NTSB National Transportation Safety Board

Managing Fatigue in Helicopter Operations: Risks and Recommendations

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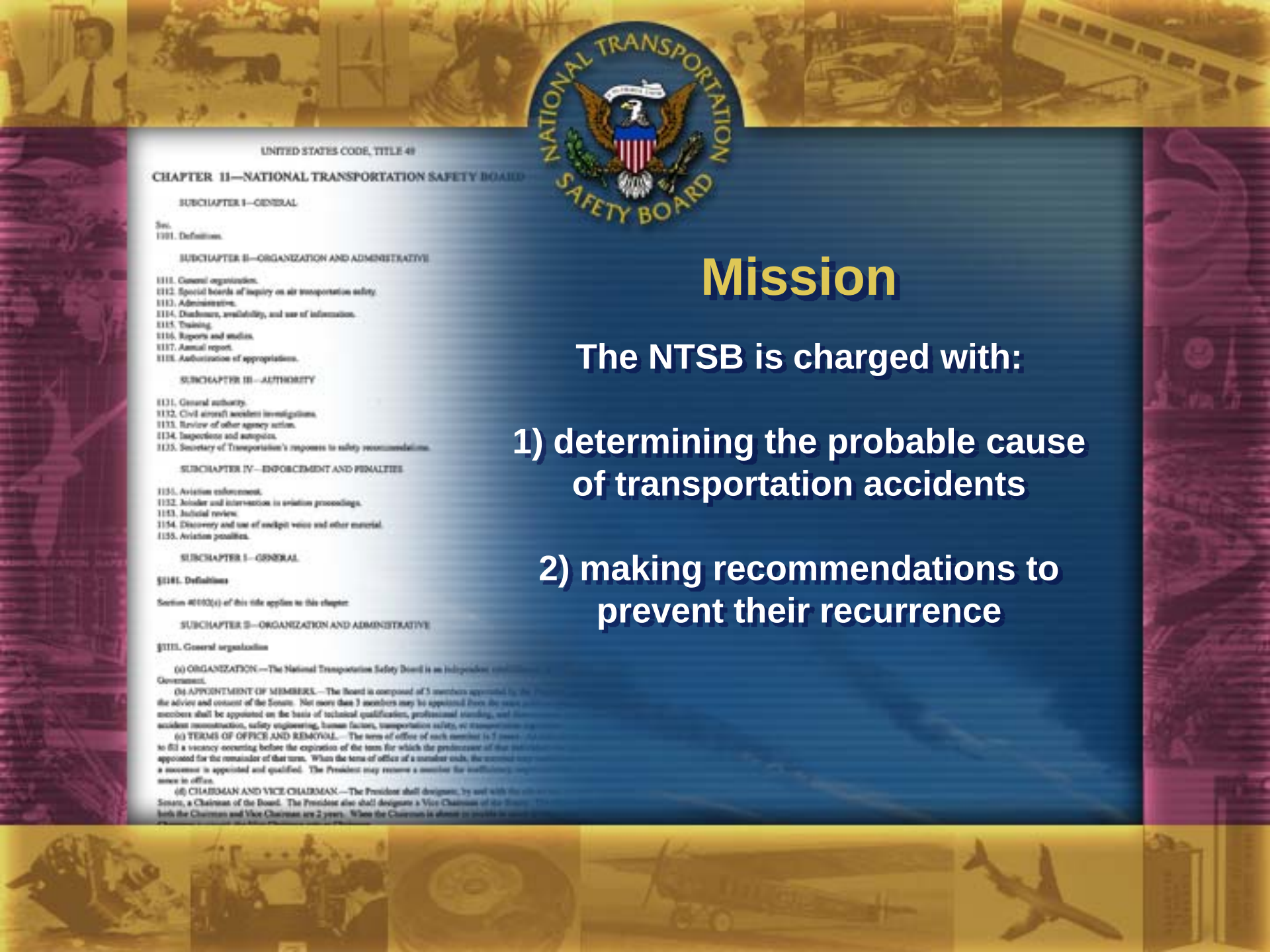
Board Member

HELI-EXPO
February 11, 2012



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

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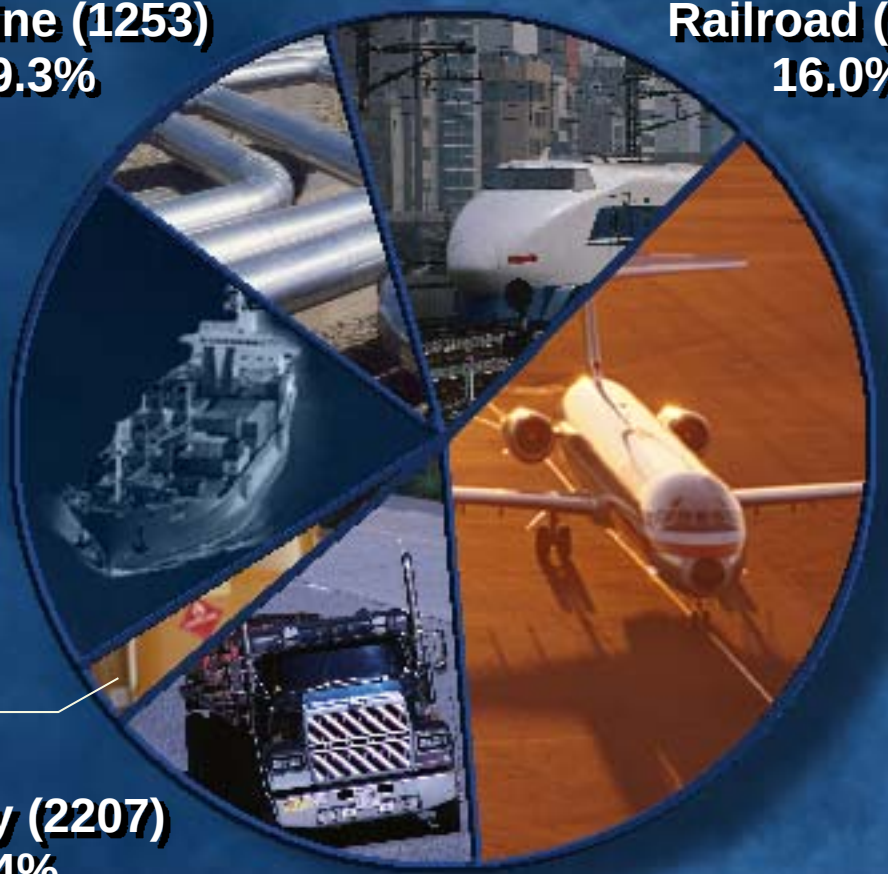
- 130,000+ accident investigations
- ~13,500 safety recommendations
- 82% acceptance rate

13,454 Safety Recommendations issued since 1967

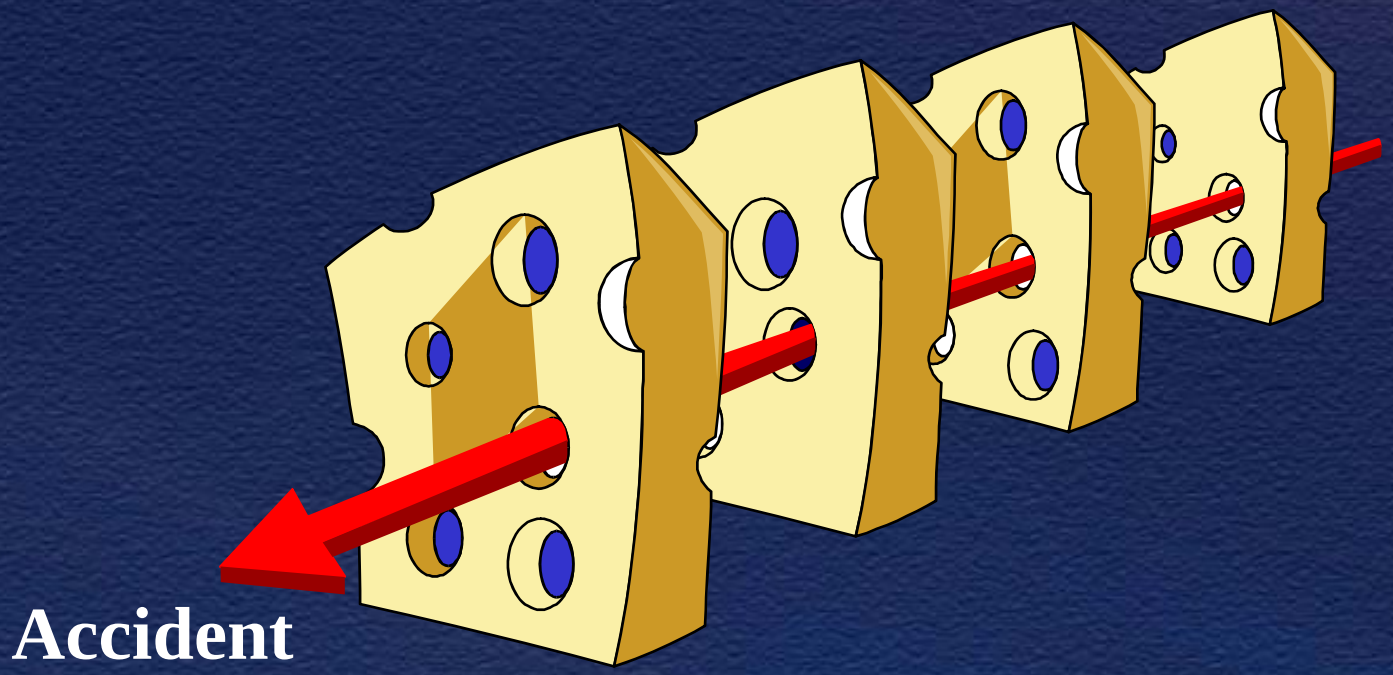


Rev: July 1, 2011

Major product: safety recommendations

Moral compass and industry conscience

“Swiss Cheese” Model (Reason)



Successive layers of defenses, barriers, and safeguards

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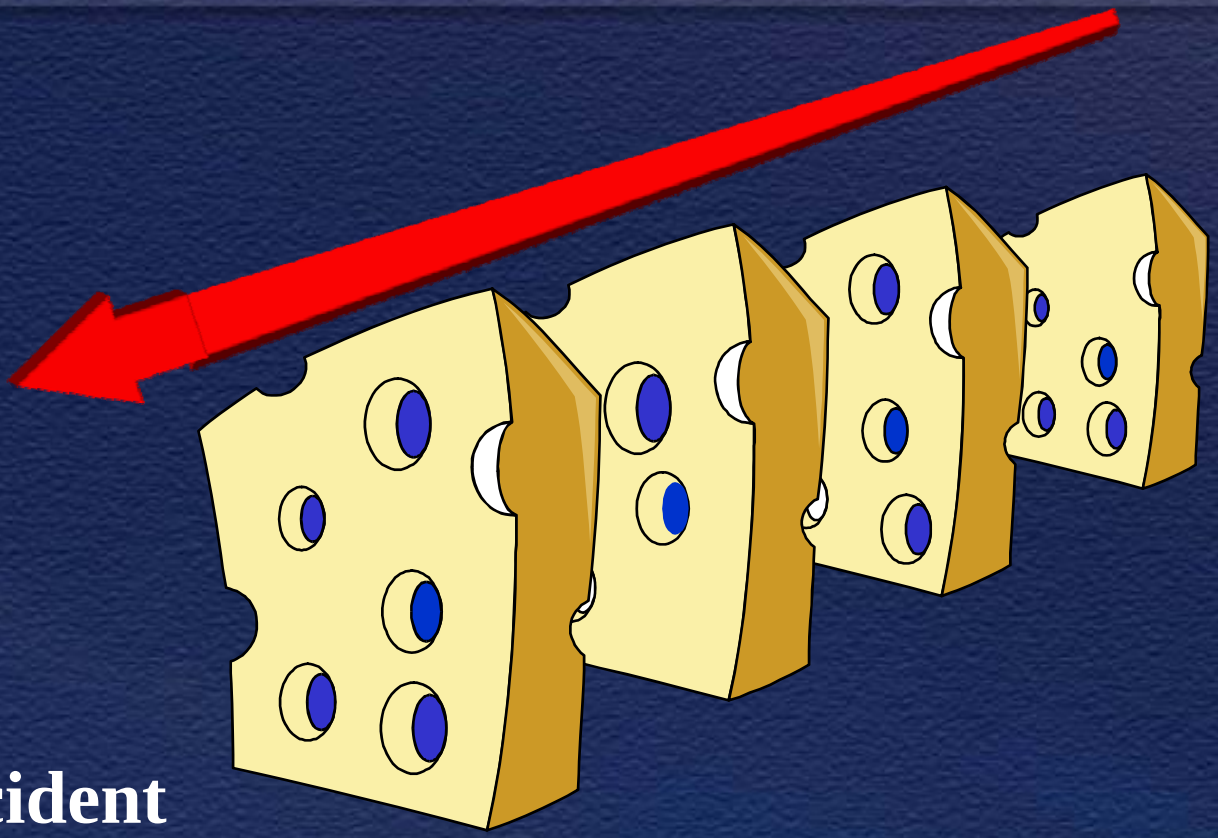
The Challenge (Haueter)



Successive layers of defenses, barriers, and safeguards

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Fatigue in Helicopter Operations

- Risks
- Fatigue factors
- NTSB recommendations

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Honorable John K. Lauber:

No Accident ≠

Safe Operation

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Kalaheo, Hawaii (September 24, 2004)

5 fatalities

Contributing Factors (Fatigue)

“operator’s pilot-scheduling practices that likely had an adverse impact on pilot decision-making and performance”

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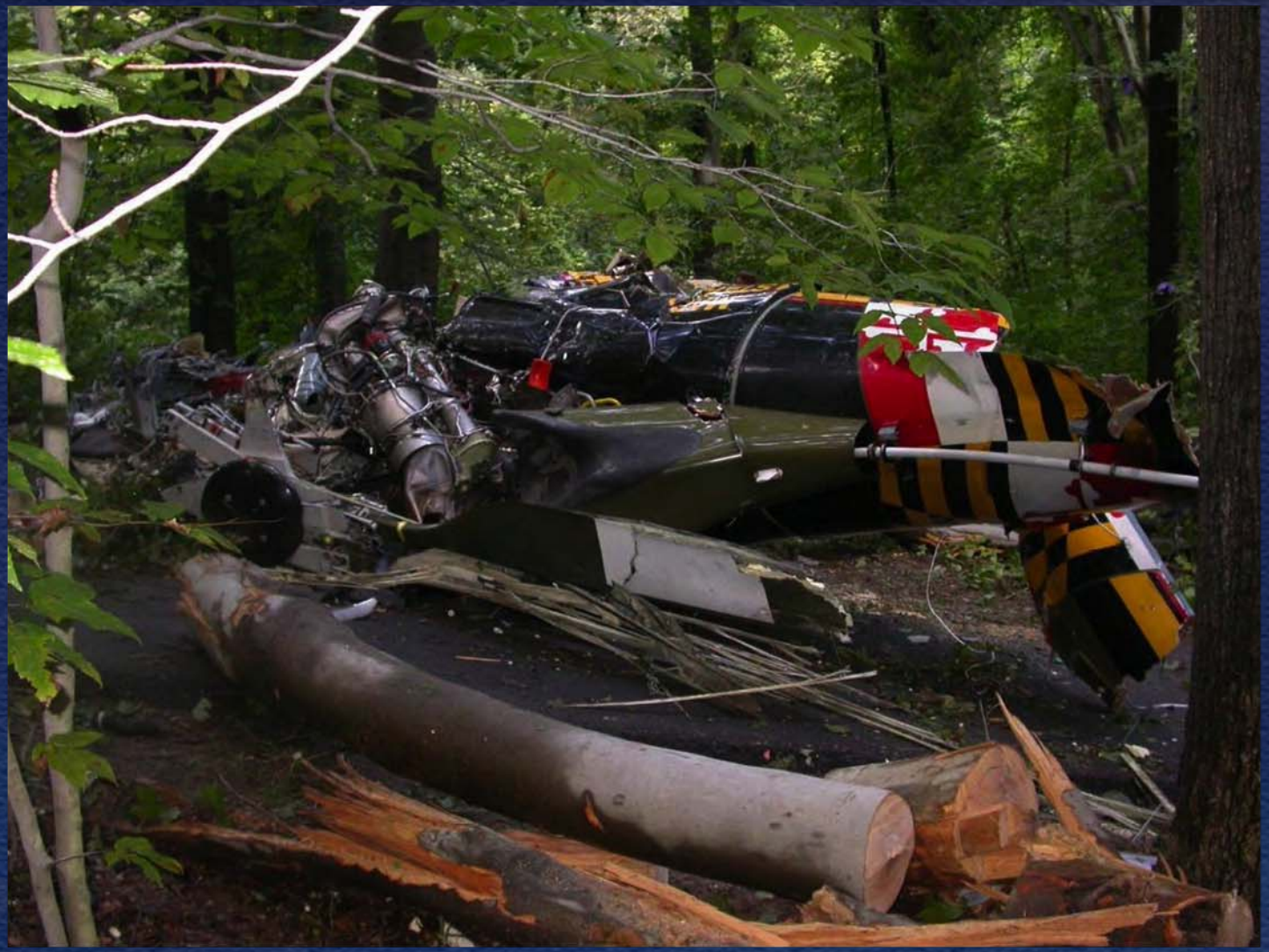
District Heights, Maryland (September 27, 2008)



4 fatalities, 1 serious injury

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Finding #17 (Fatigue)

"Based on the late hour, the length of time awake, the risk factors for sleep apnea exhibited by the pilot, and the decision to deviate from the published procedures, the pilot was likely less than fully alert, and fatigue may have contributed to his deficient decision-making."

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Santa Fe, NM (June 9, 2009)

2 fatalities, 1 serious injury

Contributing Factors (Fatigue)

. . . “the pilot’s fatigue” . . .

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Fatigue Risks

Fatigue can degrade every aspect of human capability.

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Fatigue Risks

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Performance Reduced 20-50+%

Reaction time

Memory

Communication

Judgment

Attention

Mood

Impaired mood

Situational awareness

Concentration

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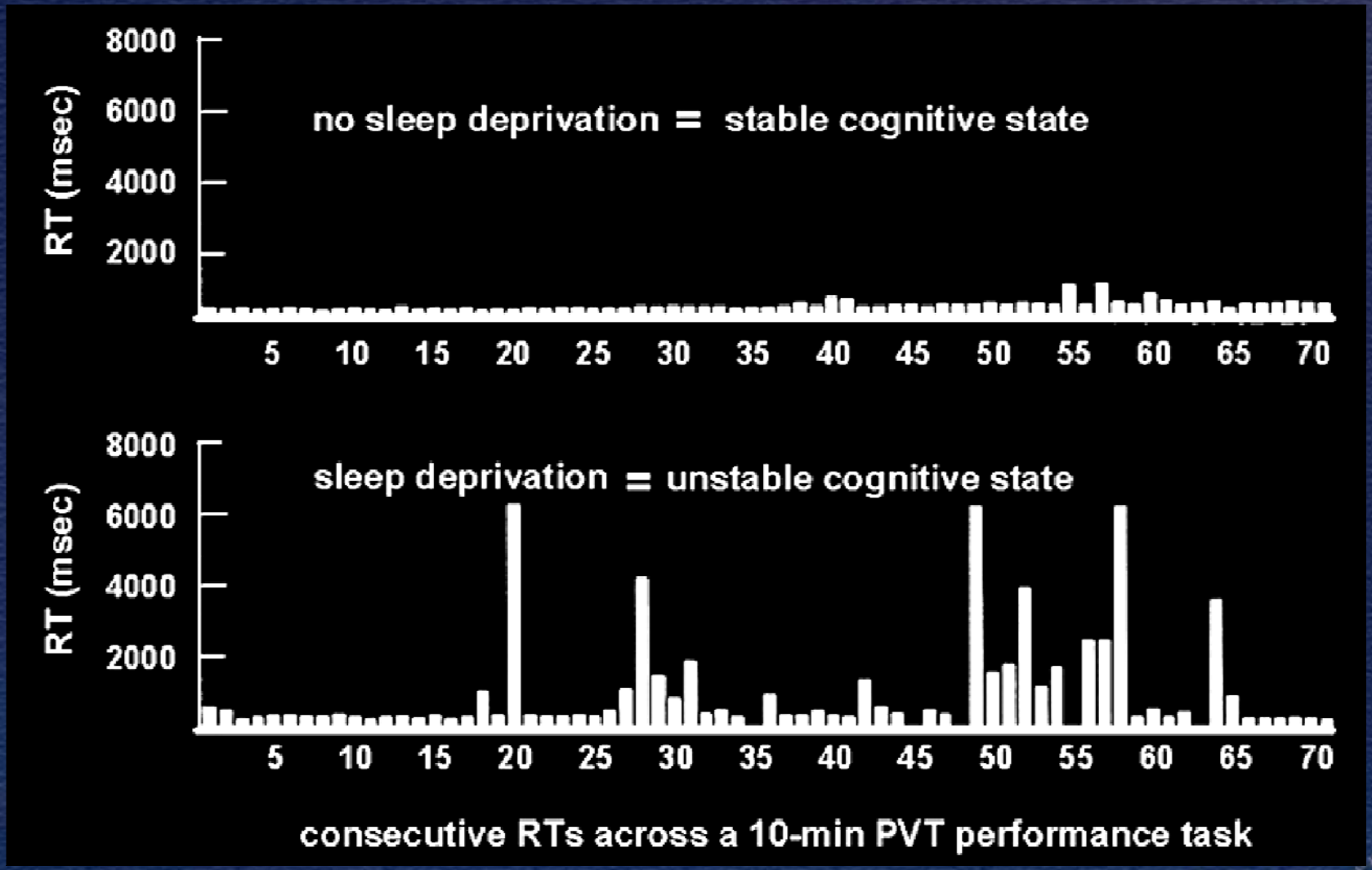
Fatigue and Reaction Times



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.

Fatigue Factors

- sleep
  - acute sleep loss
  - cumulative sleep debt
- circadian clock
- hours awake
- sleep disorders

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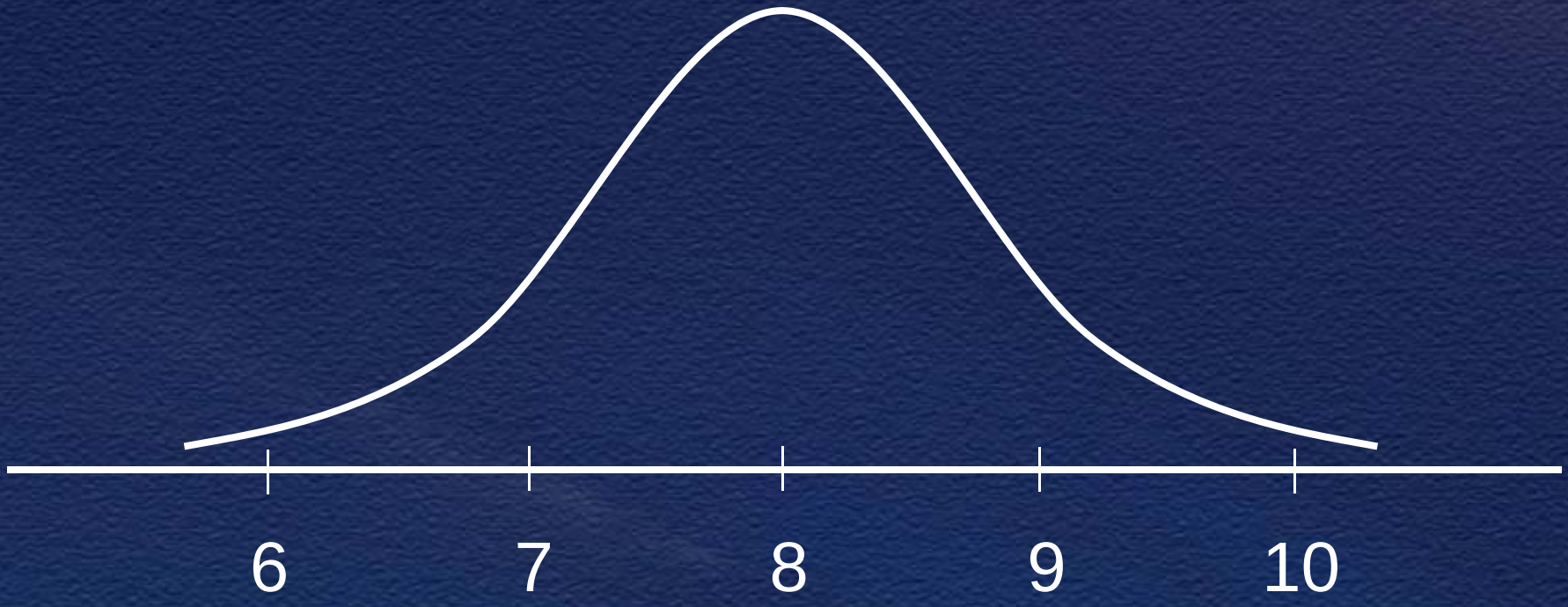
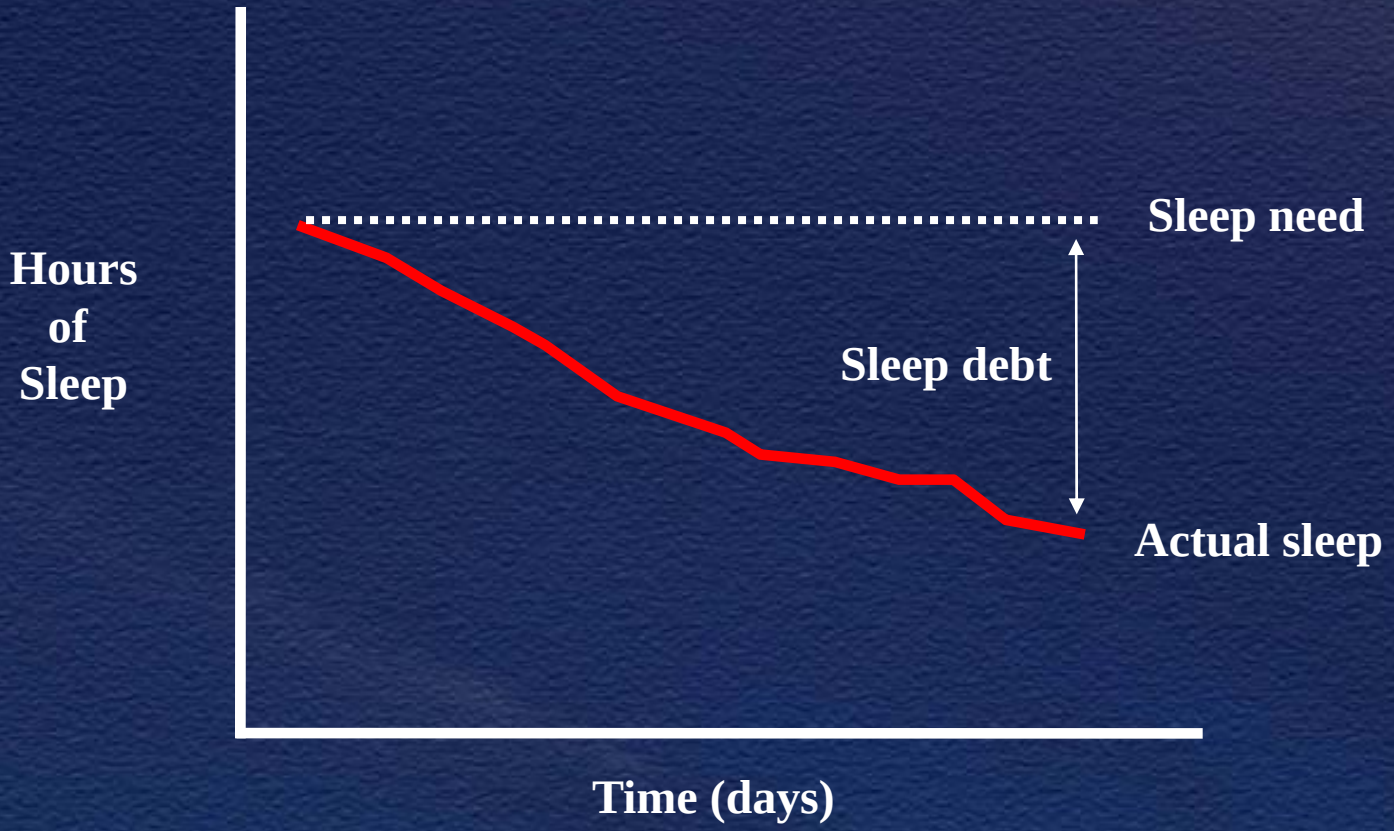
Sleep Requirement



Cumulative Sleep Debt



Sleep Need – Actual Sleep = Sleep Debt

Sleep debt grows cumulatively over time

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Fatigue Factors

- sleep
- circadian clock
  - ‘sleepy’ windows
  - ‘alert’ windows
  - irregular schedule
  - time zones
- hours awake
- sleep disorders

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Fatigue Factors

- sleep
- circadian clock
- hours awake
  - > 12 hrs
  - > 16 hrs
  - 24 hrs
- sleep disorders

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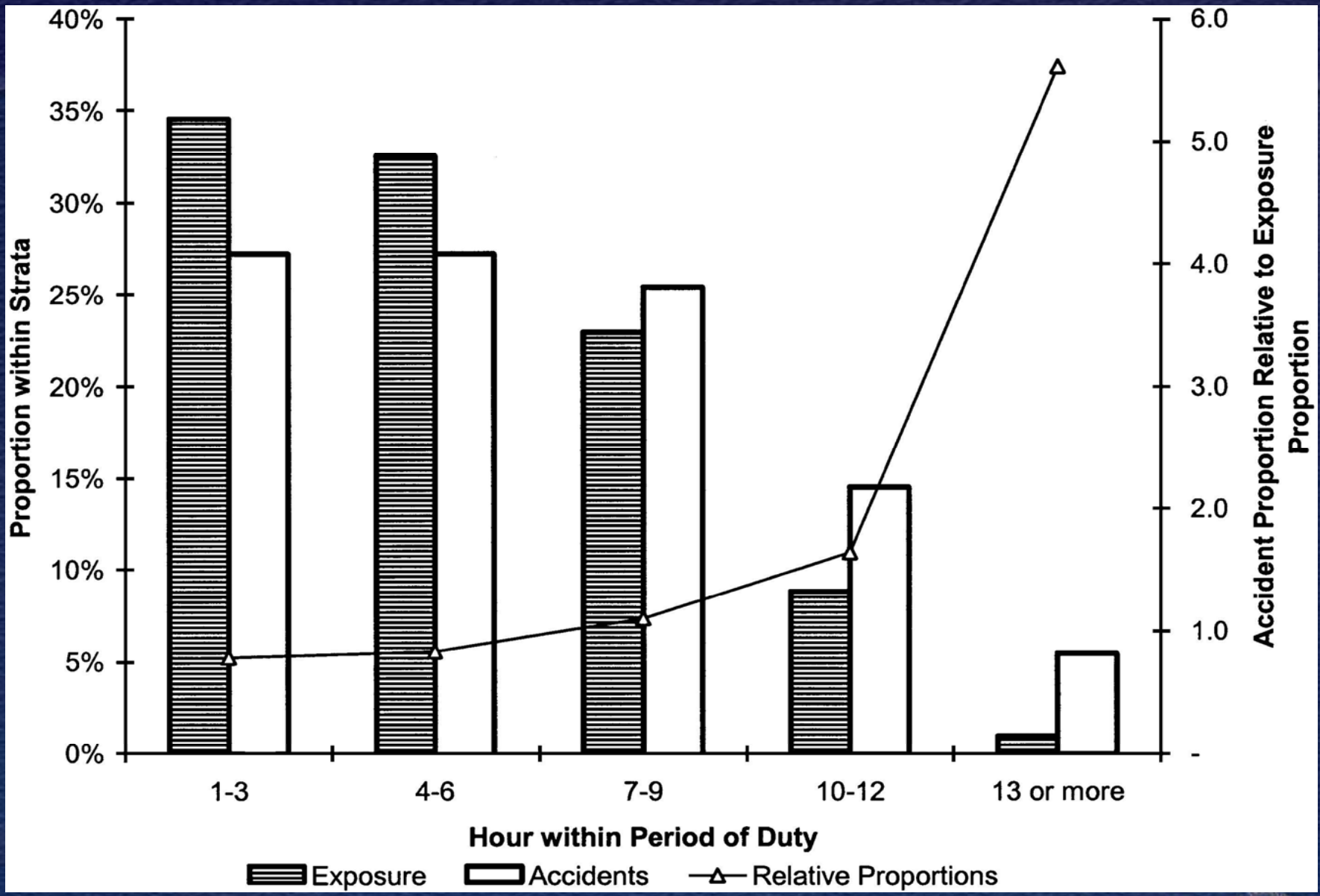
40%
35%
30%
25%
20%
15%
10%
5%
0%
Proportion within Strata
6.0
5.0
4.0
3.0
2.0
1.0
-
Accident Proportion Relative to Exposure Proportion
1-3
4-6
7-9
10-12
13 or more
Hour within Period of Duty
Exposure
Accidents
Relative Proportions

Fatigue Factors

- sleep
- circadian clock
- hours awake
- sleep disorders
  - ~ 90 sleep disorders

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Fatigue Factors: Environmental

- Helicopters:

  - noise

  - vibration

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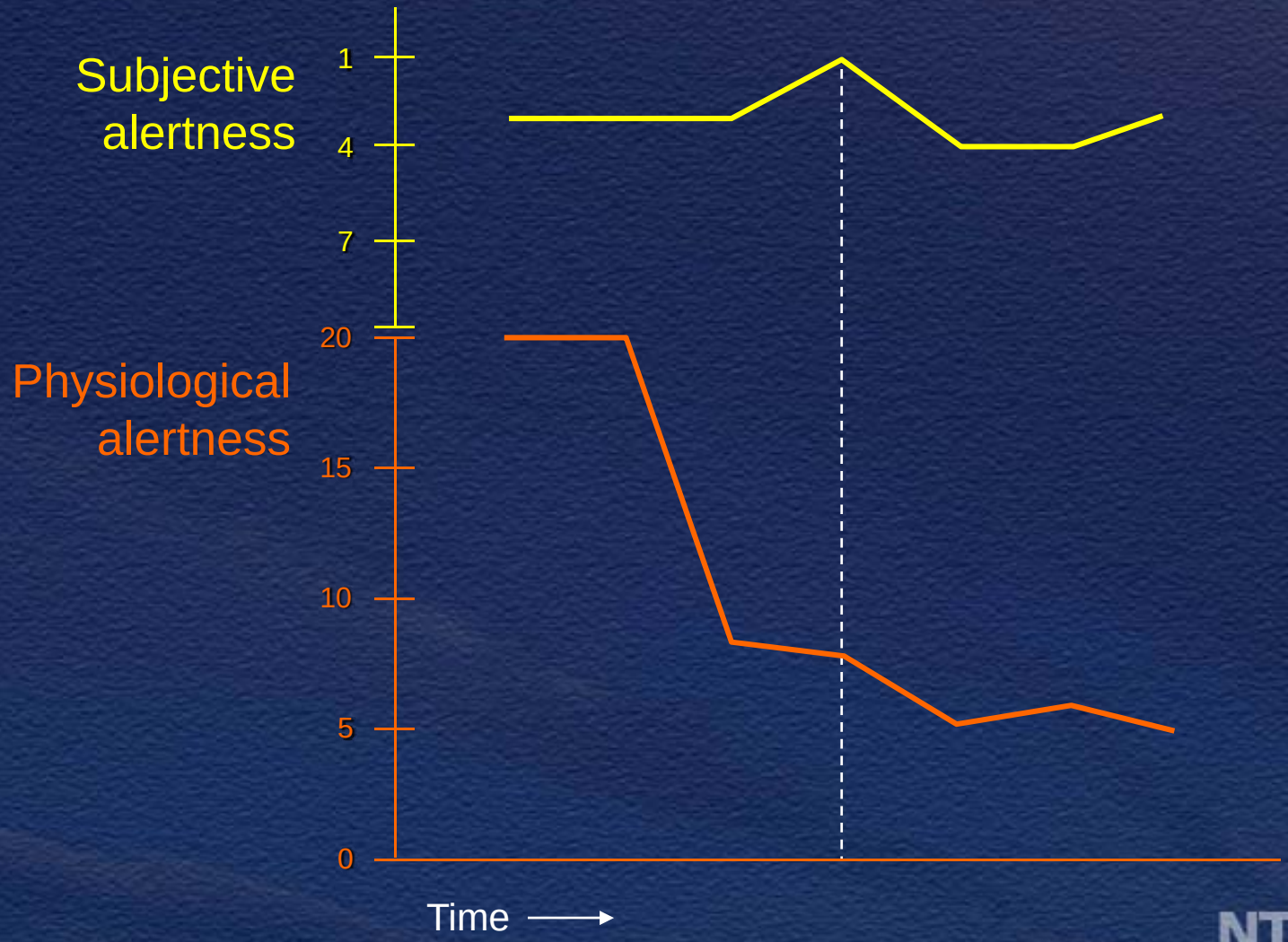
Alertness Reports Often Inaccurate



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

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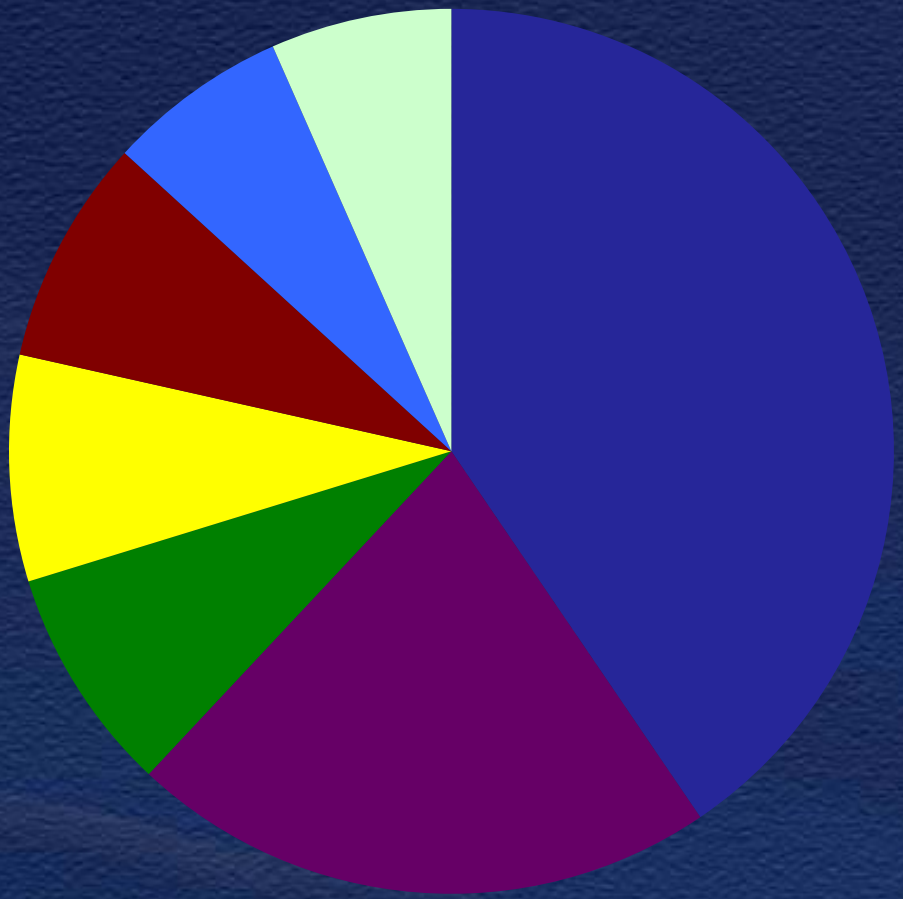
Complex Issue: Requires Multiple Solutions



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

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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

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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

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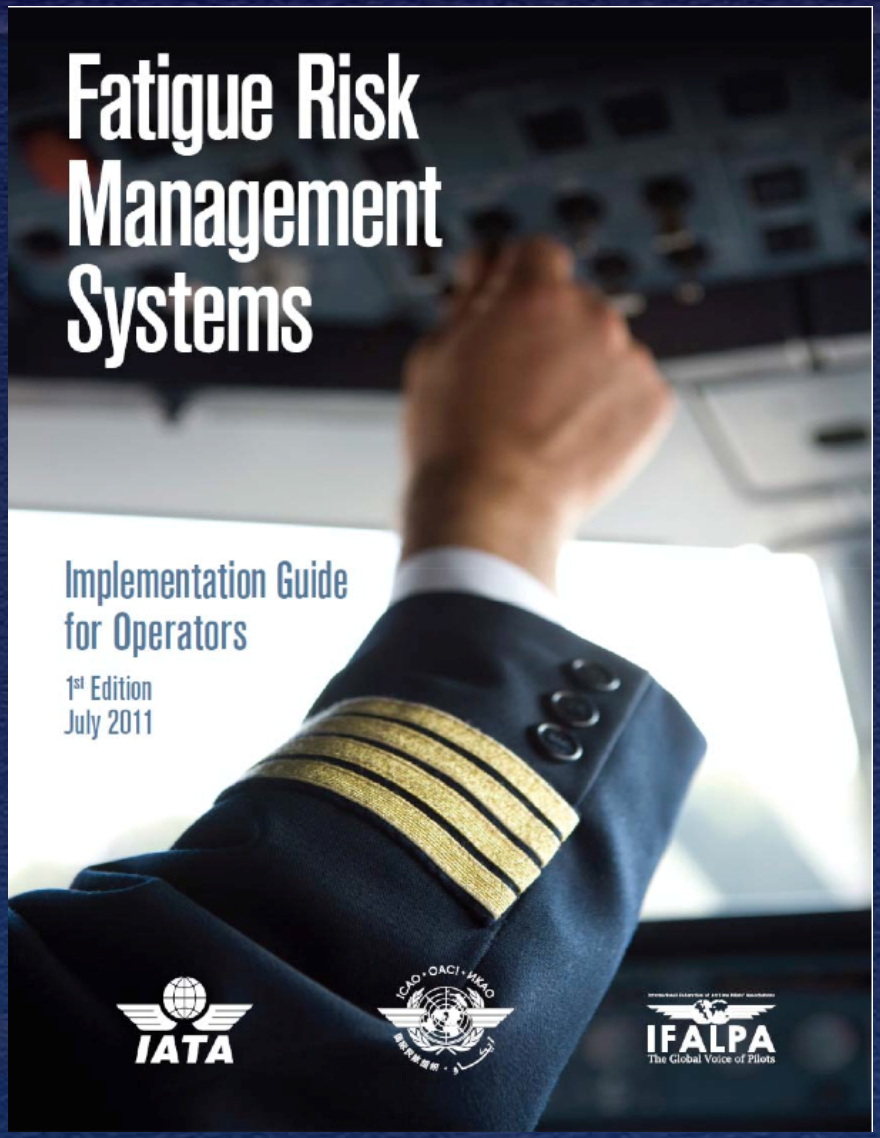
Example



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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

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NTSB Recommendations: Education/Strategies

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

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Example: NASA Planned Rest Study

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Changing Safety Culture

Safety goal . . .

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