



NTSB

National Transportation Safety Board

Examining Fatigue in an Accident Investigation: An NTSB Perspective

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Board Member

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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

§1183. General organization

(a) ORGANIZATION.—The National Transportation Safety Board is an independent constitutional body 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. 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 end 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**





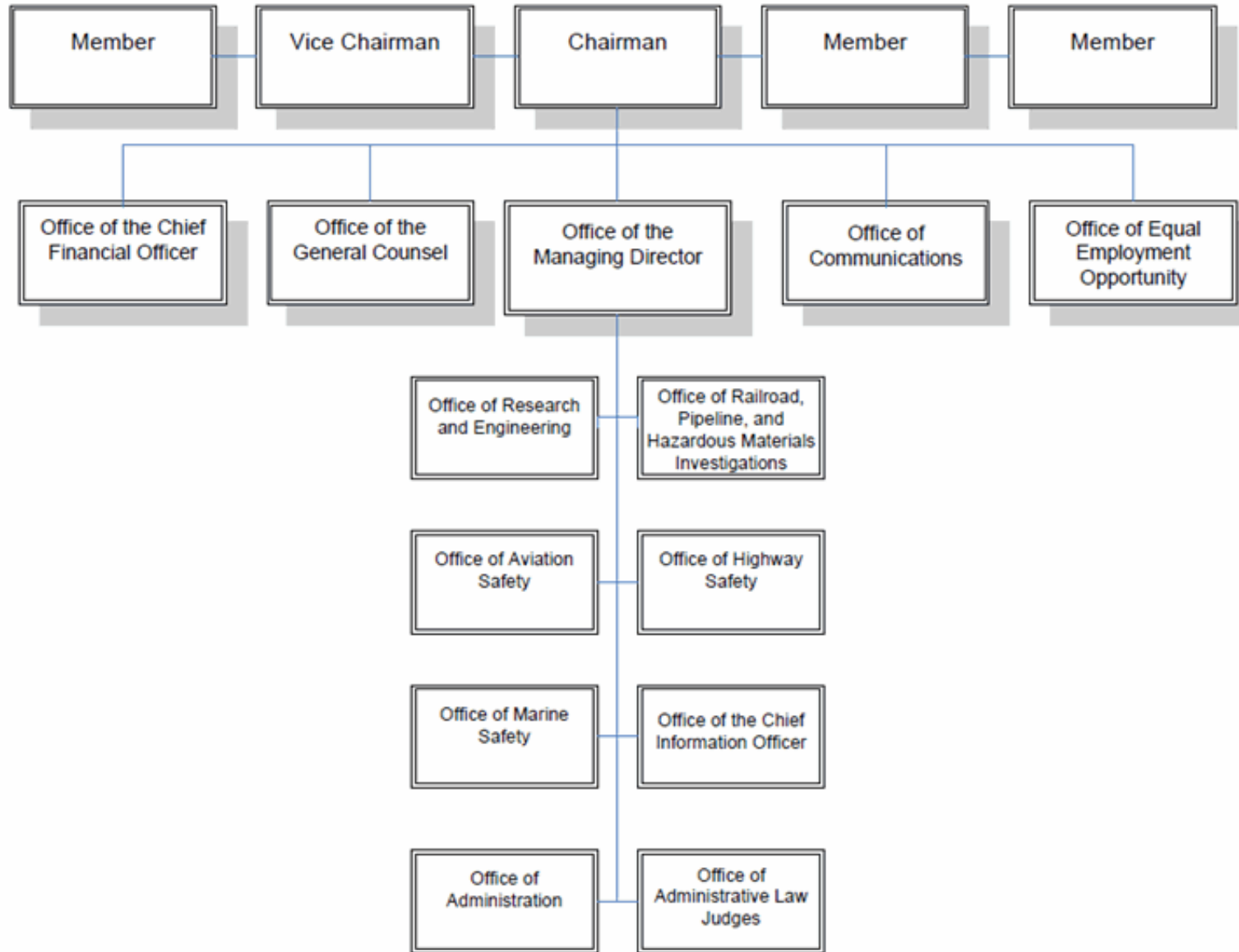
Major product: safety recommendations

Moral compass and industry conscience



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

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

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Honorable John K. Lauber:

No Accident \neq
Safe Operation

Fatigue Risks

Fatigue can degrade
every aspect of
human capability.

Fatigue Risks

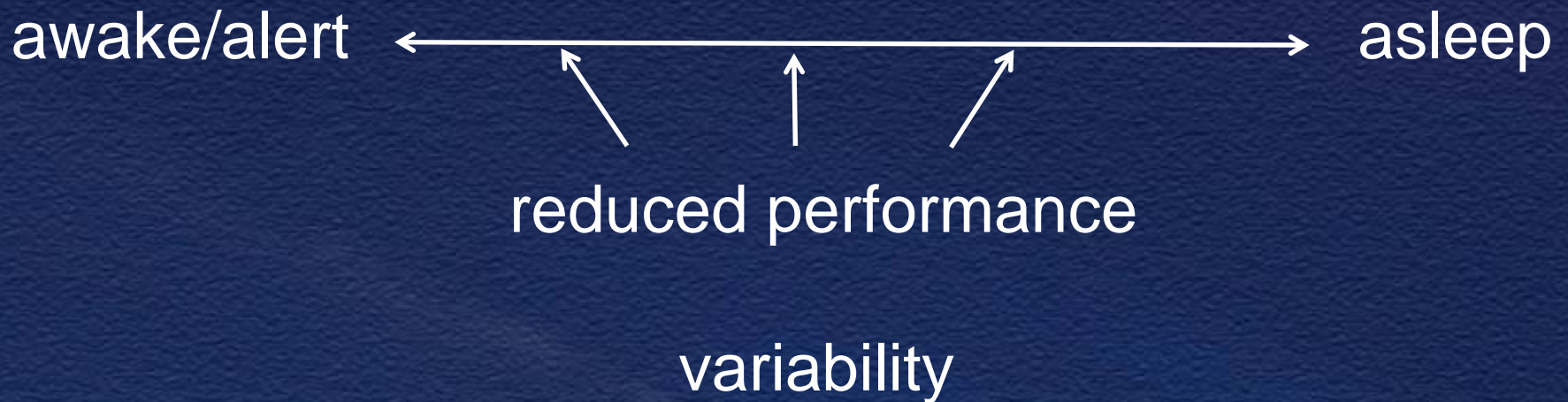
- degraded 20 – 50%+:

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

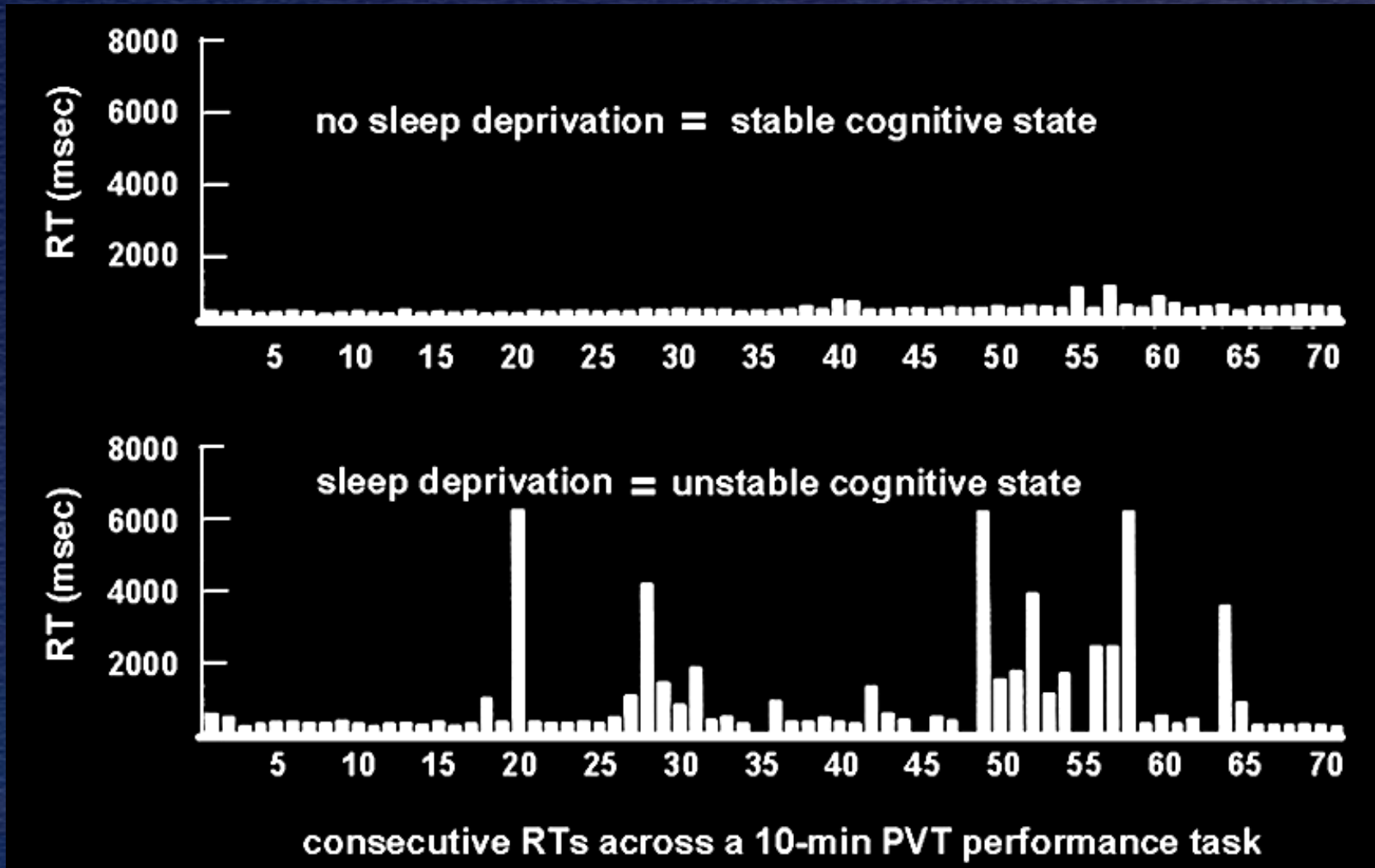
- increased:

- irritability
- attentional lapses
- apathy
- 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

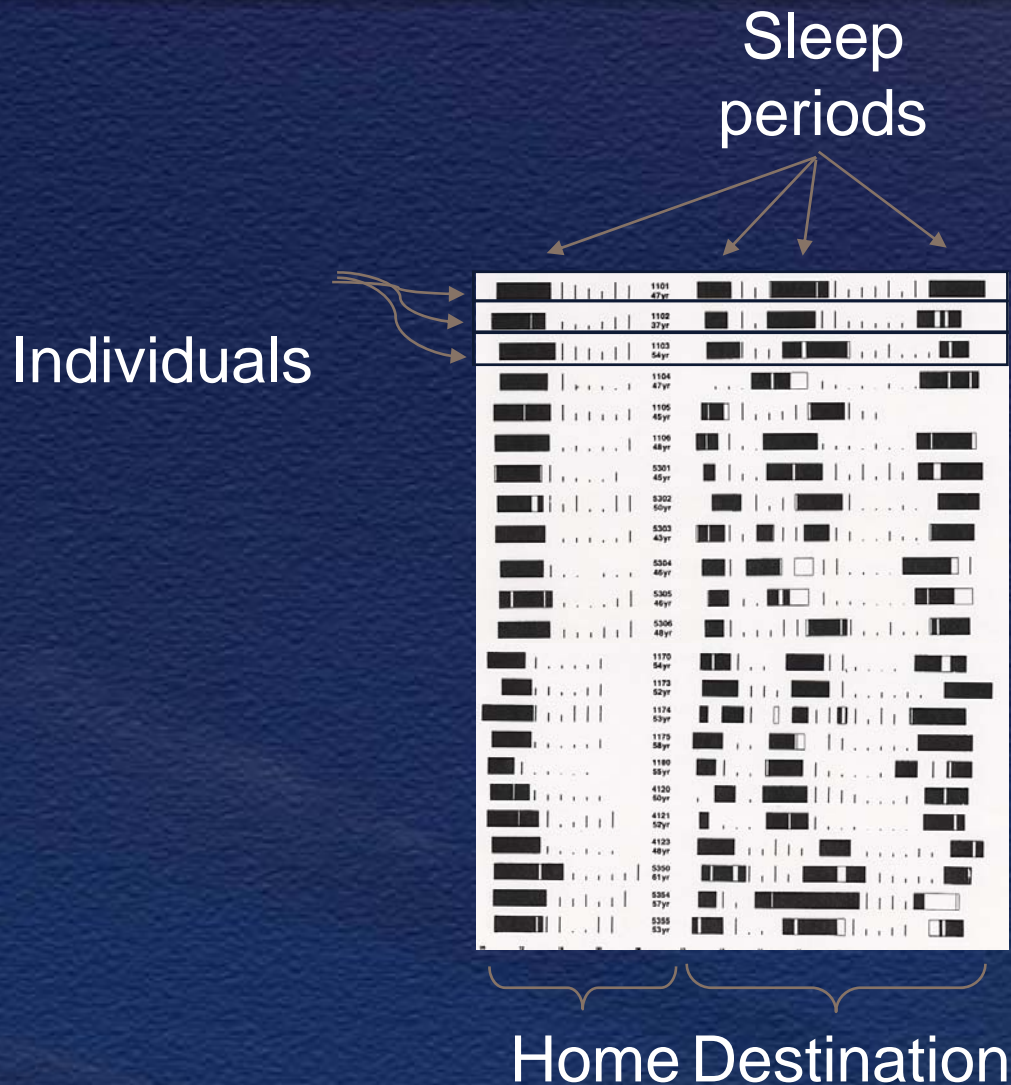
Fatigue Factors

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

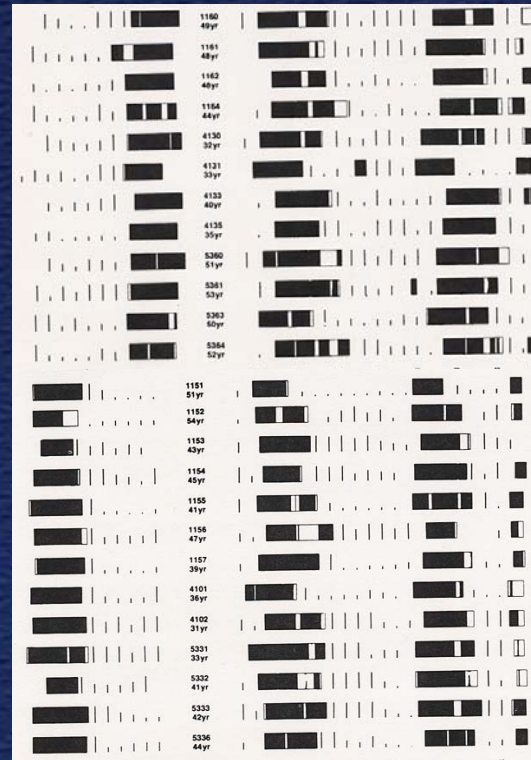
Fatigue Factors

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

After Traveling Eastward



After Traveling Westward



Home Destination



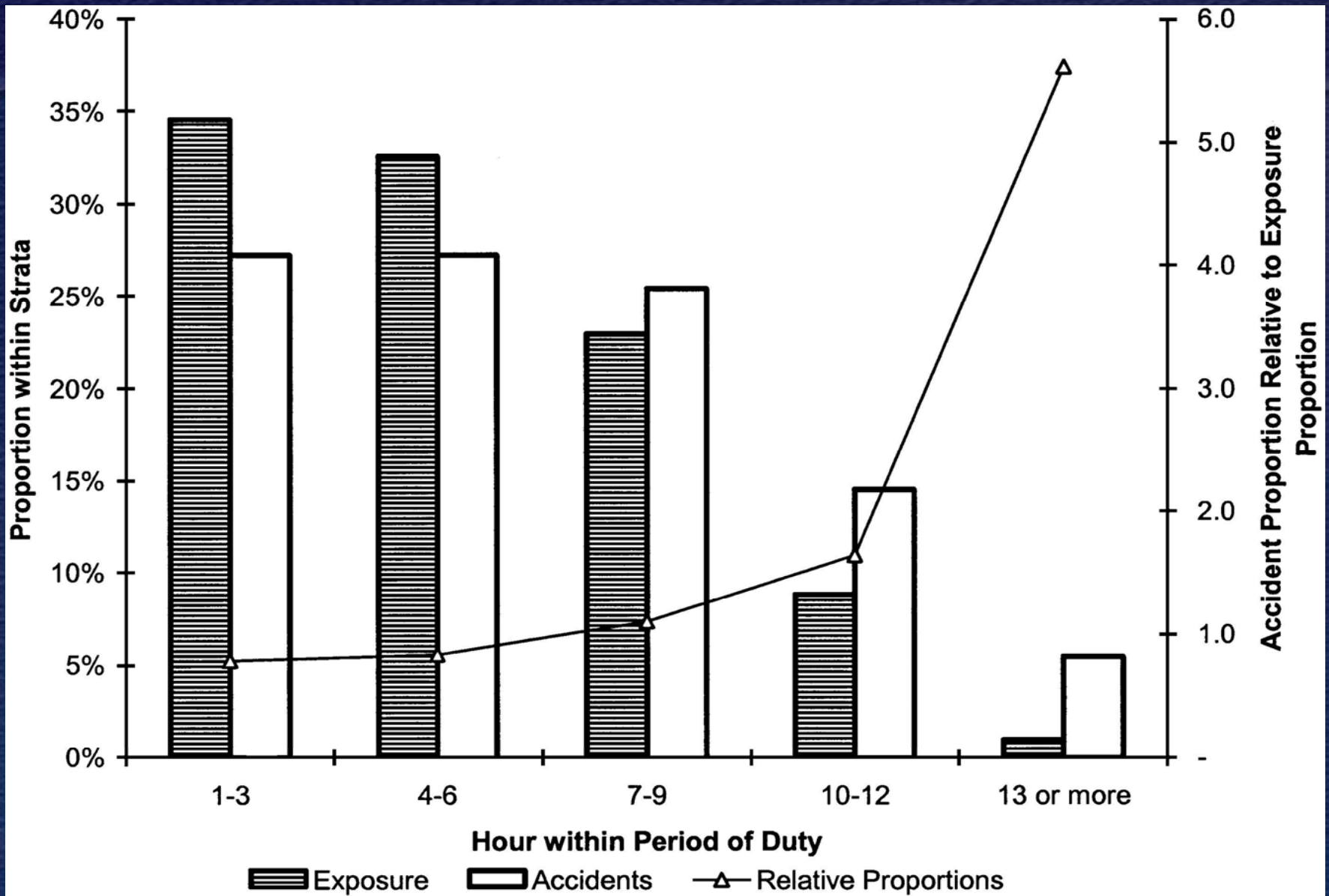
NASA Long-Haul Study

Circadian Results

- 80% of crewmembers showed circadian variation in temperature (ave period = 25.7 hr)
- 20% had no detectable circadian rhythm

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

Guantanamo Bay Cuba

First NTSB aviation accident to cite fatigue as probable cause



- acute sleep loss, sleep debt, circadian disruption

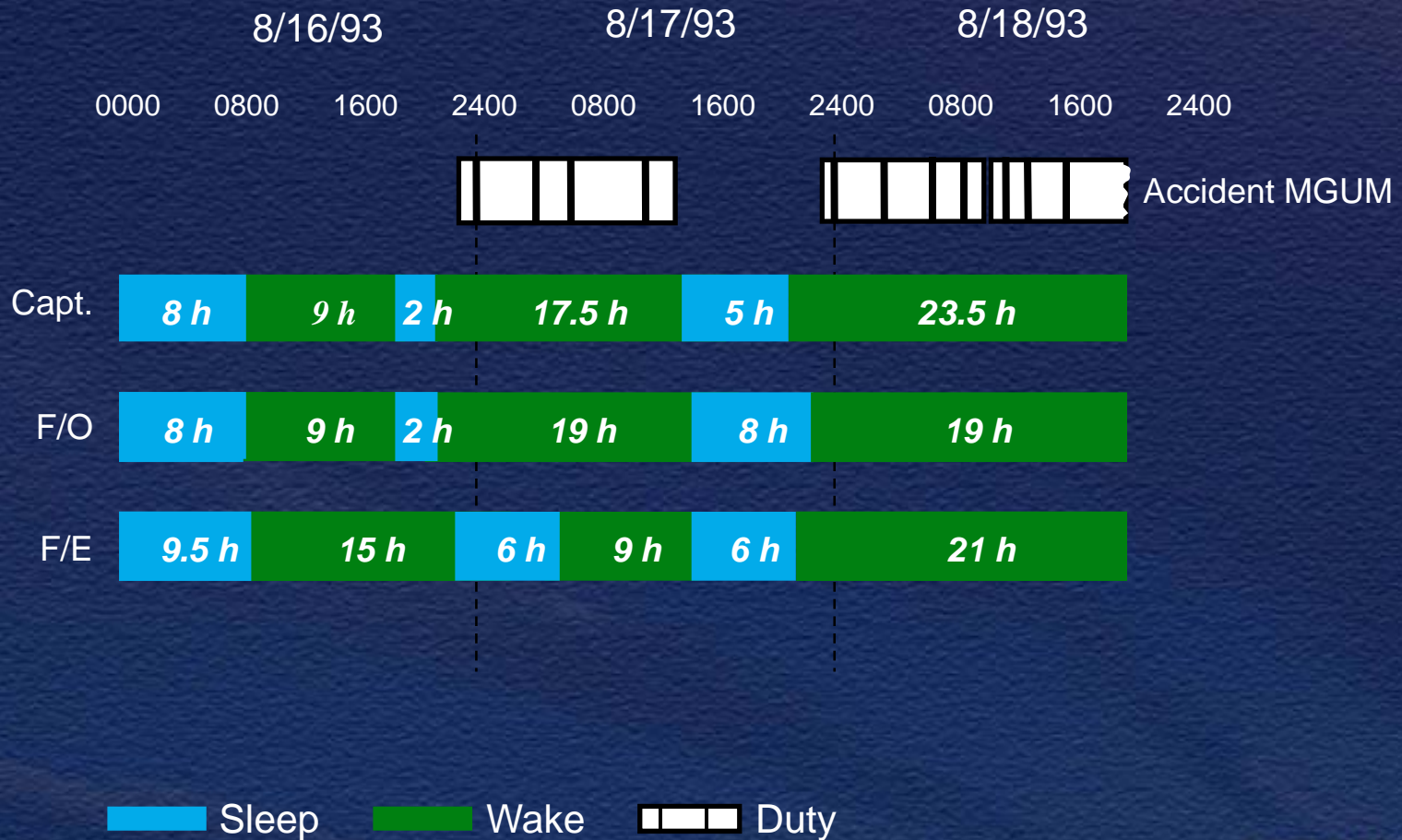
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Fatigue Factors: Accident Investigation

- Acute sleep loss/cumulative sleep debt
- Continuous hours of wakefulness
- Time of day/circadian effects
- Sleep disorders

Crew Sleep History



Observed Performance Effects

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



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**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

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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.”

Shuttle America Flight 6448



- 4 crew + 71 PAX: only 3 minor injuries
Capt awake 31 hrs, FO 3-day 6-leg sequence

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Kirksville, Missouri, October 19, 2004



- 2 crew + 11 PAX fatally injured, 2 serious injuries
circadian disruption, 6th flight segment

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Continental Connection (Colgan Air) Buffalo NY (February 12, 2009)



- 50 fatalities; commuting, acute sleep loss

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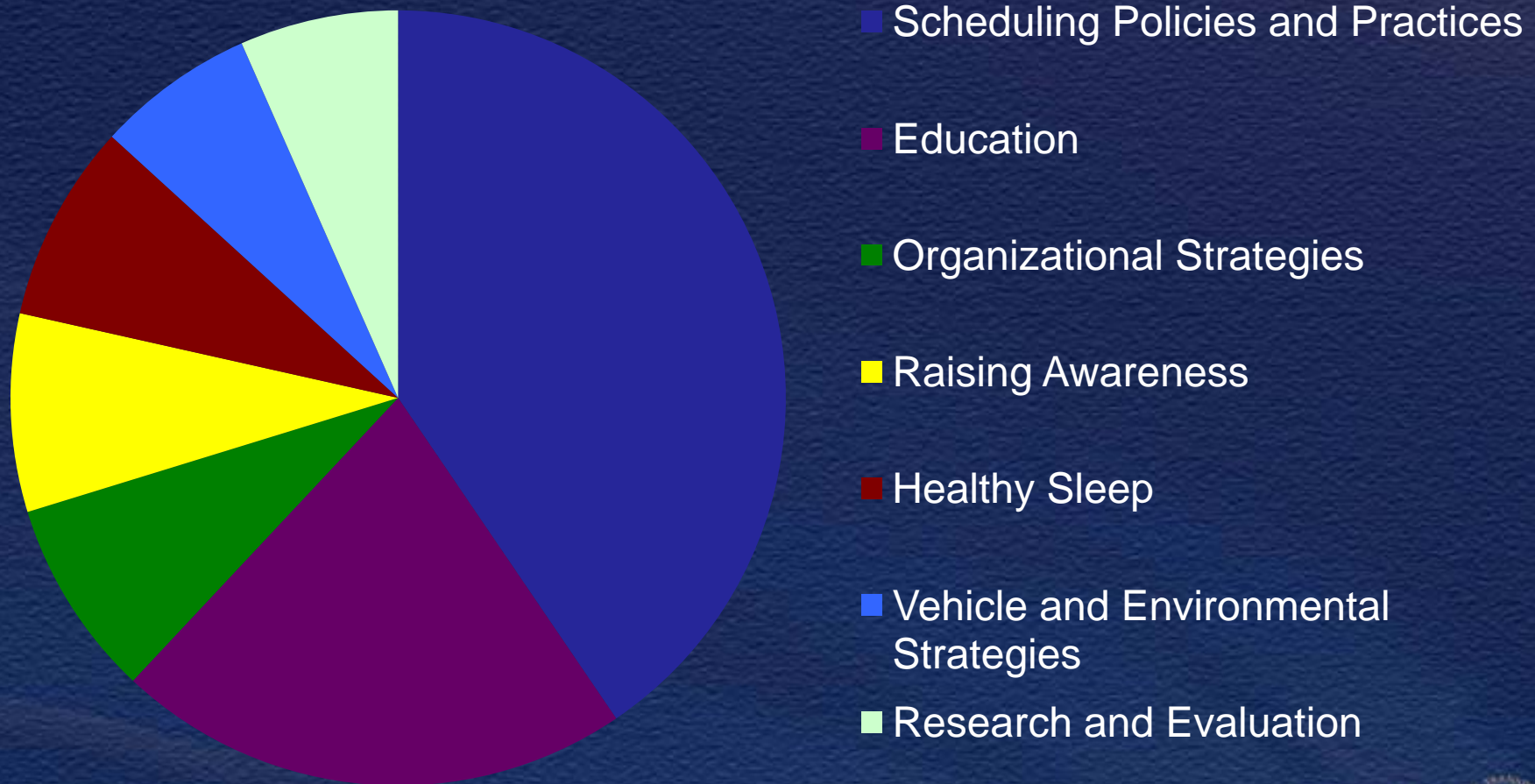
Fatal Airline Accidents (Examples) (fatigue cited)

- 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

NTSB Recommendations

- MOST WANTED since 1990
- 190+ fatigue recommendations

Complex Issue: Requires Multiple Solutions



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

Health Related Recommendations

- 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
- Establish a system to track prescription and OTC drug use of operators

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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