The Five-Second Nap

Microsleep is among the symptoms experienced by fatigued flight attendants.

REPORTS

Flight Attendant Fatigue

Nesthus, Thomas E.; Schroeder, David J.; Connors, Mary M.; Rentmeister-Bryant, Heike K.; DeRoshia, Charles A. U.S. Federal Aviation Administration (FAA) Office of Aerospace Medicine. DOT/FAA/AM-07/21. Final report. July 2007. 64 pp. Figures, tables, references, appendixes. Available via the Internet at <www.faa.gov/library/reports/medical/oamtechreports/2000s/media/200725.pdf> or from the National Technical Information Service.*

There may once have been a golden age of gracious flying for passengers, but it appears that flight attendant fatigue is nothing new. The report says, "On international flights before World War II, workload duties lasted from 16 to 24 hours, depending upon weather. The flight attendants were required to check passports, prepare formulas for infants, care for children, pass out reading and writing material, make up berths for 16 passengers, serve up to three complete meals and wash dishes if additional meals were necessitated by weather delays. Therefore, it was not uncommon for a flight attendant to work up to 25 hours without sleep."

Today's flight attendants don't have such a grueling schedule, but "they are required to perform a number of physically demanding tasks," the report says. "Many flight attendants report that they spend most of their time on their feet. But they are also challenged emotionally, e.g., by requirements to perform multiple tasks on a tight schedule, and by being the point of contact that all passengers look to for information, help and support. In short, one of the stressors of flight attendants is that they are always 'on.'"

The U.S. Congress directed the FAA to study and report on flight attendant fatigue, a safety issue because flight attendants must be physically and mentally ready to cope with emergencies.

"To meet the goals of this study, this report contains a literature review on fatigue as potentially experienced by flight attendants, an evaluation of currently used (actual versus scheduled) flight attendant duty schedules and a comparison of these schedules to the current CFRs [Code of Federal Regulations, in this case U.S. Federal Aviation Regulations (FARs)]," the report says. Supplementing the scientific literature review, the authors studied fatigue-related incident and accident reports from the U.S. National Aeronautics and Space Administration Aviation Safety Reporting System (ASRS) and the U.S. National Transportation Safety Board (NTSB) accident/incident database.

"One section of the report also describes the application of three different performance and fatigue models currently available as examples to provide the reader with an idea of how flight attendant duty schedules contribute to increased levels of fatigue and predicted changes in performance," says the report.

Reports in the ASRS database — voluntarily self-reported and subjective — "reflect a perception among the flight attendants … that fatigue and performance are safety issues," the report says. "One NTSB accident report indicated

that flight attendant fatigue contributed to that accident. The literature reviewed also contains information relating fatigue to safety concerns and suggests the intervening states by which fatigue can lead to safety problems."

The report cites two main causes of flight attendant fatigue: sleep loss and disruption of circadian rhythms — the body's biological "clock" that regulates alertness and other physiological functions according to the person's internal time, which on long-haul flights can differ considerably from local time.

"The sleep losses documented in this report raise operational performance and safety concerns by reference to other studies," the report says. "It has been shown in various ground-based studies that such levels of sleep deprivation affect neurobehavioral functioning [and] result in increased reaction times, memory difficulties, cognitive slowing and increased lapses of attention."

Memory lapses are "clearly related to disturbances of circadian rhythms and night work," the report says. "Performance problems associated with fatigue include microsleeps (brief intrusions of EEG [electroencephalograph] indicators of sleep greater than 5 seconds), lapses in attention, slowed reaction time, increase in errors, doing things in a slipshod manner, short-term memory impairment, lack of situational awareness, and impaired decision making. The non-routine situation presents the greatest challenge to the effective performance required of flight attendants. It is here that the effects of fatigue and circadian disruption would be expected to have the most serious impact on safety."

FARs concerning scheduled work and rest periods for flight attendants have been in place since 1994, but the off-duty time typically includes tasks such as clearing security, passport control and customs, eating meals and checking into a hotel, the report says. "The time required for most of these tasks and the time devoted to fall[ing] asleep are unavoidable, with the result that reductions in off-duty time must be absorbed by the time that should be devoted to sleep," says the report.

The regulations are meant to provide acceptable limits to duty time. "But [FARs] do not, and perhaps cannot, capture the multiple variables that impact fatigue and the individual's ability to tolerate fatigue," the report says. "Taken from the standpoint of just the pre-determined dimensions of the flight itself, the [FARs] do not distinguish among the number of segments flown, daytime versus nighttime flights, flights that are uni-meridional [in a single time zone] versus those that are trans-meridional [or] regional versus domestic flights.

"To truly address the fatigue issue, regulations must be combined with sound and realistic operational practices, and supplemented, as needed, by personal strategies. Air travel will always require flexibility in operations in order to adjust to unusual and/or non-routine circumstances. From the standpoint of flight attendant fitness and well-being, it is essential that work/rest practices address the exceptions and do not become the standard."

Visualisation of Offshore Gas Turbine Exhaust Plumes

U.K. Civil Aviation Authority (CAA) Safety Regulation Group. Paper 2007/02. October 2007. 114 pp. Figures, tables, references, appendixes. Available via the Internet at <www.caa.co.uk/docs/33/Paper2007_02.pdf> or from CAA.**

"Hot gas fumes from offshore platform power generation turbines present a hazard to helicopter operations," the report says. "The temperature rises above ambient can have a significant effect on helicopter performance and need to be taken into account by the pilot when calculating the maximum operating weight of the aircraft. In addition, the rates of change of temperature in the plume can cause the helicopter engines to surge or flame out, and the turbulent flow in the plume can give rise to handling difficulties."

These exhaust plumes normally cannot be seen by a pilot. CAA Civil Aviation Publication (CAP) 437, *Offshore Helicopter Landing Areas — Guidance on Standards* suggests that introducing a smoke generating agent into emissions to make the plumes visible could offer a safety benefit.

The report describes a preliminary onshore trial to determine the best agent to use, estimate the quantity of agent needed to make consistent smoke, determine how to design a later offshore trial phase and find out whether there was any risk of damaging the gas turbines.

The onshore trial evaluated six smoke generating agents. "The trial demonstrated that injecting agents into a gas turbine exhaust could produce plumes that were visible from several kilometers," the report says. "Injecting diesel [fuel] into the exhaust resulted in the best visualization. Theatrical smoke oil [a highly refined mineral oil] and glycerol/water solution produced plumes that were less dense than those generated by diesel, [and] the plume produced by glycerol/water solution reduced in density after a short period. Water, kerosene and rapeseed oil were ineffective in creating a visible plume."

In view of the good results obtained with diesel fuel, the researchers conducted an environmental impact study on that agent. Diesel fuel was found to be unacceptable because of personnel exposure and marine environment effects.

"Overall, it is concluded that a gas turbine exhaust plume visualization system would be beneficial to helicopter flight safety at platforms where significant exhaust plume encounters are experienced, and that such a system is feasible to design and operate using an environmentally friendly glycerol/water solution as the smoke generating agent," said the report.

Acknowledging that tagging a turbine exhaust location with a smoke plume would improve visibility only during daylight, the report does not consider that a serious shortcoming, because most offshore helicopter operations are in the daytime. "Nobody interviewed could explain why the idea had not been tried before, despite being recommended good practice in CAP 437 since 1981," says the report. It recognizes, however, that installation and running costs of a smoke generating system are "not insignificant," and the CAA plans to recommend that they be considered only for platforms where a problem can be identified.

An International Survey of Maintenance Human Factors Programs

Hackworth, Carla; Holcomb, Kali; Dennis, Melanie; Goldman, Scott; Bates, Cristina; Schroeder, David; Johnson, William. U.S. Federal Aviation Administration (FAA) Office of Aerospace Medicine. DOT/FAA/AM-07/25. Final report. September 2007. 28 pp. Figures, tables, references, appendixes. Available via the Internet at <www.faa.gov/library/reports/medical/oamtechreports/2000s/media/200725.pdf> or from the National Technical Information Service.*

The report, citing various specialists, says that maintenance-related errors were associated with as much as 15 percent of commercial aircraft hull loss accidents from 1982 through 1991; a study of 92 accidents found that a maintenance factor initiated the accident chain in 26 percent of the accidents; and maintenance errors are responsible for an estimated 20 to 30 percent of in-flight engine shutdowns.

This report says that according to one study, human factors are believed to be a factor in 50 percent of maintenance-related accidents. Maintenance errors are in two broad classifications — failure to detect a problem or the introduction of an error during maintenance.

"There are a variety of international approaches to the regulation of human factors programs for maintenance organizations," the report says. "Transport Canada and the European Aviation Safety Agency have established specific, yet differing, regulations regarding maintenance human factors. … The FAA has not yet established regulations but, instead, has created guidance documents and developed voluntary reporting programs for maintenance organizations. For now, the FAA has chosen to adopt a voluntary rather than a regulatory approach to maintenance human factors."

The project that resulted in this report sought to assess the effect of voluntary versus regulatory approaches to maintenance human factors programs. It tried to answer questions such as:

- "How are organizations applying human factors principles in their day-to-day operations?
- "What is the effect of a maintenance human factors program on the organization and on aviation maintenance personnel? [and,]

- "Is there a significant difference in the implementation of maintenance human factors programs across the international spectrum?"

The report describes safety practices and opinions among human factors managers, quality control managers, human factors trainers and labor organization representatives in the international airline maintenance industry. Information was derived from a questionnaire containing 66 items, with 12 possible follow-up items that could be triggered by pre-specified responses to specific items.

Items were organized into eight categories: demographics, error management, human factors training, fatigue management, proactive human factors support, motivation for a human factors program, human factors metrics and organizational policies. The questionnaire is included as an appendix.

"For organizations that [resemble] agencies with regulatory requirements, the human factors programs are more widely adopted, and the human factors instructors are given more training to prepare them for their responsibilities," said the report in discussing the results. "Human factors programs reduce cost [of events associated with maintenance errors] and foster continuing safety and control of human error in maintenance. This survey found that the best targets of opportunity for improvement are use of event-data reporting, creation of a fatigue management program and increased use of data as a means of tracking errors over time to justify the cost of human factors programs."

Co-author William Johnson will discuss the survey and its results in an article tentatively scheduled for the March 2008 *ASW*.

WEB SITE

Global Safety Network, <www.aci-safetynetwork.aero>

"Airports Council International (ACI) considers safety to be [the] no. 1 priority for airports and the aviation community," the organization says on the opening page of the Global Safety Network, an ACI Web site dedicated to safety. It "contains information to be used by airport operators and aviation executives in ensuring their operations are safe for their customers and employees."

Sections include safety management systems (SMS) information, best practices, policies, documents, training, and a questions-and-answers forum. The forum categories are runway incursions, wildlife management, new large aircraft, winter services, low visibility operations, training, adverse weather operations, and aircraft rescue and fire fighting.

The SMS section presents an overview with a model or chart of the elements of an SMS, followed by key information for developing and implementing an airport SMS. There is a discussion about identifying risks and steps to take in conducting a risk assessment of tasks and activities.

The resources section is primarily a listing of ACI documents, position papers, reports and manuals. Some materials are available online for a fee. Others are free, such as the *Global Aviation Safety Roadmap* that was produced by the Industry Safety Strategy Group, which includes ACI and Flight Safety Foundation. ●

Sources

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Internet: <www.ntis.gov>

** U.K. Civil Aviation Authority
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