



NTSB National Transportation Safety Board

Managing Fatigue: An NTSB Perspective

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Board Member

Bombardier CRJ Operators Safety Standdown
May 2, 2011



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

§1183. General organization

(a) ORGANIZATION.—The National Transportation Safety Board is an independent constitutional body of the Executive Branch of the Government.

(b) APPOINTMENT OF MEMBERS.—The Board is composed of 5 members appointed by the President, by and 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.

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

(d) 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**





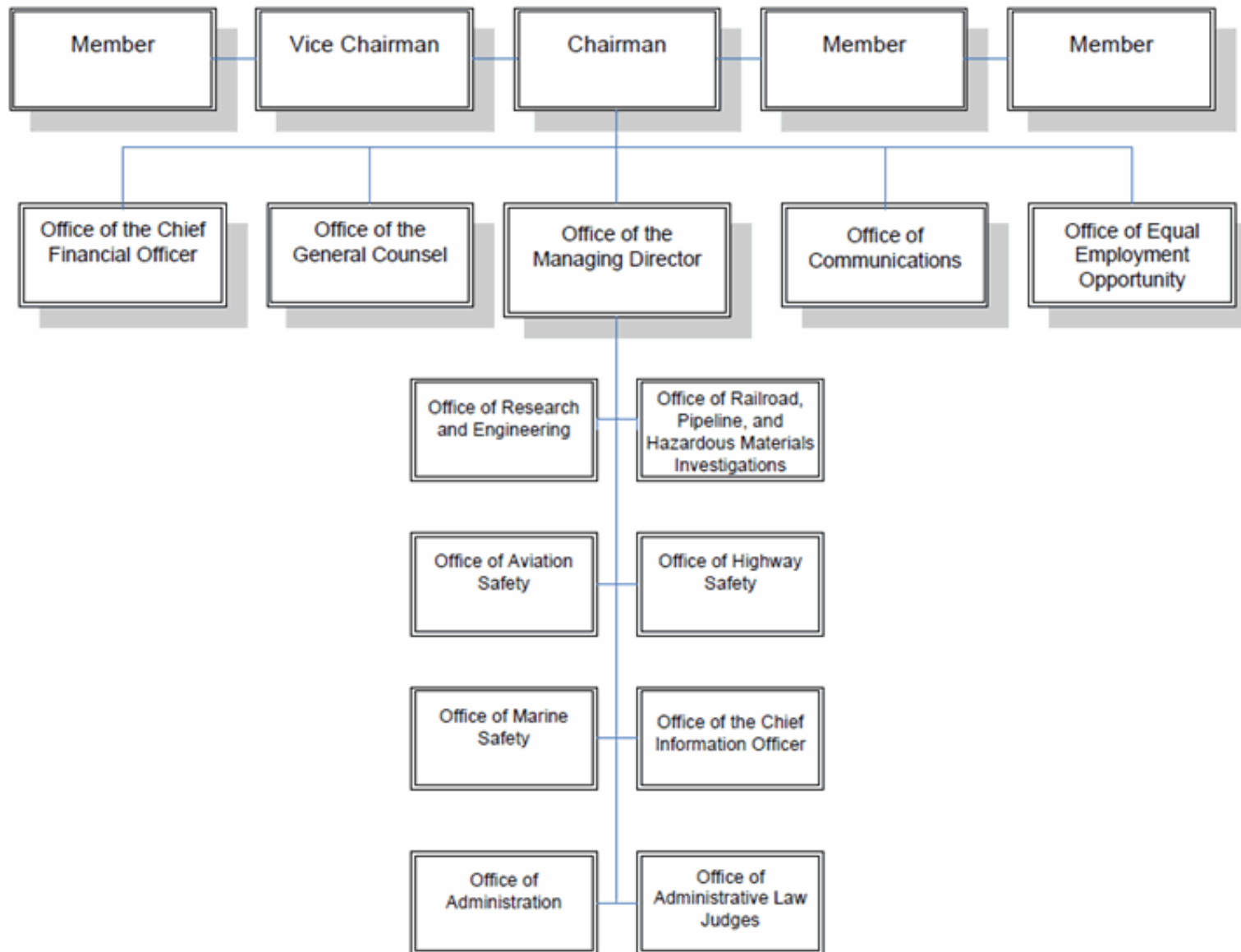
- 130,000+ accident investigations
- 13,000+ safety recommendations
 - 82% acceptance rate



Major product: safety recommendations

Moral compass and industry conscience

NATIONAL TRANSPORTATION SAFETY BOARD



NTSB: The Board

- Five Members:
 - President nominates
 - Senate confirms



Mark Rosekind
Member



Chris Hart
Vice Chairman



Debbie Hersman
Chairman



Robert Sumwalt
Member



Earl Weener
Member

Go! Flight 1002



- early starts, multiple segment days, sleep apnea

NTSB



Reagan National Airport

- March 23, 2011: 0004 – 0028 EDT
 - air traffic control service interruption
 - 2 AC/TRACON unable to establish contact
- Controller
 - supervisory controller working alone
 - 20 years' experience, 17 at DCA
 - indicated he had fallen asleep
 - working fourth consecutive night shift
(10 pm - 6 am)

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

NTSB



**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...”

Owatonna, MN/July 31, 2008



8 fatalities

NTSB



Owatonna Crew Fatigue Factors

- acute sleep loss (Capt/FO)
- cumulative sleep debt (FO)
- early start time (Capt/FO)
- excessive sleep need (Capt)
- insomnia (FO)
- self-medicate/prescription sleep med (FO)

Probable Cause/Contributing Factors

“The National Transportation Safety Board determines that the probable cause of this accident was the captain’s decision to attempt a go-around late in the landing roll with insufficient runway remaining. Contributing to the accident were (1) the pilots’ poor crew coordination and lack of cockpit discipline; **(2) fatigue, which likely impaired both pilots’ performance;** and (3) the failure of the Federal Aviation Administration to require crew resource management training and standard operating procedures for Part 135 operators.”

Fatal Airline Accidents (Examples) (fatigue cited)

- 8/97 Guam: 228 fatalities
- 6/99 Little Rock AK: 11 fatal
- 10/04 Kirksville MO: 11 fatalities
- 8/06 Lexington KY: 49 fatalities
- 7/08 Owatonna MN: 8 fatalities
- 2/09 Buffalo NY: 49 fatalities

Fatigue Risks

Fatigue can degrade
every aspect of
human capability.

Fatigue Risks

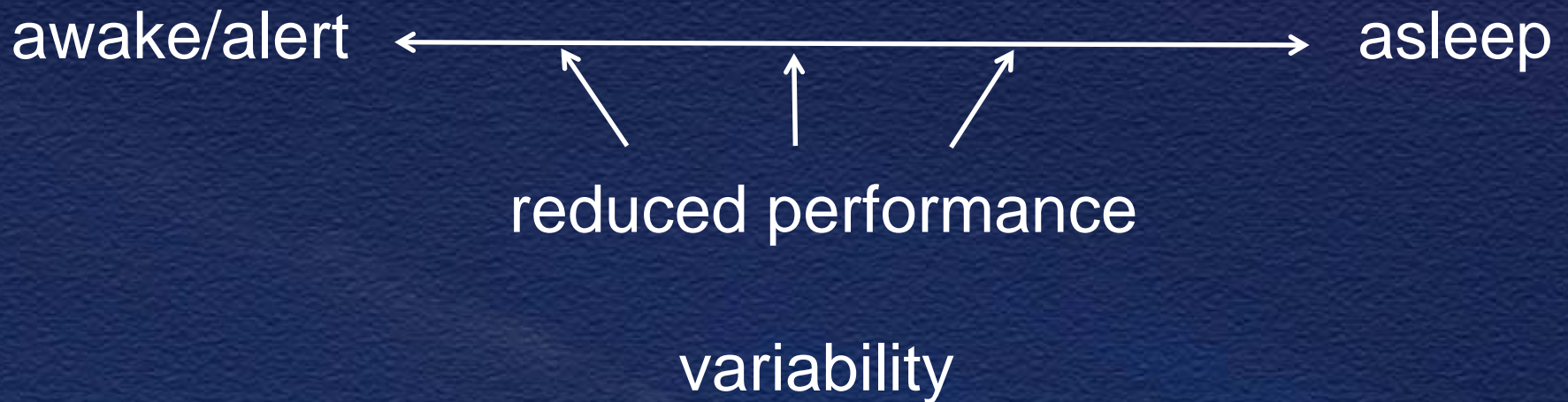
- degraded 20 – 50%+:

- reaction time
- memory
- communication
- situational awareness
- judgment
- attention
- mood

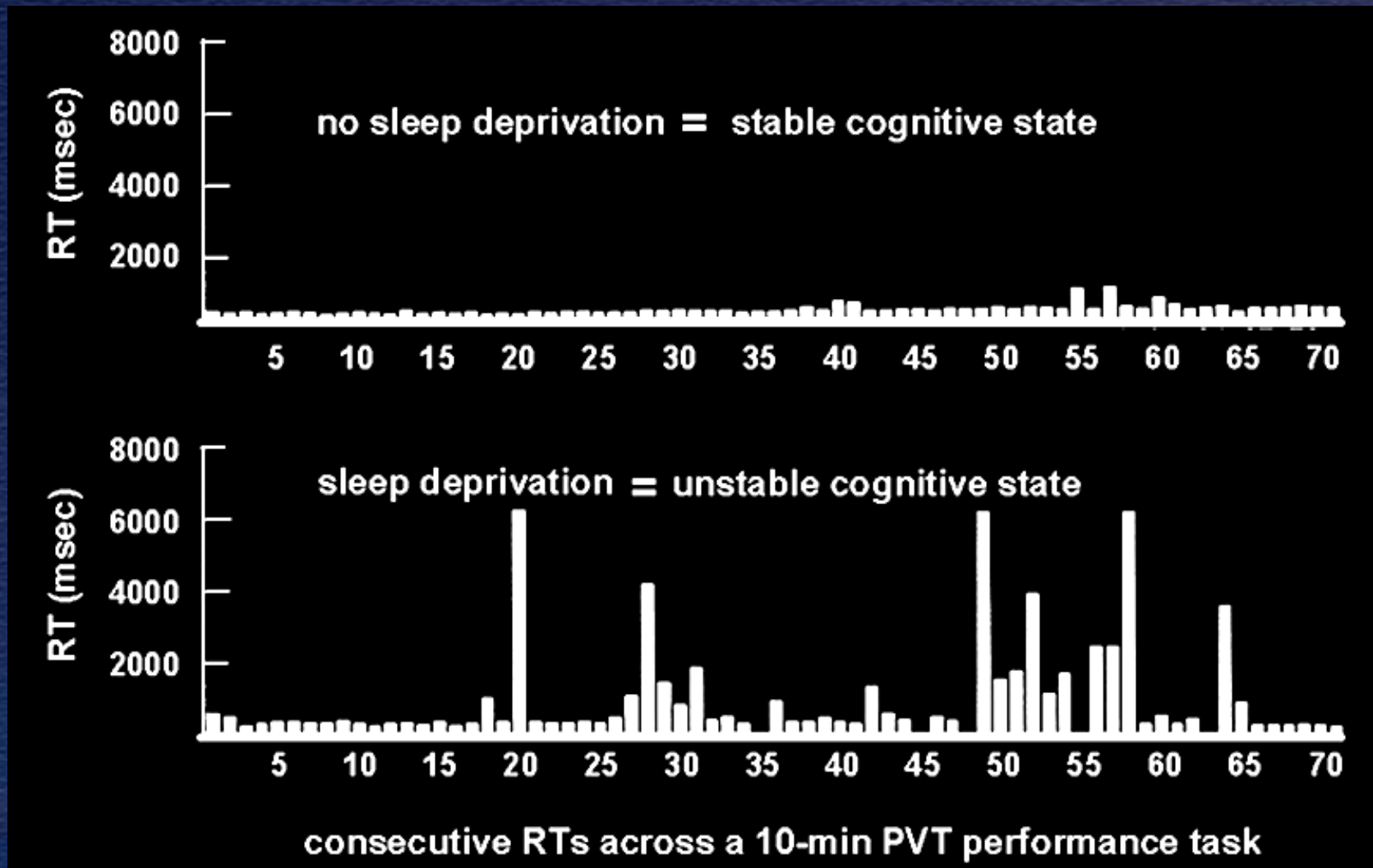
- increased:

- irritability
- apathy
- attentional lapses
- microsleeps

Fatigue Risks



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.



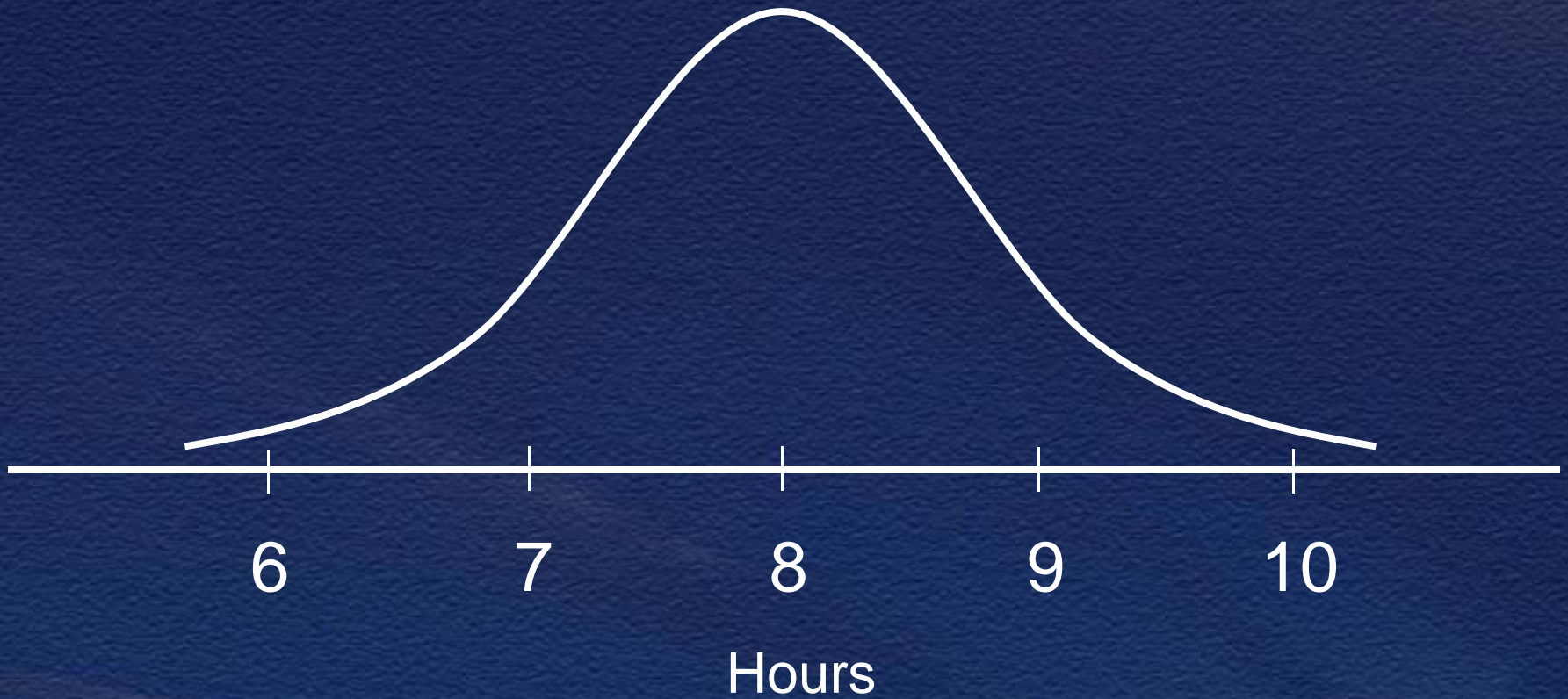
Fatigue Factors

- sleep
- circadian clock
- hours awake
- sleep disorders

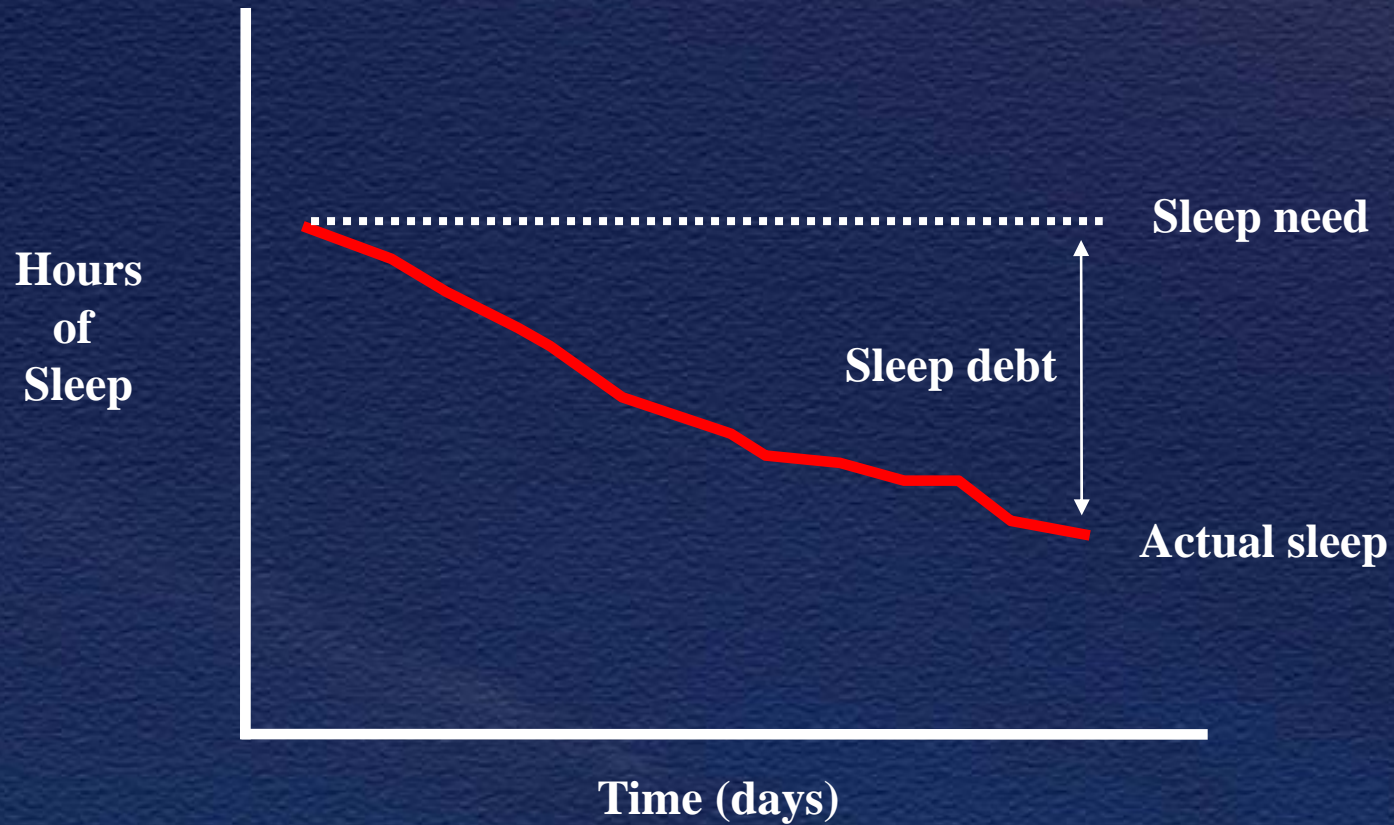
Fatigue Factors

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

Sleep Requirement



Cumulative Sleep Debt



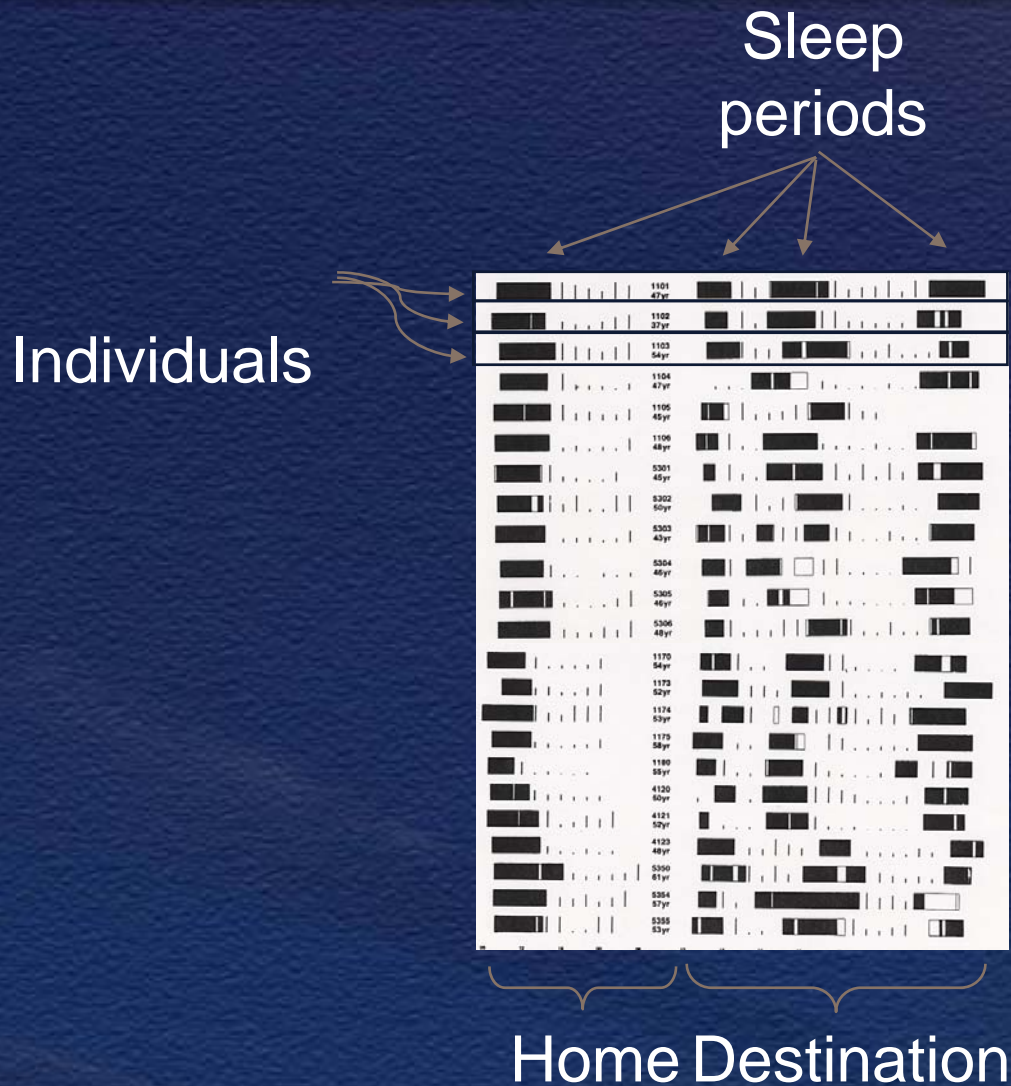
Sleep Need – Actual Sleep = Sleep Debt

Sleep debt grows cumulatively over time

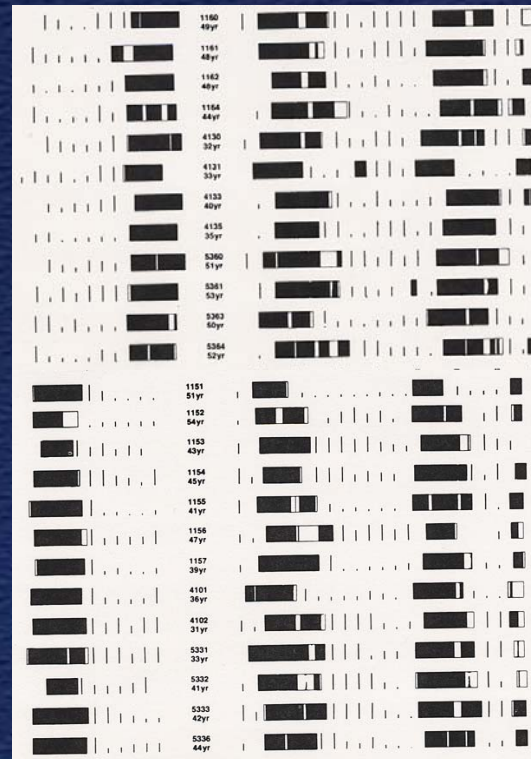
Fatigue Factors

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

After Traveling Eastward



After Traveling Westward

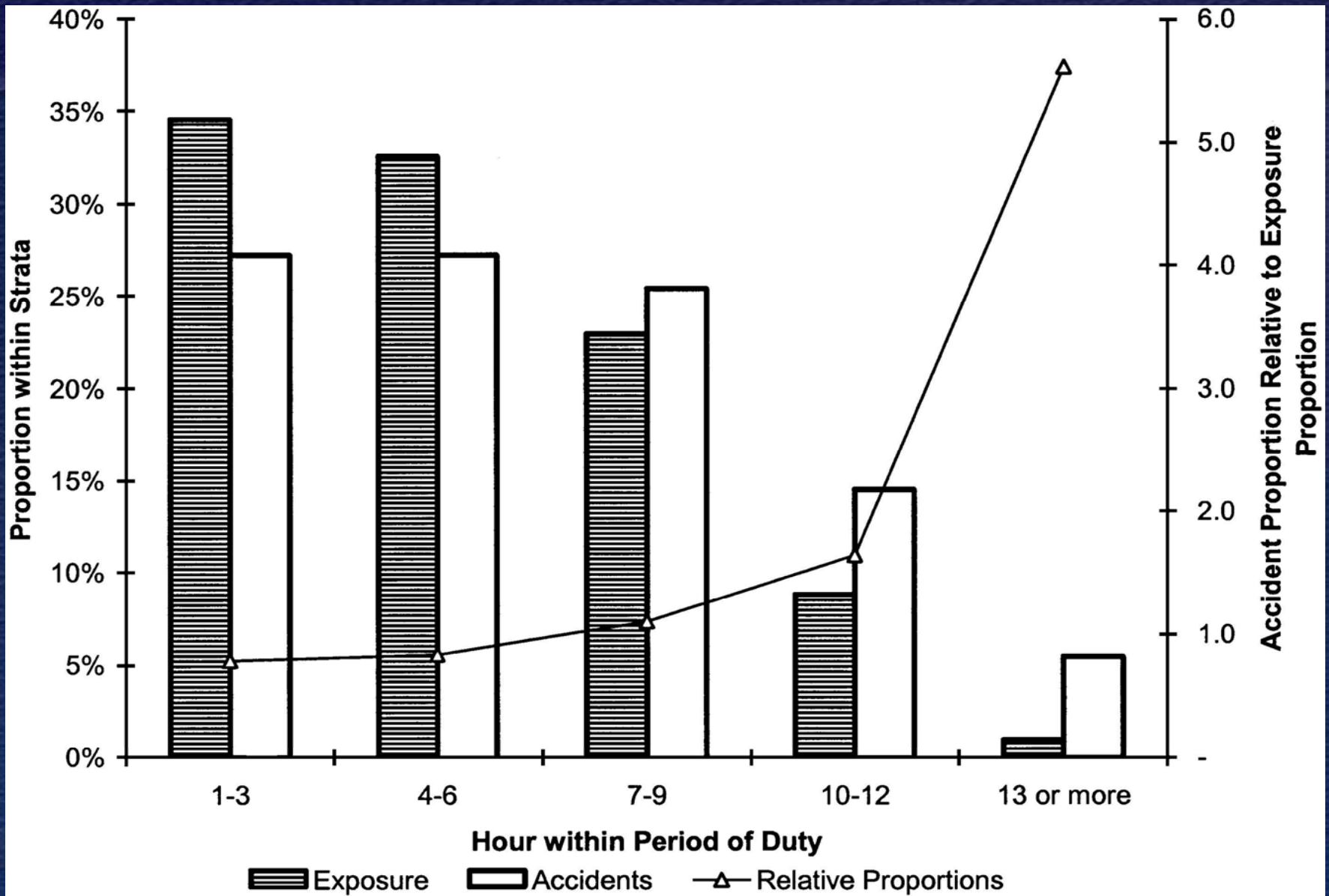


Home Destination



Fatigue Factors

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



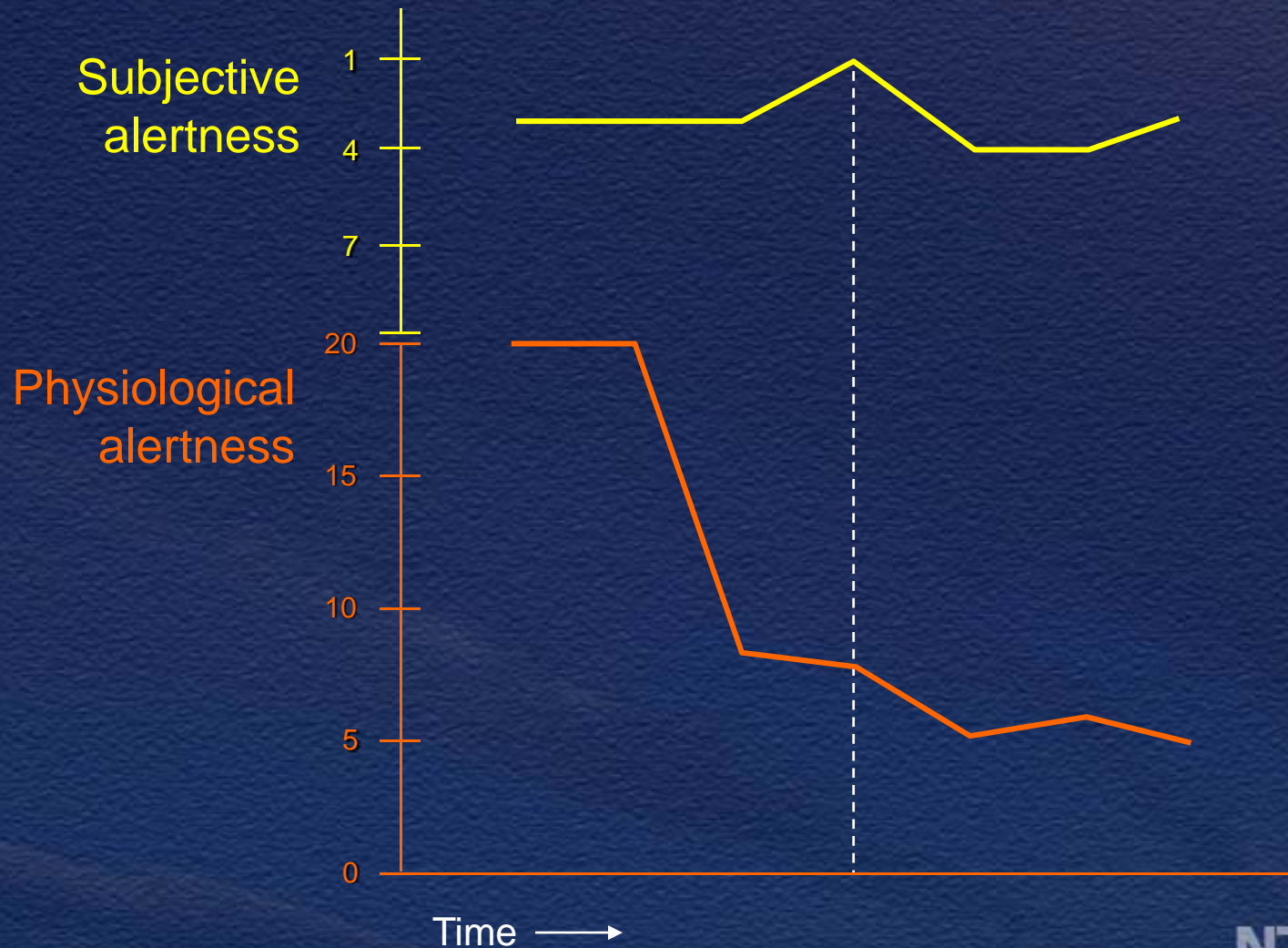
Fatigue Factors

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

Sleep Apnea is a Safety Risk

- > 6 times increased risk for crash
- > 7 times increased risk for multiple crashes
- SA performance = .06 - .08 BAC

Alertness Reports Often Inaccurate



Adapted from Sasaki et al., 1986

NTSB



The Challenges . . .

Diverse operational requirements

Individual differences

Complex physiology

History (“that’s how its always been”)

Economics

The Challenges Preclude . . .

A simple solution

A single solution

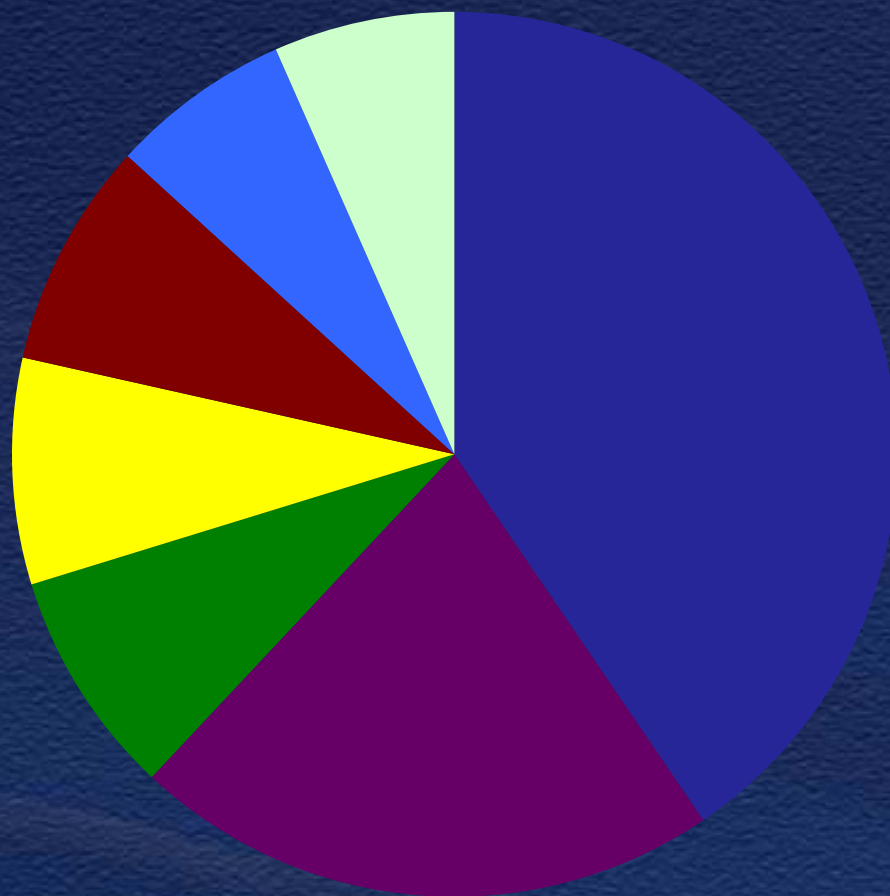
One-size-fits-all

“Magic Bullet”

NTSB Recommendations

- MOST WANTED since 1990
- 190+ 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

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

Hours of Service / Scheduling

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

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

Manage Fatigue = Enhance Safety

- Culture change
- Get educated
- Acknowledge
- Act!



NTSB