Sleep and Fatigue in Transportation Safety: An NTSB Perspective

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Sleep Grand Rounds
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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
• 130,000+ accident investigations
• 13,000+ safety recommendations
• 82% acceptance rate
13,454 Safety Recommendations issued since 1967

- Railroad (2156) 16.0%
- Aviation (5252) 39.0%
- Marine (2352) 17.5%
- Pipeline (1253) 9.3%
- Intermodal (234) 1.7%
- Highway (2207) 16.4%

Rev: July 1, 2011
“Swiss Cheese” Model (Reason)

Successive layers of defenses, barriers, and safeguards

Hazards

Accident

Successive layers of defenses, barriers, and safeguards
The Challenge (Haueter)

Successive layers of defenses, barriers, and safeguards
Go! Flight 1002

- early starts, multiple segment days, sleep apnea
Guantanamo Bay Cuba

First NTSB aviation accident to cite fatigue as probable cause

- acute sleep loss, sleep debt, circadian disruption
Crew Sleep History

Capt.
- 8/16/93: 8h, 9h, 2h, 17.5h, 5h, 23.5h
- 8/17/93: 8h, 9h, 2h, 17.5h, 5h, 23.5h
- 8/18/93: 8h, 9h, 2h, 17.5h, 5h, 23.5h

F/O
- 8/16/93: 8h, 9h, 2h, 19h, 8h, 19h
- 8/17/93: 8h, 9h, 2h, 19h, 8h, 19h
- 8/18/93: 8h, 9h, 2h, 19h, 8h, 19h

F/E
- 8/16/93: 9.5h, 15h, 6h, 9h, 6h, 21h
- 8/17/93: 9.5h, 15h, 6h, 9h, 6h, 21h
- 8/18/93: 9.5h, 15h, 6h, 9h, 6h, 21h

Colors:
- Blue: Sleep
- Green: Wake
- White: Duty

Accident MGUM
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
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)
“Contributing to the accident were . . . (2) fatigue, which likely impaired both pilots’ performance; . . .”
Lubbock, TX (January 27, 2009)

2 injuries
“Contributing to the accident were . . .

4) fatigue due to the time of day in which the accident occurred and a cumulative sleep debt, which likely impaired the captain’s 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
10 fatalities
3 serious injuries
2 minor injuries
5 no injuries

Source: Oklahoma State Police
Fatigue Factors

- Off work for 3 weeks
- Kept day active/night sleep schedule when off
- Had one work day prior to accident
- 3am to 3pm shift work/drive schedule (since 1997)
- Obtained min 3 hrs/max 5 hrs sleep prior to accident
- Early bedtime (2 hr phase advance in sleep time)
- 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.

NATIONAL TRANSPORTATION SAFETY BOARD

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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
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
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)
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.
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.
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
Future Needs . . .

- Operationally relevant science
- Implement science-based strategies
- Continuing evaluation/evolution
- A culture change that supports different attitudes and behaviors