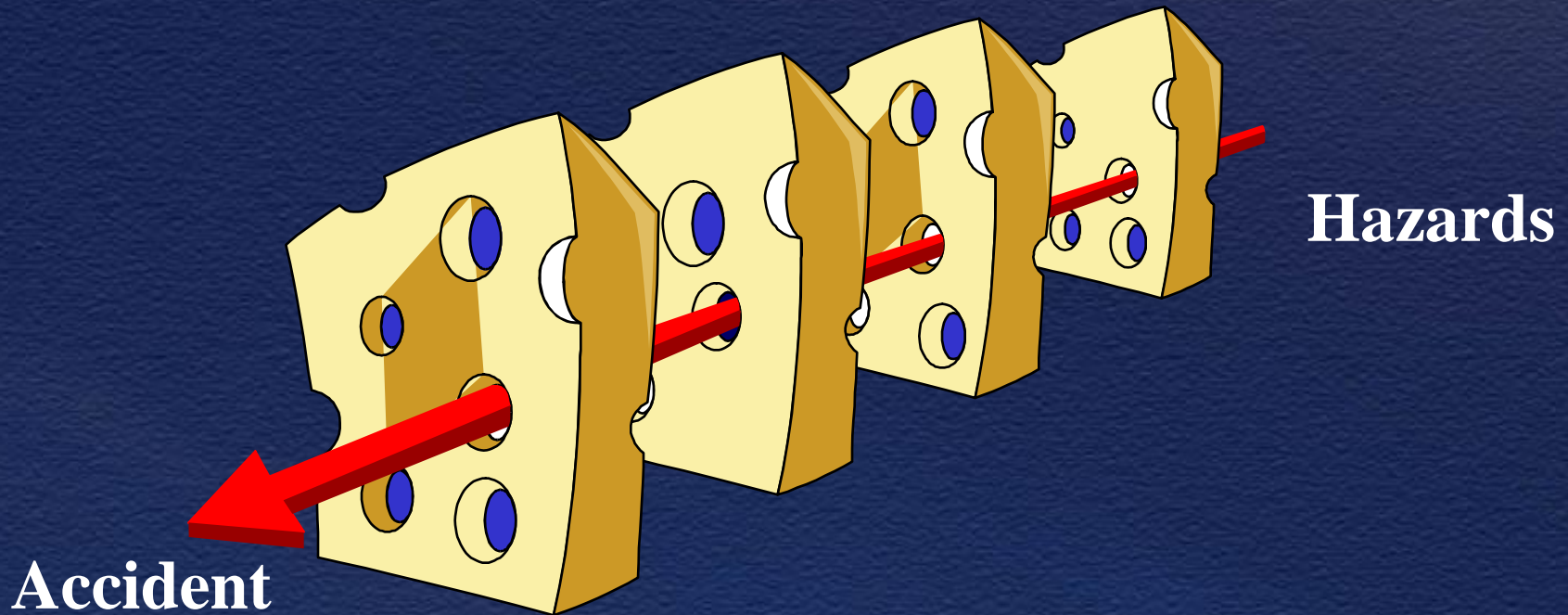
PG&E/San Bruno Gas Pipeline Explosion





- 130,000+ accident investigations
- ~13,500 safety recommendations
 - 82% acceptance rate

“Swiss Cheese” Model (Reason)



Successive layers of defenses, barriers, and safeguards

Honorable John K. Lauber:

No Accident \neq
Safe Operation

Guantanamo Bay Cuba

First NTSB aviation accident to cite fatigue as probable cause

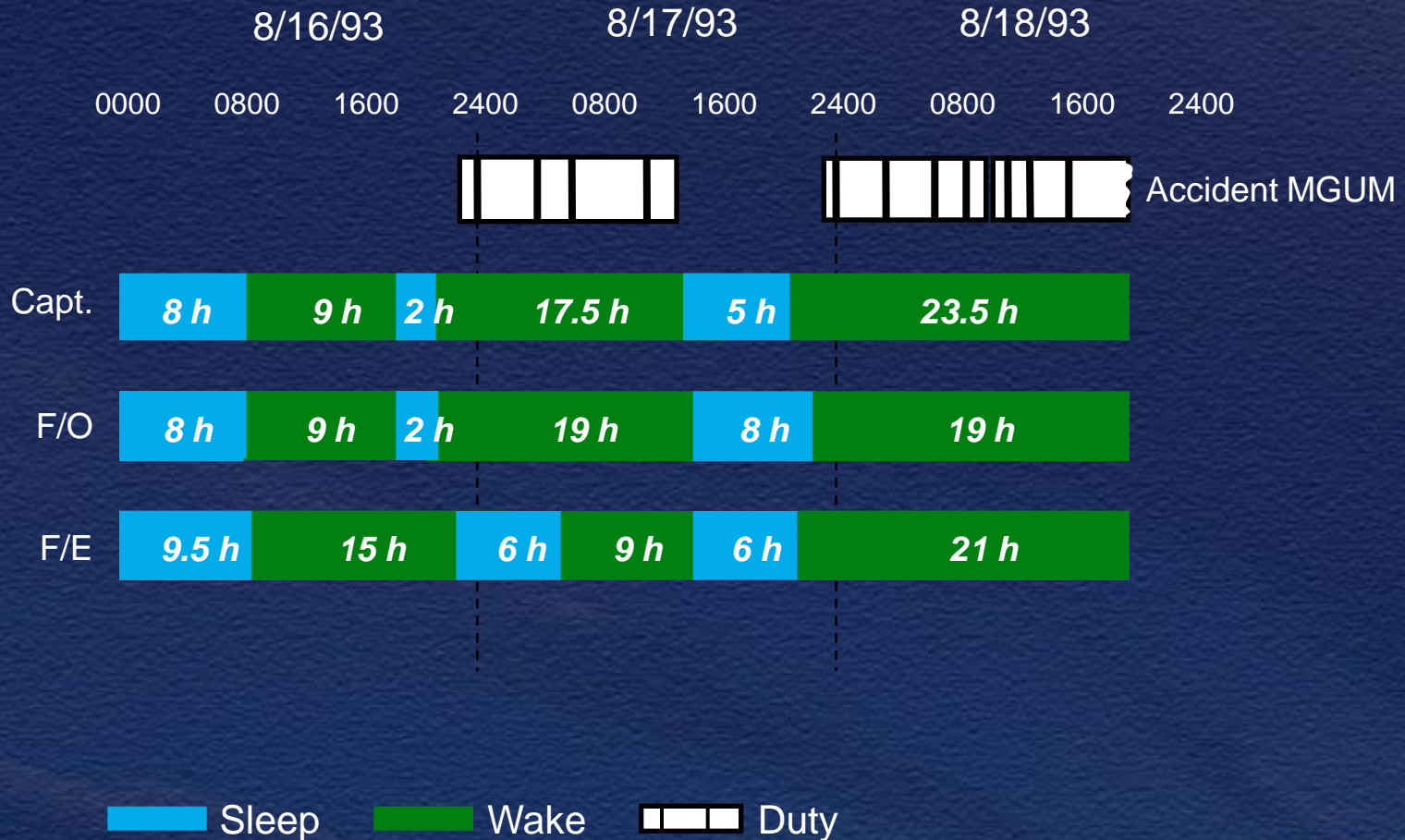


- acute sleep loss, sleep debt, circadian disruption

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Crew Sleep History



Observed Performance Effects

- Degraded decision-making
- Visual/cognitive fixation
- Poor communication/coordination
- Slowed reaction time

**Uncontrolled In-Flight Collision with Terrain
AIA Flight 808, Douglas DC-8-61, N814CK
U.S. NAS, Guantanamo Bay, Cuba, August 18, 1993**

“The National Transportation Safety Board determines that the probable causes of this accident were the impaired judgment, decision making, and flying abilities of the captain and flight crew due to the effects of fatigue...”

10 fatalities
3 serious injuries
2 minor injuries
5 no injuries

**Ford
Windstar**



**Hyundai
Sonata**

**Kia
Spectra**

Source: Oklahoma State Police

Probable Cause (fatigue)

“ . . . driver’s fatigue, caused by the combined effects of acute sleep loss, circadian disruption associated with his shift work schedule, and mild sleep apnea, which resulted in the driver’s failure to react to slowing and stopped traffic ahead by applying the brakes or performing any evasive maneuver to avoid colliding with the traffic queue. . . . ”



**National
Transportation
Safety Board**

Track Path Animation

Collision Between Two BNSF Railway Freight Trains
Red Oak, Iowa
April 17, 2011
DCA11FR002

NTSB



Probable Cause (fatigue)

“ . . . failure of the crew of the striking train to comply with the signal indication requiring them to operate in accordance with restricted speed requirements and stop short of the standing train because they had fallen asleep due to fatigue resulting from their irregular work schedules and their medical conditions.”

Challenges of a 24/7 Society



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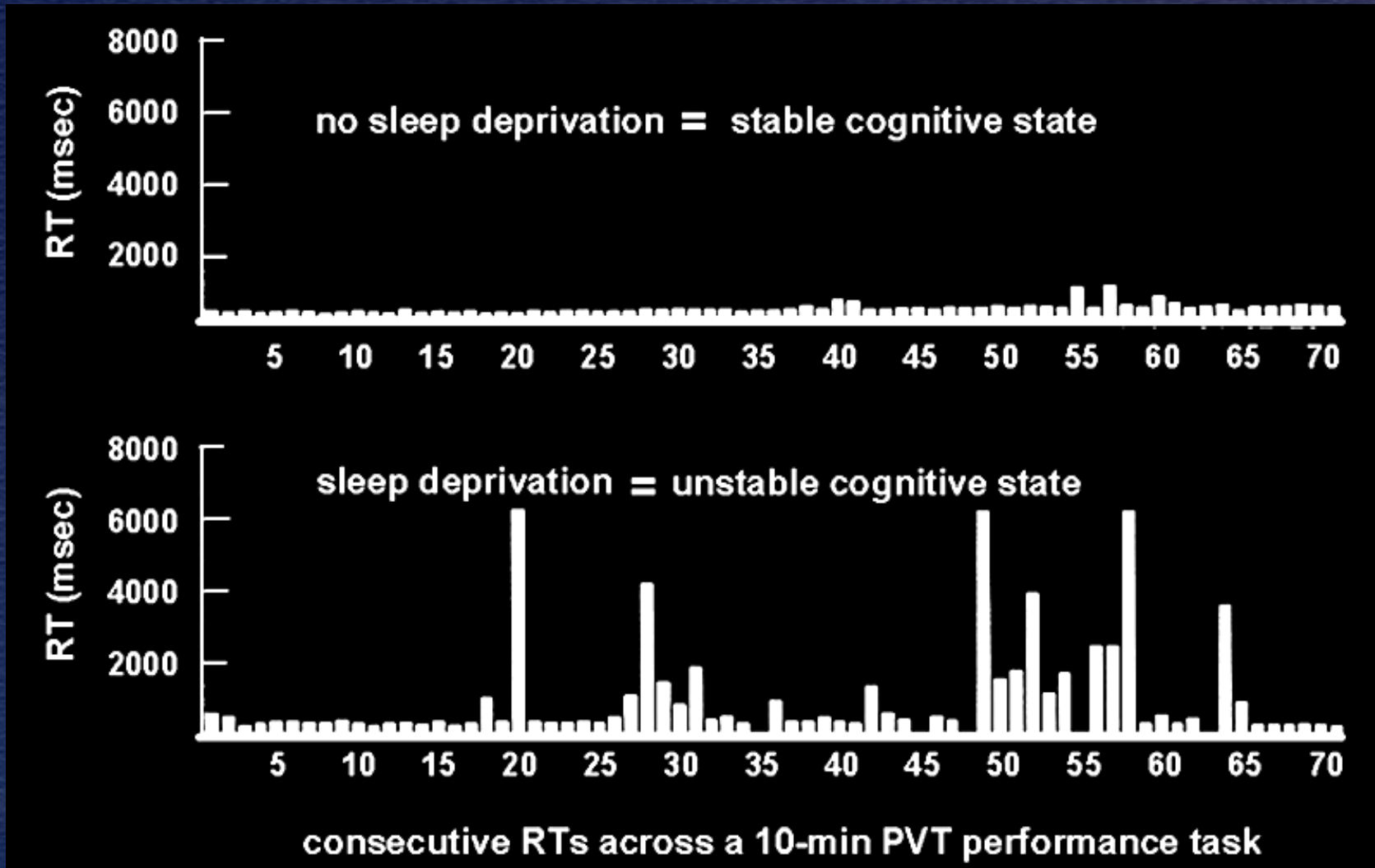
Fatigue Risks



Fatigue Risks

- degraded 20 – 50%+:
 - reaction time
 - memory
 - communication
 - situational awareness
 - judgment
 - attention
 - mood
- increased:
 - irritability
 - apathy
 - attentional lapses
 - microsleeps

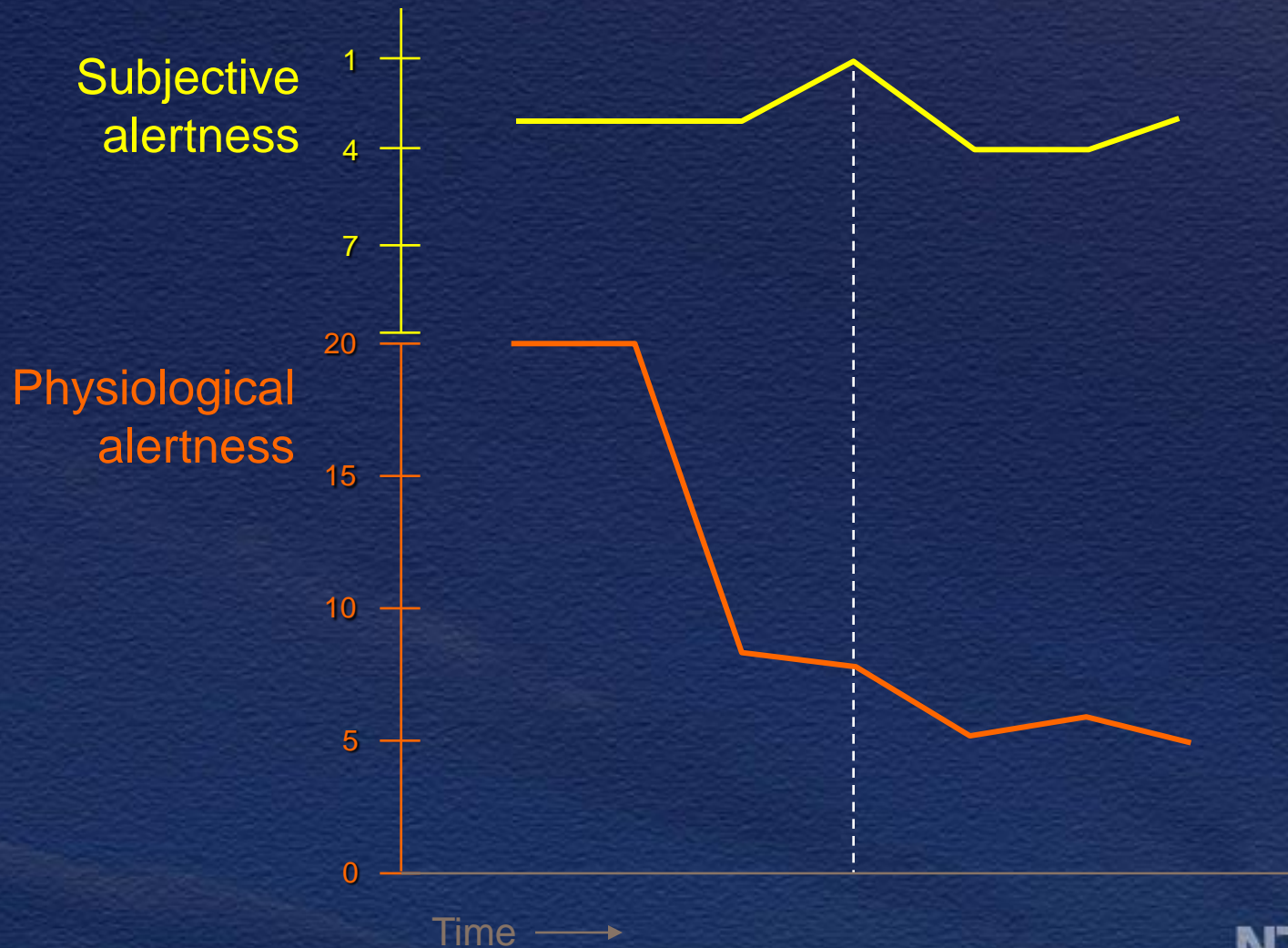
Fatigue and Reaction Times



Doran SM, Van Dongen HP, Dinges DF. Sustained attention performance during sleep deprivation: evidence of state instability. *Archives of Italian Biology: Neuroscience* 2001;139:253-267.



Alertness Reports Often Inaccurate



Adapted from Sasaki et al., 1986

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NTSB Most Wanted List




Critical changes needed to reduce transportation accidents and save lives.



NATIONAL TRANSPORTATION SAFETY BOARD

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Home > Transportation Safety > Most Wanted List

SHARE   

MOST WANTED LIST

A program to increase the public's awareness of, and support for, action to adopt safety steps that can help prevent accidents and save lives. The following are ten of the current issues.



Addressing Human Fatigue



General Aviation Safety



Safety Management Systems



Runway Safety



Bus Occupant Safety



Pilot & Air Traffic Controller Professionalism



Recorders



Teen Driver Safety



Addressing Alcohol- Impaired Driving



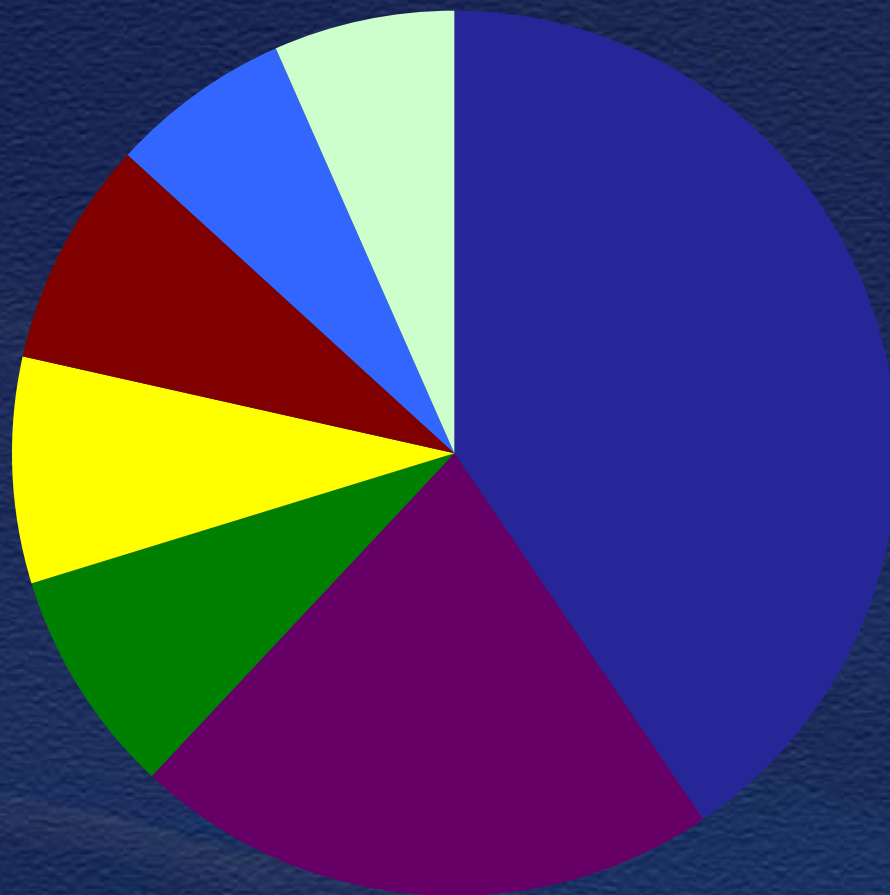
Motorcycle Safety



NTSB Recommendations

- MOST WANTED since 1990
- ~200 fatigue recommendations

Complex Issue: Requires Multiple Solutions



- Scheduling Policies and Practices
- Education
- Organizational Strategies
- Raising Awareness
- Healthy Sleep
- Vehicle and Environmental Strategies
- Research and Evaluation

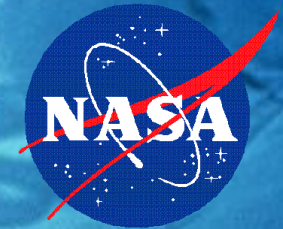
NTSB Recommendations: Education/Strategies

- Develop a fatigue education and countermeasures training program
- Educate operators and schedulers
- Include information on use of strategies: naps, caffeine, etc.
- Review and update materials

NTSB Recommendations: Education/Strategies

- Include information on use of strategies: naps, caffeine, etc.
- No recommendations on specific personal strategies

Example: NASA Planned Rest Study



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NTSB Recommendations: Hours of Service / Scheduling

- Science-based hours of service
- Allow for at least 8 hours of uninterrupted sleep
- Reduce schedule irregularity and unpredictability

NTSB Recommendations:

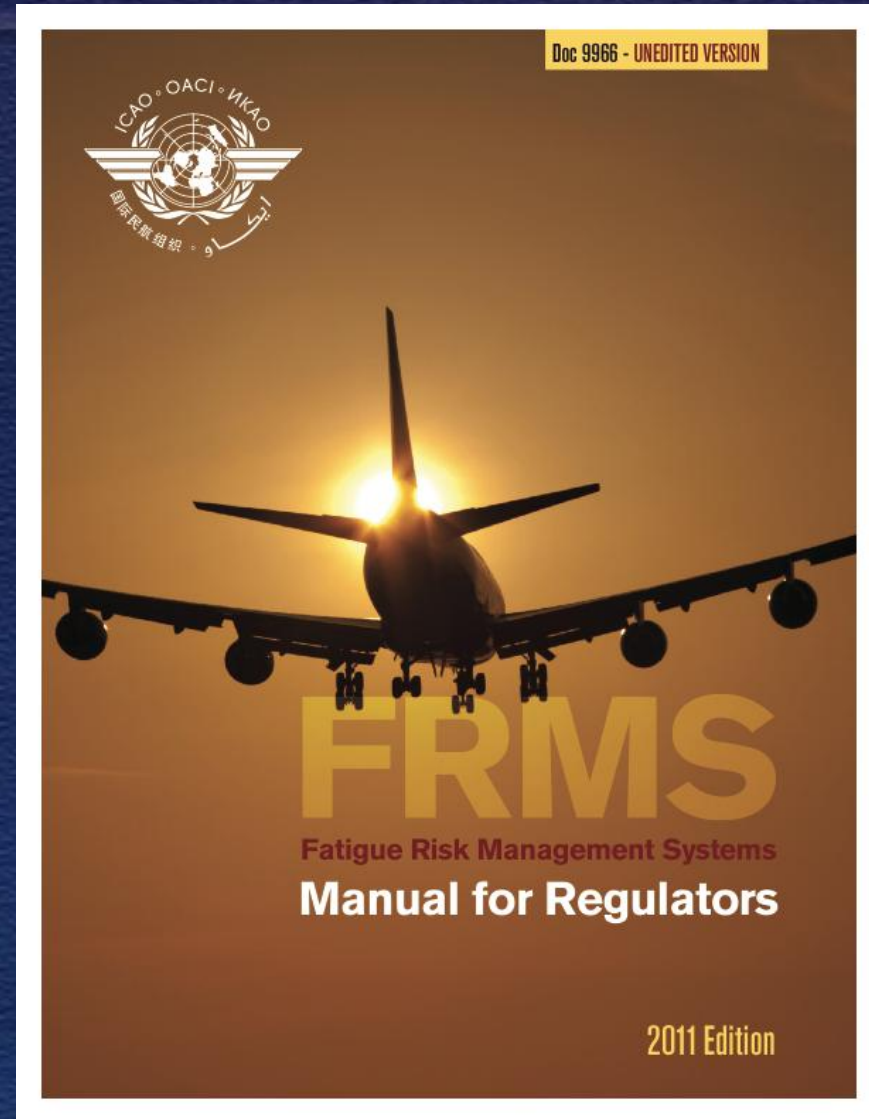
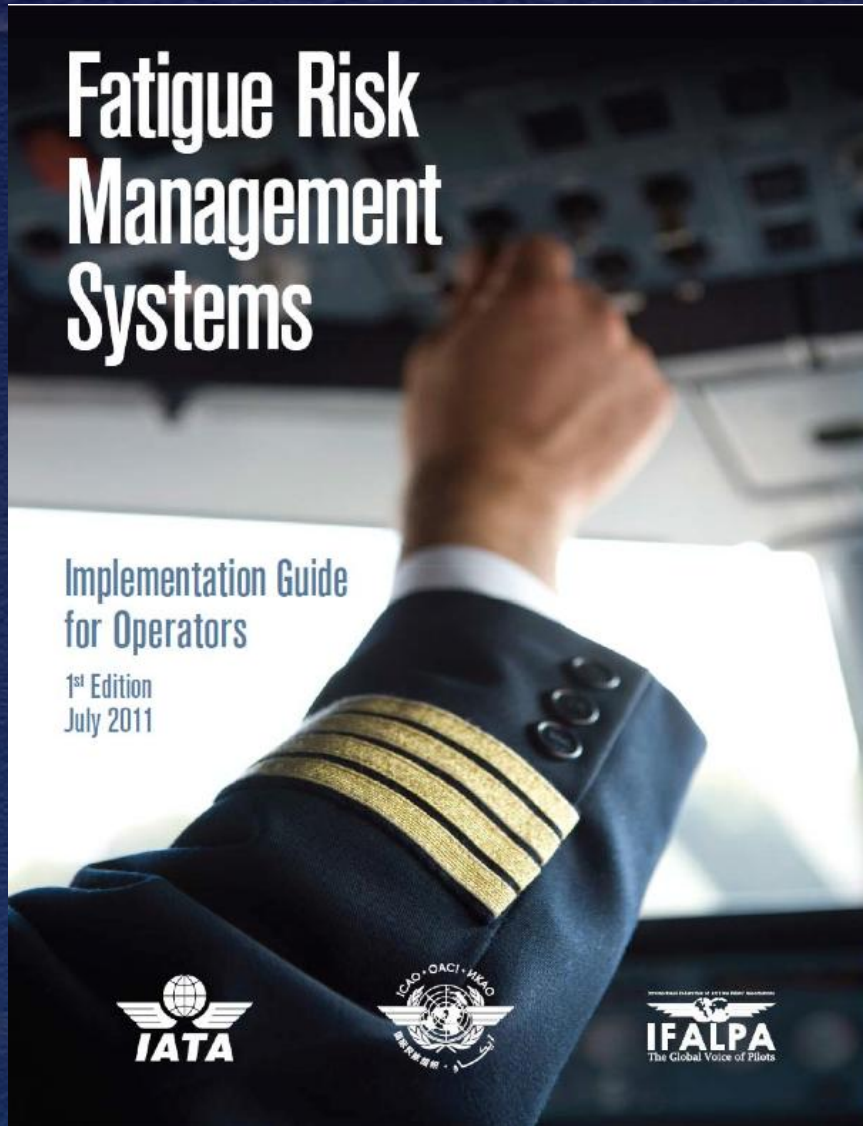
Sleep Apnea/Health Related

- Develop standard medical exam to screen for sleep disorders; require its use
- Educate companies and individuals about sleep disorder detection and treatment, and the sedating effects of certain drugs
- Ensure drivers with apnea are effectively treated before granting unrestricted medical certification

NTSB Recommendations: Fatigue Management Systems

- Develop guidance based on empirical and scientific evidence for operators to establish fatigue management systems
- Develop and use a methodology that will continually assess the effectiveness of fatigue management systems

Aviation Example



Success requires . . .

A culture change that supports
different attitudes and behaviors

Changing Safety Culture

Safety goal . . .

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