



**NTSB** National Transportation Safety Board

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# Enhancing Transportation Safety with Sleep Science: Challenges and Opportunities

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UNITED STATES CODE, TITLE 49  
**CHAPTER 11—NATIONAL TRANSPORTATION SAFETY BOARD**

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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

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

(b) 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.

(c) 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 successor may not be appointed until a successor is appointed and qualified. The President may remove a member for inefficiency, neglect of duty, or other cause.

(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





**In 1996, the Aviation Disaster Family Assistance Act:  
NTSB to coordinate victim and family assistance  
following a major aviation accident.**

**This responsibility was extended to other modes  
by Executive Order.**





## **The NTSB is Responsible for Investigating:**

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





# PG&E/San Bruno Gas Pipeline Explosion

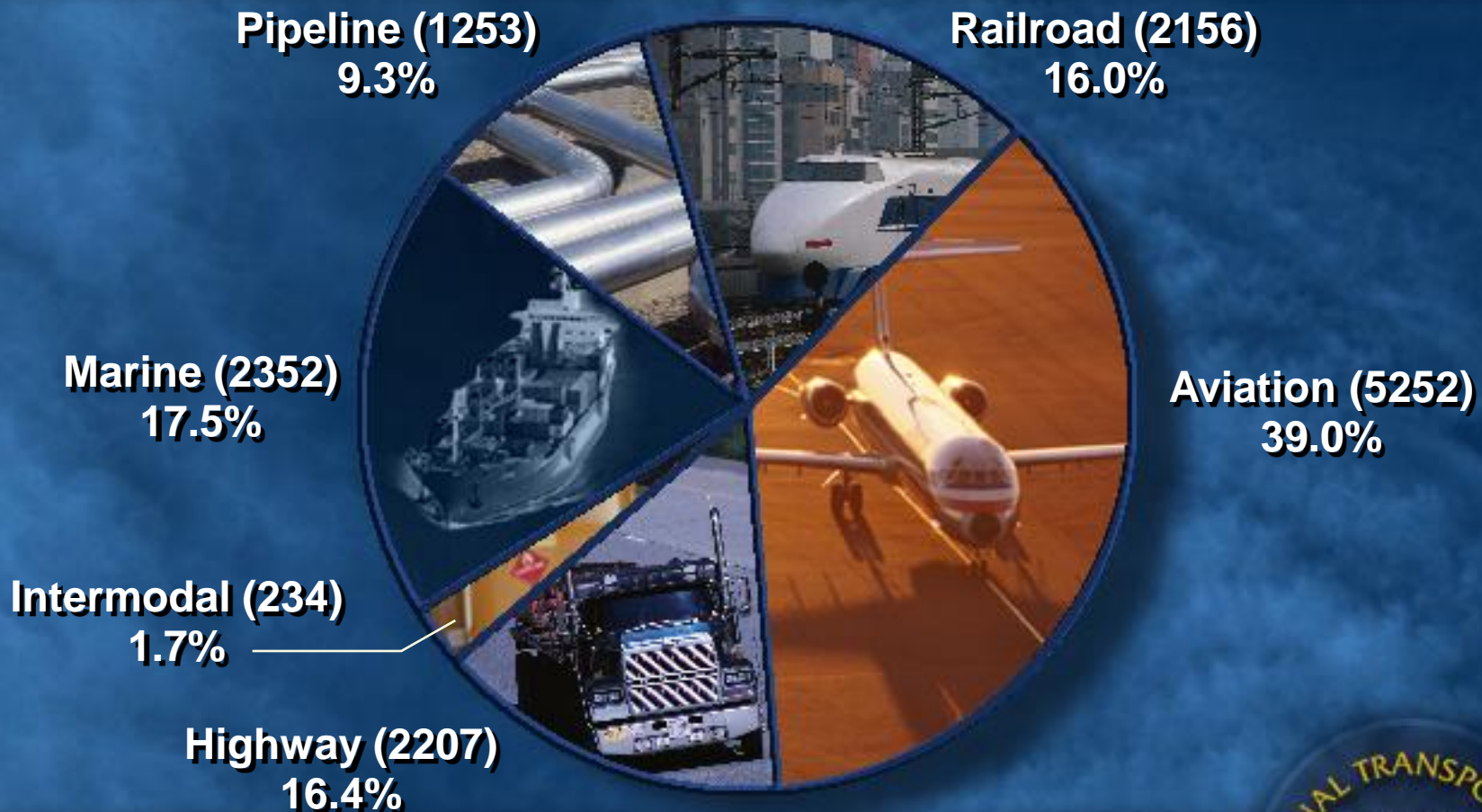






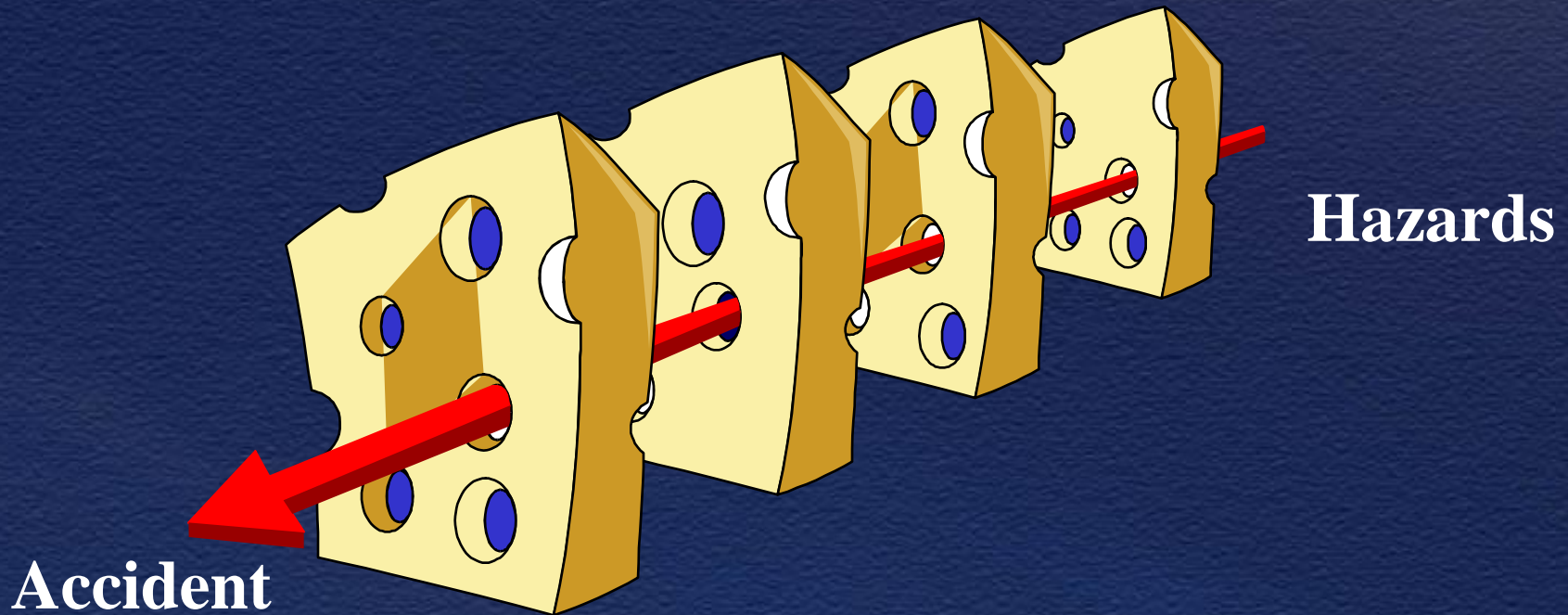
- 130,000+ accident investigations
- ~13,500 safety recommendations
  - 82% acceptance rate

# 13,454 Safety Recommendations issued since 1967





# “Swiss Cheese” Model (Reason)



Successive layers of defenses, barriers, and safeguards



# Honorable John K. Lauber:

No Accident  $\neq$   
Safe Operation

# Go! Flight 1002



- early starts, multiple segment days, sleep apnea

NTSB





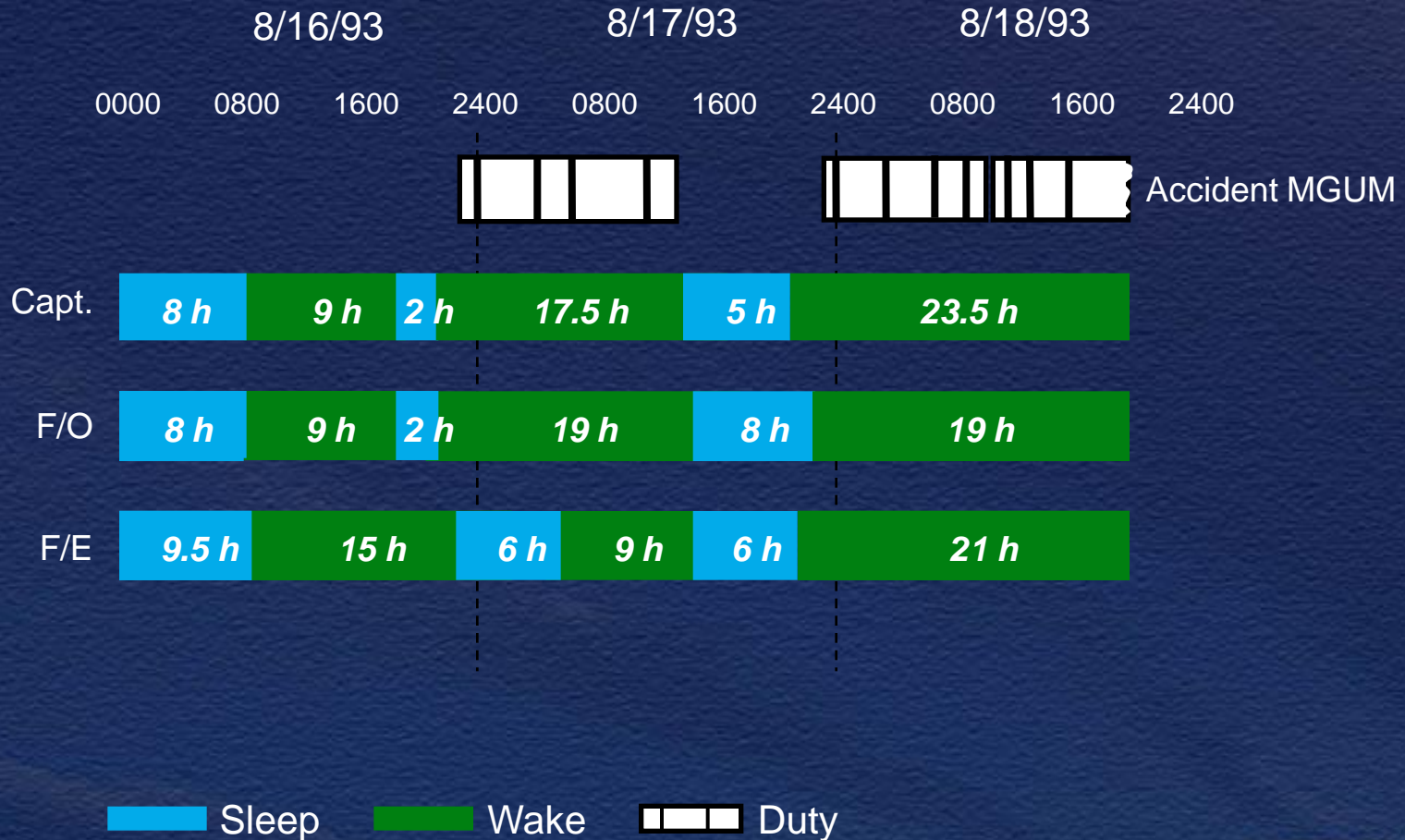
# Guantanamo Bay Cuba

First NTSB aviation accident to cite fatigue as probable cause



- acute sleep loss, sleep debt, circadian disruption

# 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...”



# 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

“Contributing to the accident were . . .  
(2) fatigue, which likely impaired both  
pilots’ performance; . . .”

# 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



# Miami, Oklahoma (June 26, 2009)

- Initial minor accident (~1:13 pm)
  - blocked eastbound I-44
- 2008 Volvo truck-tractor (~1:19 pm)
  - refrigerated semitrailer
  - traveling eastbound on I-44
  - 69 mph with cruise control engaged
  - without slowing or braking collided into queue of slowing & stopped vehicles



10 fatalities  
3 serious injuries  
2 minor injuries  
5 no injuries

**Ford  
Windstar**



**Hyundai  
Sonata**

**Kia  
Spectra**

Source: Oklahoma State Police



# Fatigue Factors

- Off work for 3 weeks: day active/night sleep schedule
- 3am to 3pm shift work/drive schedule (since 1997)
- Early bedtime (2 hr phase advance in sleep time)
- Obtained min 3 hrs/max 5 hrs sleep prior to accident
- Subsequently diagnosed with mild sleep apnea

# 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. . . . ”



# NTSB Most Wanted List

Critical changes needed to reduce transportation accidents and save lives.



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## 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



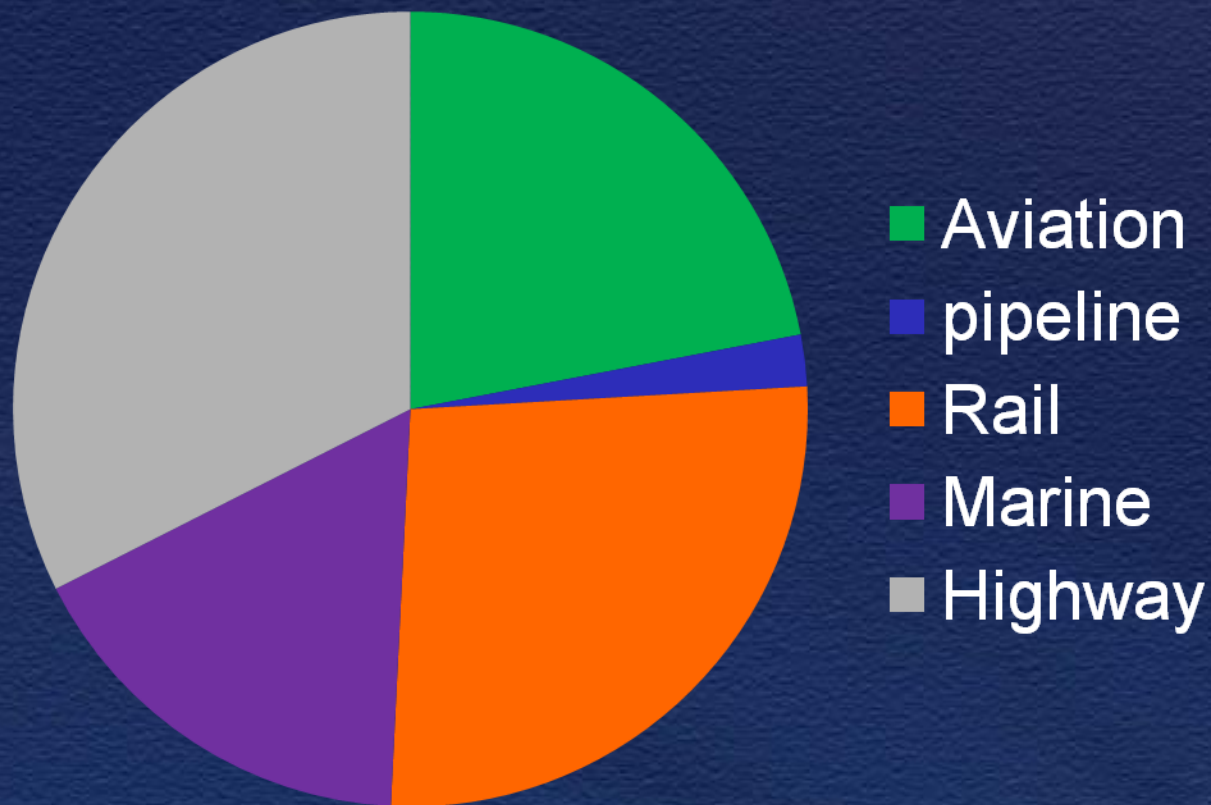
# NTSB Recommendations

- MOST WANTED since 1990
- ~200 fatigue recommendations

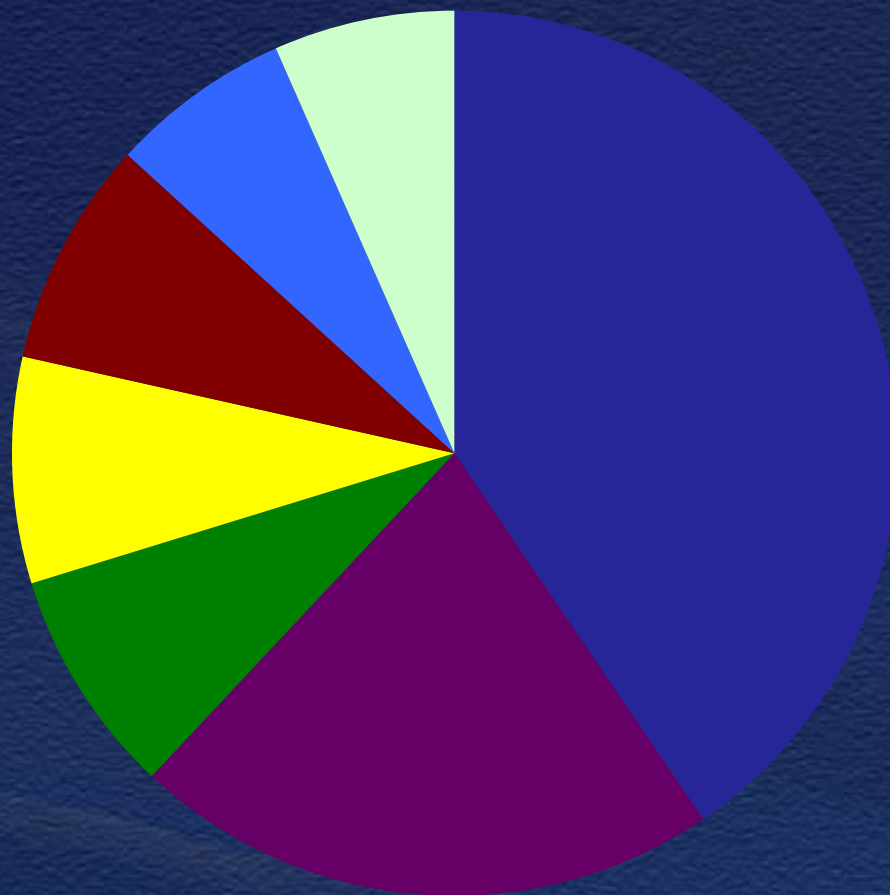


# NTSB Fatigue Recommendations by Mode

~ 200 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

# Scheduling Policies and Practices

Victoria, Texas, January 2, 2008



Victoria, Texas Fire Department

- 1 fatality, 47 injuries; day sleep, night drive, ~ 4 am WOCL

NTSB





# Hours of Service / Scheduling

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

# Healthy Sleep

Mexican Hat, UT, January 6, 2008



- 360 rollover, 50/53 ejected, 9 fatalities; OSA (-CPAP)

NTSB





# Health Related Recommendations

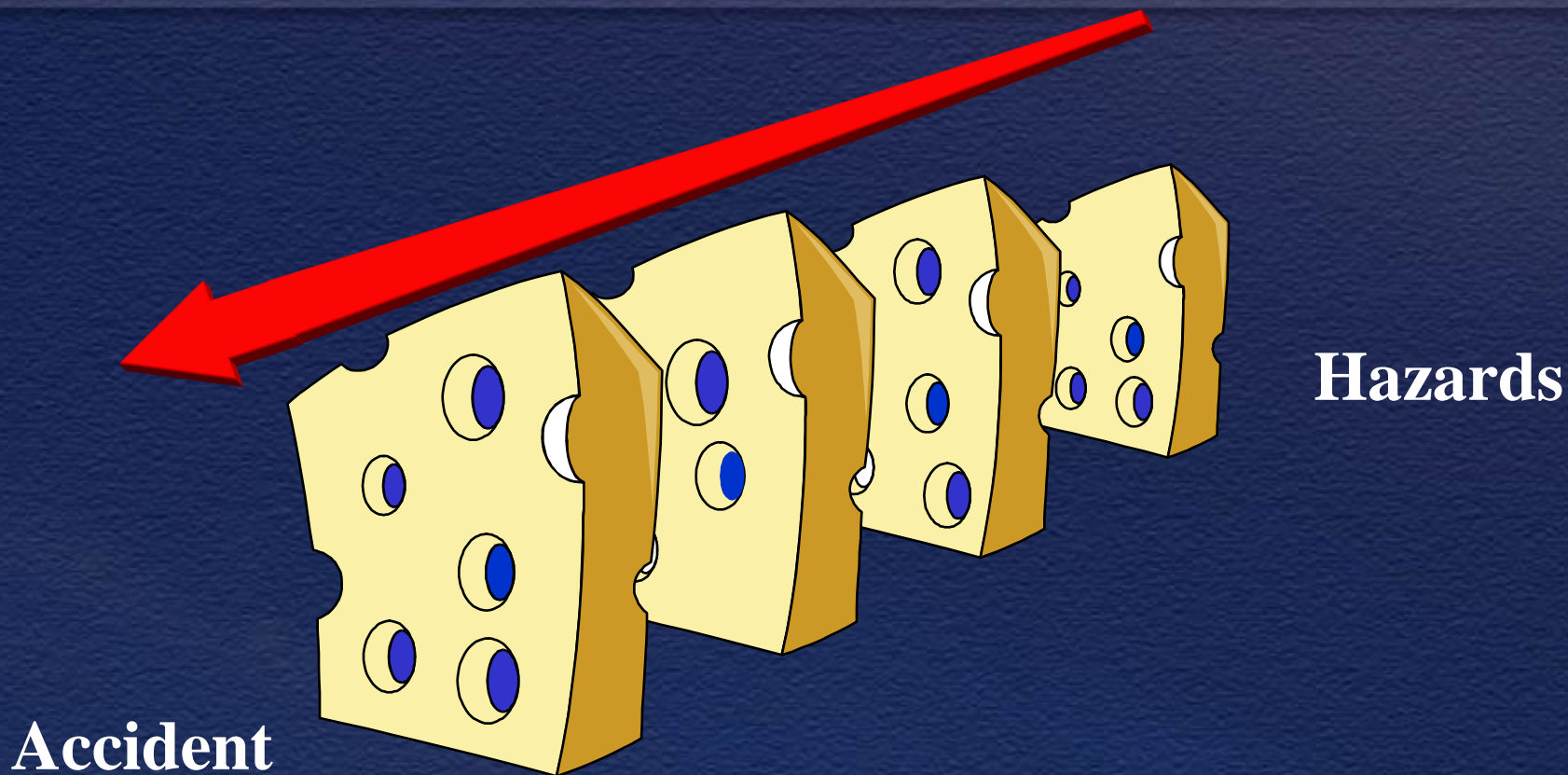
- Develop standard medical exam to screen for sleep disorders; require its use
- Educate companies and individuals about sleep disorder detection and treatment, and the sedating effects of certain drugs
- Ensure drivers with apnea are effectively treated before granting unrestricted medical certification

# Owatonna, MN (July 31, 2008): Safety Recommendations

7. Revise regulations and policies to permit appropriate use of prescription sleep medications by pilots under medical supervision for insomnia.
8. Require 14 Code of Federal Regulations Part 135 and 91 subpart K pilots to receive initial and recurrent education and training on factors that create fatigue in flight operations, fatigue signs and symptoms, and effective strategies to manage fatigue and performance during operations.
9. Review the policy standards for all common sleep-related conditions, including insomnia, and revise them in accordance with current scientific evidence to establish standards under which pilots can be effectively treated for common sleep disorders while retaining their medical certification.
10. Increase the education and training of physicians and pilots on common sleep disorders, including insomnia, emphasizing the need for aeromedically appropriate evaluation, intervention, and monitoring for sleep-related conditions.



# The Challenge (Haueter)



Successive layers of defenses, barriers, and safeguards

# Scope of Problem?

Estimate?

Underestimate?

Baseline  change?



# Interactions . . .



distraction?



# Success requires . . .

A culture change that supports  
different attitudes and behaviors



# Future Opportunities . . .

- Operationally relevant science
- Translate/transfer applied findings
- Continuing evaluation/evolution
- Educate, inform, advocate
- Be a role model for change!

# #40 Ceremonial Swearing In







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