An NTSB Perspective on
Sleep/Fatigue Risks in Transportation:
Accidents, Recommendations, and Future Needs

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Board Member

The Sleepy Brain
Stockholm, Sweden
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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
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
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
Fatigue Factors: Accident Investigation

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

### Sleep Duty Log for 8/16/93

<table>
<thead>
<tr>
<th>Time</th>
<th>Sleep</th>
<th>Wake</th>
<th>Duty</th>
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### Sleep Duty Log for 8/17/93

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### Sleep Duty Log for 8/18/93

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**Accident MGUM**
Observed Performance Effects

- Degraded decision-making
- Visual/cognitive fixation
- Poor communication/coordination
- Slowed reaction time
“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…”
Continental Connection (Colgan Air)
Buffalo NY (February 12, 2009)

- 50 fatalities; commuting, acute sleep loss
Crew Fatigue Factors

• Captain
  - acute sleep loss (lounge, interrupted)
  - cumulative sleep debt (6 – 12 hrs)
  - awake at least 15 hrs
  - landing at normal bedtime

• First Officer
  - commuted overnight from Seattle
  - 8.5 hrs sleep in previous 34 hrs
    (in-flight, crew room)
Geographic Distribution of Colgan Air Pilots Based at Newark, New Jersey

137 EWR pilots: 93 (68%) commuted

Less than 100 miles: 45 Connecticut, New Jersey, New York, Pennsylvania

100 to 199: 13 Maryland, Massachusetts, New York, Pennsylvania, Rhode Island

200 to 399: 29 Maine, Massachusetts, New Hampshire, New York, North Carolina, Pennsylvania, Virginia

400 to 999: 20 Florida, Georgia, Illinois, Iowa, Michigan, Ohio, South Carolina, Tennessee, West Virginia

1,000 or more: 29 California, Colorado, Florida, Louisiana, Minnesota, Nevada, Texas, Utah, Washington
• The pilots’ performance was likely impaired by fatigue, but extent/degree it contributed to performance deficiencies cannot be conclusively determined.

• All pilots, including those who commute, have a personal responsibility to wisely manage their off-duty time; the accident pilots did not do so.

• Colgan Air did not proactively address pilot fatigue hazards at a predominantly commuter base.

• Operators have a responsibility to identify commuting risks, implement strategies to mitigate these risks, ensure commuting pilots are fit for duty.
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. . . .”
• 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
Scheduling Policies and Practices

Victoria, Texas, January 2, 2008

- 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
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
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
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
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)
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.”
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.
Future Needs . . .

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