



NTSB National Transportation Safety Board

Sleep and Circadian Factors in Transportation Safety: An NTSB Perspective

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

SUBCHAPTER 1—GENERAL

Sec.
1101. Definitions.

SUBCHAPTER 2—ORGANIZATION AND ADMINISTRATIVE

1111. General organization.
1112. Special boards of inquiry on air transportation safety.
1113. Administrative.
1114. Disclosure, availability, and use of information.
1115. Training.
1116. Reports and studies.
1117. Annual report.
1118. Authorization of appropriations.

SUBCHAPTER 3—AUTHORITY

1121. General authority.
1122. Civil aircraft accident investigations.
1123. Review of other agency action.
1124. Inspections and audits.
1125. Secretary of Transportation's responses to safety recommendations.

SUBCHAPTER 4—ENFORCEMENT AND FINALITIES

1131. Aviation enforcement.
1132. Injurer and intervention in aviation proceedings.
1133. Judicial review.
1134. Discovery and use of cockpit voice and other material.
1135. Aviation penalties.

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 successor may not be appointed unless the member is reappointed 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

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

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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...”

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



- 50 fatalities; commuting, acute sleep loss

NTSB



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

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NTSB Findings

- 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 (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
- 2/09 Buffalo NY: 49 fatalities

10 fatalities
3 serious injuries
2 minor injuries
5 no injuries

**Ford
Windstar**



**Hyundai
Sonata**

**Kia
Spectra**

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

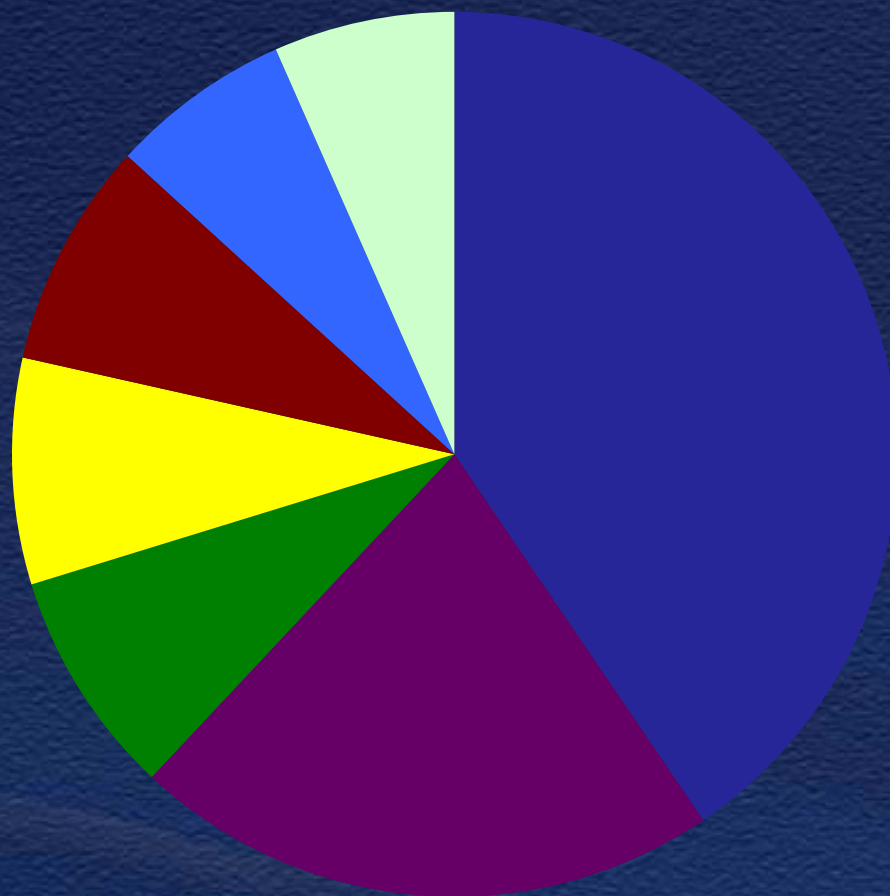
Probable Cause (fatigue)

“ . . . 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 Fatigue 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

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

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)

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
- 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

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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.”

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.

Success requires . . .

A culture change that supports
different attitudes and behaviors



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