

# Asleep at the Wheel



**To prevent more incidents in which pilots doze off at the controls, the NTSB is seeking new research into fatigue and new steps to identify pilots with obstructive sleep apnea.**

BY LINDA WERFELMAN

Cit<sup>C</sup>iting the demanding schedules flown by short-haul flight crews, the U.S. National Transportation Safety Board (NTSB) has called for new research into ways in which the “unique characteristics of the job” contribute to pilot fatigue.

The NTSB recommendation followed its investigation of a Feb. 13, 2008, incident involving a go! Airlines Bombardier CL-600-2B19 that flew about 26 nm (48 km) past its destination airport in Hilo, Hawaii, U.S., because its two pilots had unintentionally fallen asleep during the

mid-morning flight from Honolulu. The pilots awakened and turned back to Hilo, where they landed the airplane; no one was injured in the incident, and the airplane was not damaged.

“Although the incident ended without damage or injury, this outcome was dependent on two chance factors,” the NTSB said. First, the airplane had been loaded with enough fuel for a round-trip flight; with that cushion, there was 1.5 hours of fuel remaining when the pilots woke up — without it, there would have been enough fuel for 22.5 minutes of flight.

Second, the report said, “the flight crew fell asleep halfway through the 51-minute flight rather than later in the flight, and they slept 18 to 25 minutes; thus, they flew only three minutes beyond their destination and added just eight minutes to the total duration of the flight. If the flight crew had fallen asleep later in the flight or remained asleep longer, that situation, too, may have led to the exhaustion of available fuel.”

The NTSB concluded that the crew’s work schedule, including several consecutive early morning start times, was one factor that contributed to the incident. Another factor was the captain’s obstructive sleep apnea — a disorder that can disrupt sleep hundreds of times during a typical sleep period — which had not yet been diagnosed at the time of the incident (see “Obstructive Sleep Apnea,” p. 26).

The NTSB said that the fact that the pilots had fallen asleep in the mid-morning — “a time of day normally associated with wakefulness and rising alertness” — indicates that they were fatigued.

“This incident is not an isolated occurrence,” the NTSB said in a letter accompanying the safety recommendations to Randy Babbitt, administrator of the U.S. Federal Aviation Administration (FAA). “Researchers have found and pilots have reported other instances of professional pilots falling asleep on commercial flights.”

The NTSB cited several studies:

- A 2005 study, in which researchers measured pilot brain activity, found 10 episodes of “unplanned sleep or reduced alertness” in 400 person-hours of flight.<sup>1</sup>
- A search of the U.S. National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System database for 1995 through 2007 revealed 17 reports in which crewmembers on U.S. Federal Aviation Regulations Part 121 flights said that they had inadvertently fallen asleep during flight. Of the 17 reports, five described events in which both pilots had fallen asleep.<sup>2</sup>

- A 1999 NASA survey of regional airline pilots found that 80 percent said that they had “nodded off” during a flight, and respondents said that multiple flight segments and “scheduling considerations” contributed to their fatigue.<sup>3</sup>

The NTSB recommendations called for research specifically aimed at identifying methods of reducing the effects of fatigue on short-haul pilots, such as studying the “interactive effects of shift timing, consecutive days of work, number of legs flown and the availability of rest breaks.”

### Multiple Legs, Short Turnarounds

The go! pilots involved in the Hawaii incident routinely flew eight legs during a duty period of slightly more than nine hours, the NTSB said. During those eight legs a considerable amount of time was spent performing the high-workload activities involved in takeoffs and landings.

Turnaround times between legs averaged 17 minutes, a schedule that “limited their

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## Obstructive Sleep Apnea

Many people with obstructive sleep apnea — including the captain of a go! Airlines Bombardier CL-600-2B19 that overflew its destination airport during a Hawaiian Islands flight because both pilots were asleep — are unaware that they have the disorder, which can cause breathing to stop and start hundreds of times during a typical eight-hour sleep period.

Obstructive sleep apnea — by far the most common of two primary types of sleep apnea<sup>1</sup> — occurs when throat muscles relax during sleep and block the upper airway. It is most common in older adults, especially those who are overweight.

Other risk factors include hypertension (high blood pressure), a thick neck or narrow throat, chronic nasal congestion, diabetes, smoking or the use of alcohol or sedatives. The disorder is twice as likely to occur in men, two to three times as likely in people older than 65, and — among those younger than 35 — more common among blacks, Hispanics and Pacific Islanders.<sup>2</sup>

Symptoms include loud snoring that typically begins soon after falling asleep and is interrupted by silence, followed by a “loud snort and gasp” and a resumption of snoring, medical experts at the U.S. National Institutes of Health (NIH) say.<sup>3</sup> The pattern is repeated throughout the sleep period. Other symptoms include unusual daytime sleepiness, morning headaches and difficulty concentrating.

Blood tests and electrocardiograms are among the tests that may be

performed on an individual suspected of having obstructive sleep apnea, which often is confirmed through a polysomnogram (sleep study), in which electrodes are placed at various locations on the head to detect the amount and quality of sleep obtained during a sleep session, which is observed by a health care specialist. Heart rate and breathing also are monitored throughout the session.<sup>4</sup>

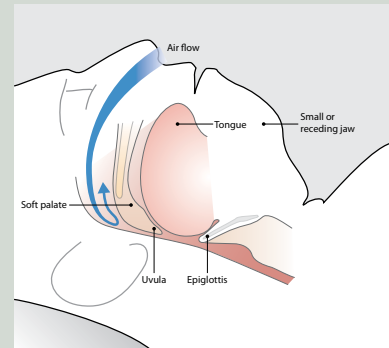
Untreated, the sudden decreases in blood oxygen levels that accompany obstructive sleep apnea can cause an increase in blood pressure, a strain on the cardiovascular system and a higher risk of heart attack and stroke.<sup>5</sup>

Treatment of mild cases of obstructive sleep apnea may involve only lifestyle changes, such as losing weight; avoiding alcohol, tobacco and sedatives; or changing the sleeping position. In some cases, an oral appliance, made by a dentist or orthodontist, can be worn to adjust the position of the lower jaw and tongue during sleep.<sup>6</sup>

For individuals with moderate to severe obstructive sleep apnea, the most common treatment is the use of a continuous positive airway pressure (CPAP) device, which consists of a mask over the nose that is connected via a tube to an air blower that directs a steady, gentle stream of air into the throat to keep the airway open.

### Notes

1. Central sleep apnea, which accounts for about 5 percent of sleep apnea cases, is a disorder in which breathing



Susan Reed

Obstructive sleep apnea occurs when throat muscles relax and block the upper airway.

stops and starts because the brain does not properly signal the muscles involved in breathing. It typically results from heart failure, stroke and other medical problems.

2. Mayo Clinic. *Obstructive Sleep Apnea: Risk Factors*. <[www.mayoclinic.com/health/obstructive-sleep-apnea/DS00968/DSECTION=risk%2Dfactors](http://www.mayoclinic.com/health/obstructive-sleep-apnea/DS00968/DSECTION=risk%2Dfactors)>.
3. U.S. National Library of Medicine (NLM); NIH. “Obstructive Sleep Apnea.” *Medline Plus*. <[www.nlm.nih.gov/medlineplus/ency/article/000811.htm](http://www.nlm.nih.gov/medlineplus/ency/article/000811.htm)>.
4. NLM; NIH. “Polysomnography.” *Medline Plus*. <[www.nlm.nih.gov/medlineplus/ency/article/003932.htm](http://www.nlm.nih.gov/medlineplus/ency/article/003932.htm)>.
5. U.S. National Heart Lung and Blood Institute (NHLBI). “What Is Sleep Apnea?” *Diseases and Conditions Index*. <[www.nhlbi.nih.gov/health/dci/Diseases/SleepApnea/SleepApnea\\_WhatIs.html](http://www.nhlbi.nih.gov/health/dci/Diseases/SleepApnea/SleepApnea_WhatIs.html)>.
6. NHLBI. “How Is Sleep Apnea Treated?” *Diseases and Conditions Index*. <[www.nhlbi.nih.gov/health/dci/Diseases/SleepApnea/SleepApnea\\_Treatments.html](http://www.nhlbi.nih.gov/health/dci/Diseases/SleepApnea/SleepApnea_Treatments.html)>.

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opportunities to eat and attend to physiological needs, which could have interfered with their ability to obtain proper nutrition and avoid dehydration,” the board said.

The NTSB found no research involving pilots flying more than five legs per duty period.

One survey that questioned pilots who flew five legs per duty period found that, by the end of a shift, they felt minor to moderate fatigue, compared with pilots who flew a single leg during a duty period and said they felt “okay” as they neared the end of a workday.<sup>4</sup>

Another study, conducted for the North Atlantic Treaty Organization (NATO), found that pilots who reported for duty before 0600 local time usually slept less than six hours a night and experienced sleep of poorer quality than pilots who reported for duty later in the day.<sup>5</sup>

The NTSB said that, in the case of the go! incident, the operator scheduled pilots to work one of two shifts: beginning at 0540 and ending about 1440 or beginning at 1400 and ending about 2300.

“Pilot schedules were not arranged to minimize individual pilots’ exposure to morning shifts, as recommended by researchers,” the NTSB said. “Rather, schedules were arranged so that some weeks included mostly morning shifts and some included mostly afternoon shifts. As a result, some pilots were required to work five consecutive early morning shifts.”

Current FAA regulations allow two-person crews to be scheduled for as many as eight flight hours a day, but they do not set daily limits on overall duty time, as long as crews are scheduled for at least nine hours of rest between duty

periods. In some cases, eight-hour rest periods are permitted, however.

### U.K. Duty Limits

The FAA regulations differ from work rules adopted in 2004 in the United Kingdom, which established maximum daily duty times that vary according to the time of day a pilot reports for duty and the number of legs he or she flies. For example, a flight crew that begins work between 2200 and 0559, is acclimated to the local time zone and flies one leg may work a maximum of 11 hours; if the crew flies four or more legs, they may work no more than nine hours. Crews with several consecutive early morning reporting times also are restricted to nine hours of duty time, regardless of how many legs they fly.

Three of the NTSB safety recommendations called on the FAA to conduct fatigue research specifically relating to short-haul flight operations, to issue interim guidance to operators of multi-segment short-haul flights that provides relevant information that becomes available during the course of the research and, ultimately, to require the operators to incorporate the guidance into their operations specifications.

### Sleep Apnea

The three other recommendations resulting from the investigation of the go! incident

Obstructive sleep apnea often is treated with a continuous positive airway pressure (CPAP) device, which consists of a mask to cover the nose, a connecting tube and an air blower that uses a stream of air to keep the upper airway open.



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called on the FAA to take steps to identify pilots at high risk for obstructive sleep apnea. The captain's case was considered severe, and the NTSB said that symptoms existing before the incident could have prompted physicians during at least two medical examinations to determine that he was at risk.

“The captain was experiencing excessive daytime sleepiness and loud nighttime snoring, was obese, ... and had hypertension that was not optimally controlled despite the use of two different blood pressure medications,” the NTSB said. He had discussed the snoring with his primary care physician in December 2007, but testing for obstructive sleep apnea was not recommended.

FAA records show that 0.5 percent of pilots with first class medical certificates report having obstructive sleep apnea, compared with 1 percent of active U.S. Air Force pilots and 7 percent of the general adult population. The NTSB said that, considering the Air Force's fitness requirements, civilian pilots are more likely than military pilots to have risk factors, such as obesity and hypertension, associated with obstructive sleep apnea — and that a survey published in 2007 determined that 15 to 24 percent of civilian pilots could be classified as obese.<sup>6</sup>

The FAA's guidance to aviation medical examiners does not include a discussion of risk factors for obstructive sleep apnea, and the application for an airman's medical certificate does not ask pilots if they have a history of obstructive sleep apnea or if they have symptoms of the disorder, the NTSB said.

Federal agencies overseeing other forms of passenger transportation

already gather such information from operators, or are revising forms and guidance as part of plans to begin gathering it, and at least one regional transit agency is conducting a test project to screen operators for obstructive sleep apnea and other sleep disorders. The FAA also should develop this type of guidance, the NTSB said.

“Objective medical data already gathered by the FAA could be used to measure risk for [obstructive sleep apnea] using existing consensus guidance on screening, but the most effective screening would require the FAA to gather additional information and develop additional guidance,” the NTSB said. “Because [obstructive sleep apnea] is associated with excessive daytime fatigue, leads to an increased risk of accidents and cognitive impairment, substantially increases the likelihood of critical errors and of actually falling asleep during flight, and because many individuals who have the disorder do not know they have it, the NTSB concludes that efforts to identify and treat the disorder in commercial pilots could improve the safety of the traveling public.”

NTSB safety recommendations called on the FAA to modify the application for a pilot medical certificate to include questions about whether the applicant had ever been diagnosed with obstructive sleep apnea and whether he or she had risk factors for the disorder.

The FAA also should implement a program to “identify pilots at high risk for obstructive sleep apnea and require that those pilots provide evidence through the medical certification process of having been appropriately evaluated and, if treatment is needed,

effectively treated ... before being granted unrestricted medical certification,” the NTSB said.

Another recommendation said the FAA should disseminate guidance to help pilots, their employers and their physicians to identify individuals at high risk for obstructive sleep apnea, at the same time “emphasizing that pilots who have obstructive sleep apnea that is effectively treated are routinely approved for continued medical certification.”

*This article is based on NTSB safety recommendations A-09-61 through A-09-66 and the accompanying letter to the FAA, dated Aug. 7, 2009, and incident report SEA08IA080.*

Notes

1. Wright, N. et al. “Avoiding Involuntary Sleep During Civil Air Operations: Validation of a Wrist-Worn Alertness Device.” *Aviation, Space, and Environmental Medicine* Volume 76 (no. 9, 2005): 847–856.
2. The NTSB said that it reviewed reports to determine the relevance of all events.
3. Co, E.L., et al. *Crew Factors in Flight Operations XI: A Survey of Fatigue Factors in Regional Airline Operations*, NASA/TM Report no. 1999–208799.
4. Powell, D.M.C. et al. “Pilot Fatigue in Short-Haul Operations: Effects of Number of Sectors, Duty Length, and Time of Day.” *Aviation, Space, and Environmental Medicine* Volume 78 (no. 7, 2007): 698–701.
5. Simons, M.; Valk, P.J.L. “Early Starts: Effects on Sleep, Alertness, and Vigilance,” Report AGARD-CP-599 (Neuilly-sur-Seine, France: NATO-AGARD, 1998): 6/1–6/5.
6. Bryan, D.A.; Mills, W. “Co-Morbid Conditions in Overweight and Obese Airmen; Trends and Aeromedical Implications.” *Aviation, Space, and Environmental Medicine* Volume 78 (no. 7, 2007): 702–705.