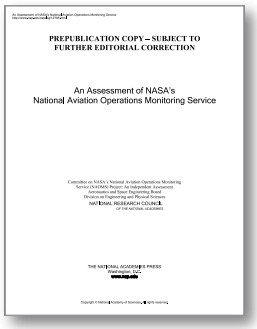
# Sample Case

**Researchers were not the masters of all they surveyed.**


PREPUBLICATION COPY – SUBJECT TO FURTHER EDITORIAL CORRECTION

An Assessment of NASA's National Aviation Operations Monitoring Service

## REPORTS

### Questionnaire Trouble

**An Assessment of NASA's National Aviation Operations Monitoring Service**

National Research Council of the National Academies. Washington, D.C.: The National Academies Press, 2009. Pre-publication copy, subject to further editorial correction. 146 pp. Available via the Internet at <www.nap.edu/catalog/12795.html>.

The National Aviation Operations Monitoring Service (NAOMS) comprised a survey of pilots by the U.S. National Aeronautics and Space Administration (NASA) that began in April 2001 and concluded in December 2004. Its results probably would have rested in benign neglect had not the Associated Press (AP) requested, through the Freedom of Information Act, details of the survey. NASA refused the request, saying, "Release of the requested data, which are sensitive and safety-related, could materially affect the public confidence in, and the commercial welfare of, the air carriers and general aviation companies whose pilots participated in the survey."

An AP article, citing an unnamed source familiar with the survey results, said that "the pilots reported at least twice as many bird strikes, near-midair collisions and runway incursions as other government monitoring systems show."

A U.S. House of Representatives committee held a hearing on NAOMS, during which the NASA administrator expressed disagreement with the wording of NASA's denial and said that the information request was rejected because "the data likely contained confidential commercial information." He said that a redacted, de-identified version of the data would be released.

The administrator added that "none of the research conducted in the NAOMS project, including the survey methodology, has been peer-reviewed to date. Accordingly, any product of the NAOMS project, including the survey methodology, the data and any analysis of that data, should not be viewed or considered at this stage as having been validated."

NASA asked the National Research Council (NRC) of the National Academies to "assess the NAOMS survey methodology and to analyze the publicly available survey data to determine their potential utility." An NRC committee formed for the task released this draft report.

"The sampled pilots were contacted first by mail with a pre-notification letter from the NAOMS team," the report says. "This letter was followed by a telephone call during which the survey was administered. … The survey questionnaire included a computer screen to allow checking for qualifying activity during the *recall period* — which consisted of [a period] varying initially from 30 to 90 days but fixed at 60 days after March 2002. The survey was conducted by professionally trained interviewers using a computer-assisted telephone interview system."

The report found that the NAOMS overall methodology — a sample survey — was a valid way of collecting relevant data. It says, "Generally speaking, NAOMS was an attempt to capture the experiences of frontline personnel (pilots, flight attendants, air traffic controllers and mechanics) regarding flight operations and aviation safety. In the committee's view, such information could be potentially useful, particularly in those segments of aviation [such as general aviation] that are not well covered by the other databases. In addition, carefully planned surveys can provide useful information not only about specific events, but about the views and perceptions of the frontline personnel on flight operations. However, care must be taken to solicit information only when they are in a position to provide accurate and consistent responses."

The NAOMS team had selected pilots meeting certain criteria from the U.S. Federal Aviation Administration (FAA) Airmen Certification Database for its sample. There were actually two surveys, one of air carrier (AC) pilots operating under U.S. Federal Aviation Regulations [FARs] Part 121, and another of general aviation (GA) pilots. But, says the report, "The flights of interest in the GA questionnaire were those conducted under FARs Part 91 and 135. However, because FARs Part 135 governs the operation of scheduled commuter carriers and on-demand 'for hire' air taxi and charter providers, including flights operated under Part 135 in the general aviation survey extended the notion of general aviation well beyond normal usage of the term."

**"The questionnaires were designed so that events and experiences from markedly different segments of the aviation industry were aggregated together (and cannot be disaggregated)."**

Ideally, the report says, the sampling frame would have been the list of all flight legs during the recall period. "However, collecting data for a simple random sample of flight legs would not have been economical or even feasible," the report said. "The NAOMS team decided to draw samples of pilots and to ask them about all events that occurred during the recall period."

Thus, pilots and not flight legs were the primary sampling unit, which resulted in what statisticians call a cluster sample. "Such a cluster sample of flights differs from a simple random sample in several ways," the report says. "In particular, the flight legs of any particular pilot are either sampled or not sampled as a group. This typically reduces the information content relative to a simple random sample of the same size because the responses within clusters are likely to be correlated." In other words, the same data sources are being sampled more than would be the case in a random sample.

The AC pilot sample was limited to U.S.-based pilots who had an airline transport pilot certificate, multi-engine rating and a flight engineer (FE) certificate. "However, some active AC pilots do not meet all these criteria," the report says. "Many AC pilots, including captains and first officers, do not hold an FE certificate."

Most modern aircraft have eliminated the flight engineer as a crewmember. As a result, pilots who had an FE certificate, and were therefore eligible for the survey, were likely to be senior pilots whose FE certificates were a legacy of their early careers. Such pilots were also more likely to be flying widebody aircraft, the report says. The survey's inclusion criteria "excluded many active air carrier pilots and appears to have led to biases such as over-representation of widebody aircraft and under-representation of small aircraft in the NAOMS sample," the report says.

In its analysis of the NAOMS questionnaires — separate ones for AC and GA pilots, with the same "structure" but different questions as appropriate — the NRC review committee found four types of problems.

First, "the questionnaires were designed so that events and experiences from markedly different segments of the aviation industry were aggregated together (and cannot be disaggregated)." Because of the unconventional definitions of AC and GA, and the wide variety of flights that fall under the term *air carrier*, "the inability to link safety-related events to the aircraft type or operating environment in which the event occurred severely hinders any meaningful analysis of event rates or trends in event rates by aircraft type or by segment of aviation," the report says.

Second, "some of the questions asked pilots for information they would not likely have had without a post-flight analysis." Some perceptions

recalled by pilots might not have reflected the nature and cause of the event as revealed by flight data analysis — information pilots do not normally have access to, the report says.

Third, "some of the questions had vague or ambiguous definitions of what constituted an event to be measured." The report says that those included "long questions with complex structure that would be difficult to understand in a computer-assisted telephone interview; questions that appear to combine multiple, unrelated events; questions about events that are not well defined; and questions containing vague terms."

Fourth, "some of the questions did not have a clear link between the measured event and aviation safety."

The redacted data — edited to eliminate pilot identification or confidential commercial information — were released in two phases, about nine months apart. The report says that the nature of the redaction differed in its two phases, hampering analysis of the data overall. It finds other data anomalies:

"The time of survey response is grouped into years … , so estimates of event rates can be computed only by years. This limits the ability to track the changes in event rates over shorter time scales, determine the effects of changes in the aviation system on event rates and assess seasonal and similar types of effects."

The quality of the data was further compromised by other factors, the report says.

"Substantial fractions of the non-zero counts of events had implausibly large values, as did the reported flight legs and hours flown," the report says. "Simple audits to alert for such values should have been used during the computer-assisted telephone interviews and data-cleaning steps to reduce the occurrence of these problems." Further, "it appears that respondents often rounded their answers to convenient numbers; for example, there were unusually high occurrences of numbers with final digits of '0' and '5.'"

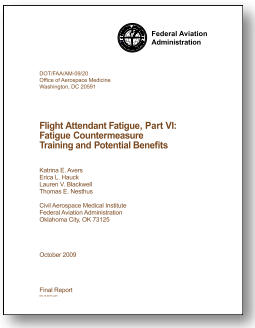
In summarizing, the report said that the NRC committee "did not find any evidence that the NAOMS team had developed or documented data analysis plans or conducted preliminary analyses as additional data became available in order to identify early problems and refine the survey methodology. … The publicly available NAOMS data should not be used for generating rates or trends in rates of safety-related events in the National Airspace System. The data could, however, be useful in developing a set of lessons learned from the project."

*— Rick Darby*

## Beyond 'Hours of Service' Regulations

### Flight Attendant Fatigue, Part VI: Fatigue Countermeasure Training and Potential Benefits

Avers, Katrina E.; Hauck, Erica L.; Blackwell, Lauren V.; Nesthus, Thomas E. U.S. Federal Aviation Administration (FAA) Office of Aerospace Medicine. DOT/FAA/AM-09/20. Final report. October 2009. 17 pp. Figure, tables, references, appendixes. Available via the Internet at <www.faa.gov/library/reports/medical/oamtechreports/2000s/media/200920.pdf>.




The cabin crewmember's physiology is a square peg that must fit into a daily round of multiple flight legs, extended duty time, early departures, late arrivals, jet lag, nonstandard schedules and other strains. However, "despite operational requirements, the body's biological need for sleep to maintain alertness does not change," the report says. "Individuals are not physiologically prepared to operate effectively on the 24/7 schedules that define today's flight operations."

In an emergency, cabin crewmembers are responsible for passenger safety, and fatigue can degrade performance when it is most needed to survive an accident.

"The FAA has traditionally sought to manage fatigue through hours of service (HOS) regulations," the report says. "The increasing number of fatigue-related [U.S. National Aeronautics and Space Administration] Aviation Safety Reporting System reports, however, suggests that HOS regulations are insufficient for systematically managing fatigue for flight attendants."

Systematic fatigue management cannot be reduced to a purely numerical formula, the report says. It takes support from all parties involved: "For example, the FAA is responsible for fatigue management regulations, while the operators have a responsibility for work schedule design, workload distribution, working conditions and training. The

cabin crewmembers are responsible for optimizing their rest opportunities to get the sleep they need to be fit for work and for implementing personal fatigue countermeasures as needed to mitigate fatigue and maintain alertness."

The researchers conducted a review of existing fatigue countermeasure programs in an effort to determine the critical elements that should be included. Using designated criteria, 49 programs were analyzed.

"Not all fatigue-related factors were included with the same degree of frequency across programs," the report says. "Topic areas such as sleep, circadian rhythms, nutrition, work hours and substance abuse (e.g., caffeine, alcohol) were cited more frequently, while commuting, workload and hydration topics were cited less frequently."

The report concludes that "airlines should implement training as outlined in Appendix B" — which includes recommended topics and subtopics — "and training should be integrated into broader fatigue risk management strategies."

*— Rick Darby*

## WEB SITES

### Garlic for Flight Safety

**2009 Bird Strike North America Conference, <www.birdstrikecanada.com/CanadaConference.html>**

Garlic is said to repel vampires. It may also be a tool in the never-ending effort to control bird strikes.

Natural garlic oil makes grass taste bitter to Canadian geese, which then move on to other locations, said Bill Milne's poster board presentation at the 2009 Bird Strike North America Conference. He added that garlic oil is also unpopular with European starlings.

The 11th joint meeting of Bird Strike Committee Canada and Bird Strike Committee USA was held recently in Canada to exchange statistics, ideas and information on wildlife mitigation and control techniques, new technologies, habitat management, training, and other influences on aviation safety.

"Bird Strike Committee Canada [is] a not-for-profit organization dedicated to flight safety by


reducing collisions with birds," says its Web site. Bird Strike Committee USA describes itself as a volunteer organization composed of members from the U.S. Federal Aviation Administration, Department of Agriculture and Department of Defense; airlines and airports; and the aviation industry. The organizations hold separate meetings throughout Canada and the United States and alternate annual joint meetings.

Current and previous conference presentations and bird strike facts and statistics are available from Bird Strike Committee Canada <www.birdstrikecanada.com> and Bird Strike Committee USA <www.birdstrike.org>. This year's conference presentations focused on "Risks and Strategies to Reduce Risk," "Aircraft Design and Consequences" and "Populations, Management and the Courts." Presentations are full text and may be read online or downloaded at no cost. Meeting abstracts and poster presentations appear in the 2009 program, which may be downloaded from the Canada committee's Web site.

*— Patricia Setze*

## BY OUR CONTRIBUTORS

### It's All in Your Head


**Helmet-Mounted Displays: Sensation, Perception and Cognition Issues**

Rash, Clarence E.; Russo, Michael B.; Letowski, Tomasz R.; Schmeisser, Elmar T. (editors). Fort Rucker, Alabama, U.S.: U.S. Army Aeromedical Research Laboratory. 972 pp. Figures, tables, references, glossary, index.

Clarence E. Rash's most recent article for *AeroSafety World* is "Stressed Out" (8/09), with Sharon D. Manning.