AeroSafety WORLD

FLIGHT ATTENDANT FATIGUE
Study reveals persistent state

FATAL BIRD STRIKE
Window fails, fuel flow reduced

IOSA EVOLUTION
New uses for evaluation tool

AVIATION ENGLISH
ICAO weighs in, deadline looms

A LOUD BANG
CYLINDER FAILURE DEPRESSURIZES 747

THE JOURNAL OF FLIGHT SAFETY FOUNDATION

DECEMBER 2010–JANUARY 2011

To-Do List

With 2011 officially under way, I believe it is a good time to point out some auspicious beginnings that deserve our attention during the year.

As 2010 wound down, I was very pleased by an Airbus briefing on recommended flight crew responses to ambiguous airspeed indications. It boiled down to this: If something funny seems to be going on when at altitude, set the pitch at 5 degrees nose up and put the power in the climb detent.

I loved hearing that. I have been saying we need the modern equivalent of the "dead foot, dead engine" quick guide to flying through an engine failure; this simple recommendation from Airbus sounds like a good start. I hope we develop a few more of these jewels so we can stop training as if we still fly aircraft with radial engines.

In a related development, we have seen the data from a four-year joint effort by the U.S. Federal Aviation Administration and its industry partners examining flight path management problems. In particular, the study looked at instances in which the aircraft automation and the flight crew were not on the same page. We have always known this was a big problem, but in seeking mitigations we never really knew where to start the conversation. Well, the best way to start an intelligent conversation is with data, and now data are on the table. This year we must take action based on what those data tell us.

I was also pleased to see the Civil Air Navigation Services Organisation develop serious training materials for air traffic controllers regarding unstabilized approaches, and how they can prevent aircraft from entering them. A few years ago, I never would have expected this sort of action, and that is a refreshing change. But, like everything else, this is just a beginning. There is so much more we can do to help our various professions in this industry understand one another.

I am pleased to see the renaissance of approach and landing accident reduction training, and the new focus on runway excursions. This is not something new for many of us, but for the generation that is taking over the controls, a lot of it is.

Finally, I am excited to see the International Civil Aviation Organization (ICAO) launch a new effort to protect safety information involving a multi-disciplinary group that will look to develop standards — not guidance — regarding the protection of safety information even when there isn't an accident. That is a pretty bold move for ICAO. It will take some time and dedication, but it is the start of something good.

Parts of 2010 were tough, but we can be proud that this industry managed to identify what needed to be done and started working on it. However, this will be the year where we will all have to decide if we have the resources and energy to follow through on what has begun. In past years, companies never questioned the need to give back to the system to move safety forward. At the end of this year we hope we can look back at the work done on this to-do list and see that is still the case.

William R. Voss
President and CEO
Flight Safety Foundation

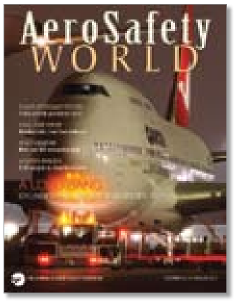
AeroSafetyWORLD

contents

December 2010–January 2011
Vol 5 Issue 11

features

departments



About the Cover
The 747 landed safely despite a fuselage breach.
© Chris Sorensen Photography

We Encourage Reprints (For permissions, go to <flightsafety.org/aerosafety-world-magazine>)

Share Your Knowledge

If you have an article proposal, manuscript or technical paper that you believe would make a useful contribution to the ongoing dialogue about aviation safety, we will be glad to consider it. Send it to Director of Publications J.A. Donoghue, 601 Madison St., Suite 300, Alexandria, VA 22314-1756 USA or donoghue@flightsafety.org.

The publications staff reserves the right to edit all submissions for publication. Copyright must be transferred to the Foundation for a contribution to be published, and payment is made to the author upon publication.

Sales Contacts

Europe, Central USA, Latin America
Joan Daly, joan@dalyllc.com, tel. +1.703.983.5907

Northeast USA and Canada
Tony Calamaro, tcalamaro@comcast.net, tel. +1.610.449.3490

Asia Pacific, Western USA
Pat Walker, walkercom1@aol.com, tel. +1.415.387.7593

Regional Advertising Manager
Arlene Braithwaite, arlenetbg@comcast.net, tel. +1.410.772.0820

Subscriptions: Subscribe to *AeroSafety World* and become an individual member of Flight Safety Foundation. One year subscription for 12 issues includes postage and handling — US$350. Special Introductory Rate — $310. Single issues are available for $30 for members, $50 for nonmembers. For more information, please contact the membership department, Flight Safety Foundation, 601 Madison St., Suite 300, Alexandria, VA 22314-1756 USA, +1 703.739.6700 or membership@flightsafety.org.

AeroSafetyWORLD
telephone: +1 703.739.6700

William R. Voss, publisher,
FSF president and CEO
voss@flightsafety.org

J.A. Donoghue, editor-in-chief,
FSF director of publications
donoghue@flightsafety.org, ext. 116

Mark Lacagnina, senior editor
lacagnina@flightsafety.org, ext. 114

Wayne Rosenkrans, senior editor
rosenkrans@flightsafety.org, ext. 115

Linda Werfelman, senior editor
werfelman@flightsafety.org, ext. 122

Rick Darby, associate editor
darby@flightsafety.org, ext. 113

Karen K. Ehrlich, webmaster and
production coordinator
ehrlich@flightsafety.org, ext. 117

Ann L. Mullikin, art director and designer
mullikin@flightsafety.org, ext. 120

Susan D. Reed, production specialist
reed@flightsafety.org, ext. 123

Serving Aviation Safety Interests for More Than 60 Years

Flight Safety Foundation is an international membership organization dedicated to the continuous improvement of aviation safety. Nonprofit and independent, the Foundation was launched officially in 1947 in response to the aviation industry's need for a neutral clearinghouse to disseminate objective safety information, and for a credible and knowledgeable body that would identify threats to safety, analyze the problems and recommend practical solutions to them. Since its beginning, the Foundation has acted in the public interest to produce positive influence on aviation safety. Today, the Foundation provides leadership to more than 1,050 individuals and member organizations in 150 countries.

MemberGuide

Flight Safety Foundation
Headquarters: 601 Madison St., Suite 300, Alexandria, VA, 22314-1756 USA
tel: +1 703.739.6700 fax: +1 703.739.6708

flightsafety.org

Member enrollment — ext. 102
Ahlam Wahdan, membership services coordinator — wahdan@flightsafety.org

Seminar registration — ext. 101
Namratha Apparao, seminar and exhibit coordinator — apparao@flightsafety.org

Seminar sponsorships/Exhibitor opportunities — ext. 105
Kelcey Mitchell, director of membership and seminars — mitchell@flightsafety.org

Donations/Endowments — ext. 112
Susan M. Lausch, director of development — lausch@flightsafety.org

FSF awards programs — ext. 105
Kelcey Mitchell, director of membership and seminars — mitchell@flightsafety.org

Technical product orders — ext. 101
Namratha Apparao, seminar and exhibit coordinator — apparao@flightsafety.org

Seminar proceedings — ext. 101
Namratha Apparao, seminar and exhibit coordinator — apparao@flightsafety.org

Web site — ext. 117
Karen Ehrlich, webmaster and production coordinator — ehrlich@flightsafety.org

Regional Office: GPO Box 3026 • Melbourne, Victoria 3001 Australia
Telephone: +61 1300.557.162 • Fax +61 1300.557.182

Paul Fox, regional director — fox@flightsafety.org

FATIGUE Progress

Usually a good indication that a fair compromise has been reached on a contentious issue is representatives from both sides of the debate saying that they are the ones taking the hit. Judging the recent notice of proposed rule making (NPRM) on flight and duty-time rules (FTLs) by this dual-aggravation standard, the U.S. Federal Aviation Administration (FAA) did a pretty good job in coming up with something that will move the issue forward (see story, p. 23).

FAA has wanted to deal with this issue about as much as you might want to lick a hot skillet. The existing rules for the most part weren't even in play at large airlines, with far more constraining work rule packages built up over decades of labor/management negotiations; further, every time the issue had been approached in the past the only dependable results were that the agency would receive a severe beating and no progress would be made.

This time around, however, was different. More of the U.S. airline system is being flown by pilots not covered by restrictive labor contracts — especially for duty and flight time — and an accident where fatigue seems to have had a significant role caught everyone's attention, including the U.S. Congress. An industry-government advisory group began the work, finished by FAA, in a way that paid more attention to science than past efforts.

When the proposed rules came out, a few pilots saw that in some limited situations their workday would actually increase, and that was all they needed to know to oppose the NPRM. They failed to dig into the package and see that the increased protection built into the rules meant that airlines were going to have to staff up — a 5 percent increase, some said — just to maintain existing operations. Naturally, the airlines howled.

But these rules have a lot of benefits for everybody, and particularly in improving aviation safety. Frequent readers of this magazine might remember a story a few months ago that was a scientific examination of different work rule sets and fatigue risk management systems (FRMSs) to see where good ideas could be found (*ASW*, 6/10, p. 40). What many probably didn't notice several months later was that the authors re-visited the story to include the FAA proposal in its comparisons, and we posted the resulting story on our Web site: <flightsafety.org/media-center/white-papers>.

The authors concluded that the NPRM somewhat improved the protection of pilot alertness at the cost of a slight reduction in worker efficiency. However, they noted that all FTLs have problems — they do not fully protect pilots from fatigue but they do restrict crew productivity. The authors say the answer is in the developing stage: "We are faced with a dilemma. FTLs are imperfect but well understood and easy to apply. An FRMS is better for managing fatigue-related risk but must be developed and validated to be trusted. Until FRMSs are widely proved and implemented, the goal must be to refine FTLs to be as close as possible to an FRMS-based approach. ... While the prescriptive aspects of the NPRM are a mixed bag, the inclusion of FRM in the NPRM language represents a potentially major step forward in flight and duty time regulation."

J.A. Donoghue
Editor-in-Chief
AeroSafety World

Let the FMC Help Calculate Takeoff Data

I read Volker Pechau's suggestion on incorrect takeoff data (*ASW*, 11/10, p. 6) with interest, because a similar thing happened to me yesterday. For takeoff speed calculations, I added a 0.3 tonne QNH correction to the computed 66.7 tonnes takeoff weight and arrived at a figure of 70.0 tonnes!

My captain caught the simple mathematical error in time, and luckily, the error was on the positive side, so at worst we would have ended up offloading some cargo that didn't need offloading, but the incident drove home the potential for error.

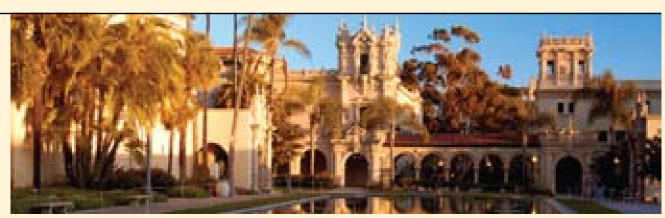
I read both of Mr. Pechau's solutions and thought I'd add a suggestion of my own: Why not use the computer provided on board? The flight management computer does all the calculations and takes inputs for those from various sensors.

Wouldn't it be simple to have a small load sensor that computes the aircraft's weight on ground and feeds that to the FMC? I can think of a number of ways to accomplish that, but I'm sure a mechanical solution already exists. Two such sensors would provide redundancy, and a third would provide a basis for comparison and determination of faulty sensor readings. Cross-check that against the load and trim sheet, and the margin for error is diminished.

Atul Bhatia
New Delhi, India

AeroSafety World encourages comments from readers, and will assume that letters and e-mails are meant for publication unless otherwise stated. Correspondence is subject to editing for length and clarity.

Write to J.A. Donoghue, director of publications, Flight Safety Foundation, 601 Madison St., Suite 300, Alexandria, VA 22314-1756 USA, or e-mail <donoghue@flightsafety.org>.



CALL FOR PAPERS ➤ International Winter Operation Conference: "Safety Is No Secret." Air Canada Pilots Association. Oct. 5–6, 2011, Montreal. Capt. Barry Wiszniowski, <bwiszniowski@acpa.ca>, +1 905.678.9008; 800.634.0944, ext. 225.

JAN. 4–6 ➤ Basic HFACS/HFIX Training and Super-User Training. HFACS. Houston. <www.hfacs.com/workshops/dates>, +1 386.295.2263.

JAN. 10–14 ➤ Safety Management Systems Complete Course. Southern California Safety Institute. San Pedro, California, U.S. Mike Doiron, <mike.doiron@scsi-inc.com>, <www.scsi-inc.com/safety-management-systems-complete.php>.

JAN. 17–19 ➤ Middle East Conference: Transforming ATM Performance. Civil Air Navigation Services Organisation. Abu Dhabi, United Arab Emirates. Anouk Achterhuis, <events@canso.org>, <www.canso.org/middleeastconference>, +31 (0)23 568 5390.

JAN. 17–21 ➤ Investigation in Safety Management Systems Course. Southern California Safety Institute. San Pedro, California, U.S. Mike Doiron, <mike.doiron@scsi-inc.com>, <www.scsi-inc.com/ISMS.php>.

JAN. 20 ➤ Volcanic Ash Operations Workshop. European Aviation Safety Agency. Cologne, Germany. <easa.europa.eu/events/events.php?startdate=20-01-2011&page=Volcanic_Ash_Operations_Workshop>.

JAN. 24–28 ➤ Cabin Accident Investigation Course. Southern California Safety Institute. San Pedro, California, U.S. Denise Davalloo, <registrar@scsi-inc.com>, <www.scsi-inc.com/CAI.php>.

JAN. 25 ➤ EASA Part M Training Course. Avisa Gulf and CAA International. Gatwick Airport, England. <www.avisa-ltd.com/training/coursetypes/caa-international.html>.

JAN. 27 ➤ Part 145 Maintenance Organisation. Avisa Gulf and CAA International. Gatwick Airport, England. <www.avisa-ltd.com/training/coursetypes/caa-international.html>.

JAN. 31–FEB. 2 ➤ Human Factors in Aviation Maintenance Course. Southern California Safety Institute. San Pedro, California, U.S. Mike Doiron, <mike.doiron@scsi-inc.com>, <www.scsi-inc.com/HFAM.php>.

JAN. 31–FEB. 4 ➤ SMS Principles Course. MITRE Aviation Institute. McLean, Virginia, U.S. Mary Page McCanless, <mpthomps@mitre.org>, <www.mitremai.org/MITREMAI/sms_course/sms_principles.cfm>, +1 703.983.6799.

JAN. 31–FEB. 9 ➤ SMS Theory and Application Course. MITRE Aviation Institute. McLean, Virginia, U.S. Mary Page McCanless, <mpthomps@mitre.org>, <www.mitremai.org/MITREMAI/sms_course/sms_application.cfm>, +1 703.983.6799.

FEB. 1 ➤ Aviation Safety Management Summit. EtQ. Tempe, Arizona, U.S. Angela Lodico, <alodico@etq.com>, <www.etq.com/smssummit>.

FEB. 8–9 ➤ Functional Check Flight Symposium. Hosted by Flight Safety Foundation, sponsored by Airbus, Boeing, Bombardier and Embraer. Vancouver, British Columbia, Canada. Namratha Apparao, <apparao@flightsafety.org>, <flightsafety.org/aviation-safety-seminars/functional-check-flight-symposium>, +1 703.739.6700, ext. 101.

FEB. 14–15 ➤ 1st Business Aviation Safety Conference. Aviation Screening. Munich, Germany. Christian Beckert, <info@basc.eu>, <www.basc.eu>, +49 (0)7158 91 34 420.

FEB. 15–16 ➤ Risk Management Course. ScandiAvia. Stockholm. Morten Kjellesvig, <morten@scandiavia.net>, <site3.scandiavia.net/index.php/web/artikkel_kurs/risk_management_course>.

FEB. 22 ➤ EASA Part M Training Course. Avisa Gulf and CAA International. Manchester Airport, England. <www.avisa-ltd.com/training/coursetypes/caa-international.html>.

FEB. 22–24 ➤ Aviation Ground Safety Seminar and Section Meeting. National Safety Council International Air Transport Section. Atlanta. Details to be announced.

FEB. 24 ➤ Part 145 Maintenance Organisation. Avisa Gulf and CAA International. Manchester Airport, England. <www.avisa-ltd.com/training/coursetypes/caa-international.html>.

MARCH 1–3 ➤ 23rd annual European Aviation Safety Seminar. Flight Safety Foundation, European Regions Airline Association and Eurocontrol. Istanbul, Turkey. Namratha Apparao, <apparao@flightsafety.org>, <flightsafety.org/aviation-safety-seminars/european-aviation-safety-seminar>, +1 703.739.6700, ext. 101.

MARCH 7–10 ➤ Safety Management Course. ScandiAvia. Stockholm. Morten Kjellesvig, <morten@scandiavia.net>, <scandiavia.net/index.php/web/artikkel_kurs/management_sto_2011_01>, +47 91 18 41 82.

MARCH 15–16 ➤ Human Factors in Aviation Course — Threat and Error Management (TEM) Model. ScandiAvia. Stockholm. Morten Kjellesvig, <morten@scandiavia.net>, <scandiavia.net/index.php/web/artikkel_kurs/tem_sto_2011_01>, +47 91 18 41 82.

MARCH 15–17 ➤ Safety Management Systems Implementation and Operation Course. MITRE Aviation Institute. McLean, Virginia, U.S. Mary Page McCanless, <mpthomps@mitre.org>, <www.mitremai.org/MITREMAI/sms_course/sms2.cfm>, +1 703.983.6799.

MARCH 17–18 ➤ Overview of Aviation Safety Management Systems Workshop. ATC Vantage. Tampa, Florida, U.S. <info@atcvantage.com>, <atcvantage.com/sms-workshop-March.html>, +1 727.410.4757.

MARCH 18 ➤ Aviation SMS Audit Course. MITRE Aviation Institute. McLean, Virginia, U.S. Mary Page McCanless, <mpthomps@mitre.org>, <www.mitremai.org/MITREMAI/sms_course/smsaudit.cfm>, +1 703.983.6799.

MARCH 20–22 ➤ Implementing SMS at Your Airport Workshop. American Association of Airport Executives and Airports Council International–North America. San Antonio, Texas, U.S. <AAAEMeetings@aaae.org>, <www.aaae.org/meetings/meetings_calendar/mtgdetails.cfm?Meeting_ID=110306>, +1 703.824.0500.

MARCH 21–APRIL 1 ➤ Flight Operations Inspector Theory Training. CAA International. Gatwick Airport, England. Sandra Rigby, <training@caainternational.com>, <www.caainternational.com/site/cms/contentviewarticle.asp?article=505>, +44 (0)1293 573389.

Aviation safety event coming up? Tell industry leaders about it.

If you have a safety-related conference, seminar or meeting, we'll list it. Get the information to us early — we'll keep it on the calendar until the issue dated the month of the event. Send listings to Rick Darby at Flight Safety Foundation, 601 Madison St., Suite 300, Alexandria, VA 22314-1756 USA, or <darby@flightsafety.org>.

Be sure to include a phone number and/or an e-mail address for readers to contact you about the event.

Safety News

ELT Inspections

Annual inspections should be required to ensure that emergency locator transmitters (ELTs) in general aviation aircraft have been mounted and retained according to manufacturer specifications, the U.S. National Transportation Safety Board (NTSB) says.

The NTSB recommended that the U.S. Federal Aviation Administration (FAA) require the inspections as part of annual aircraft maintenance inspections. The NTSB also said that the FAA should determine whether the ELT mounting requirements and retention tests specified by Technical Standard Orders (TSOs) C-91a and C-126 are "adequate to assess retention capabilities in ELT designs" and, if necessary, should revise TSO requirements to ensure proper retention of ELTs in the event of a crash.

In making the recommendations, the NTSB cited the Aug. 9, 2010, crash of a de Havilland Turbine Otter in a mountainous area near Aleknagik, Alaska. The pilot and four passengers, including former U.S. Sen. Ted Stevens of Alaska, were killed in the crash, and four other passengers received serious injuries.

Searchers located the wreckage about five hours after the crash. No ELT signals were detected by search aircraft or by satellites, and after the wreckage was found, a searcher observed the ELT on the floor of the airplane. The NTSB said that it was "dislodged from its mounting tray [and] detached from its antenna" during the crash and that it "failed to transmit radio signals to alert personnel of the downed airplane."

If the ELT had remained attached to its mounting tray, "it is likely that the signal would have been detected soon after the accident, and search and rescue personnel could have been dispatched directly to the accident site hours earlier," the NTSB said.

U.S. National Transportation Safety Board

Seats for Lap Children

Safe seating for young children "should not be considered optional," U.S. National Transportation Safety Board (NTSB) Chairman Deborah A.P. Hersman said in marking the start of a yearlong effort to promote child passenger safety.

"The laws of physics don't change, whether you are on an airplane or in an automobile," Hersman said, calling on the U.S. Federal Aviation Administration (FAA) to require that all airplane passengers — including children younger than 2 years, who currently are permitted to travel on the lap of an adult — occupy a seat with appropriate safety restraints.

© Gene Chutka/iStockphoto

"The safest place for children younger than age 2 traveling on airplanes is in an appropriate child safety seat," Hersman said. "The era of the lap child on airplanes should come to an end."

She praised a U.S. Department of Transportation advisory committee for recognizing the risks associated with children being held by adults during flights but added that the committee's acknowledgement of the risk is not enough. Instead, she said the FAA should be directed to require "that every person, including our youngest children, be restrained appropriately for their age and size."

Single European Sky

Six European nations have signed a pact seen as a step toward achieving the Single European Sky initiative.

Belgium, France, Germany, Luxembourg, the Netherlands and Switzerland agreed to establish the Functional Airspace Block — Europe Central (FABEC).

A European Union news release said that several functional airspace blocks, or FABs, are being established to "put an end to the current fragmentation of European airspace and enable more efficient and shorter flights. This, in turn, will increase safety and reduce aviation's impact on the environment."

This agreement marks the creation of the third FAB; previous agreements created the U.K.–Ireland FAB and the Denmark–Sweden FAB.

Siim Kallas, European Commission vice president responsible for transport, said that the agreement should be "an inspiration for the other member states," which aim to have all functional airspace blocks in place by Dec. 4, 2012.

Loading Errors

Aircraft operators must develop and comply with a system of cross checks by load personnel, computer software and flight crewmembers to guard against safety occurrences involving the loading of high capacity aircraft, the Australian Transport Safety Bureau (ATSB) says.

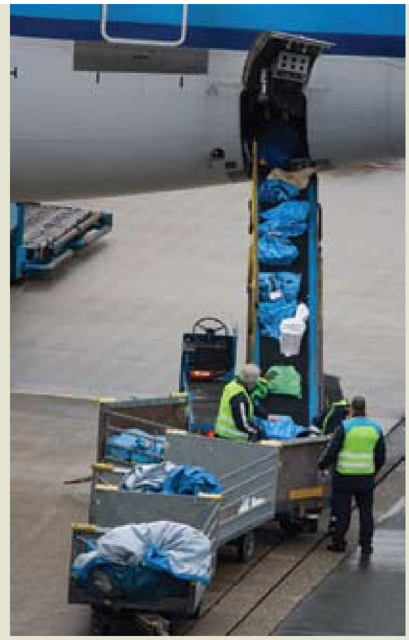
An ATSB review of loading occurrences from July 2003 through June 2010 found that most such incidents are relatively minor and that aircraft performance has been affected in a "small number" of cases. The most frequently reported problem, the ATSB said, is "cargo locks not being raised."

Other occurrences cited in the ATSB review involved the crew of an Airbus A330 being surprised that their airplane was nose-heavy during takeoff, the discovery — as an airplane left the gate — of a baggage handler who had fallen asleep in the cargo hold while waiting for late baggage, and the observation by ground personnel that the front wheel of an airplane was "almost off the ground during loading" because the airplane was tail-heavy.

"The process of loading, flying and then unloading an aircraft is quite complex. … Sometimes the complex coordination involved in loading high capacity aircraft breaks down," the ATSB said.

Nevertheless, the agency added, "There are people, processes, procedures and engineering equipment used by aircraft and ground operators to control the risks to an aircraft from a loading perspective."

To help guard against common loading errors, the ATSB recommended comparing aircraft weight as recorded in the aircraft manual with the load-report weight, incorporating rules within load-control software to prevent the generation of incorrectly configured aircraft load sheets and



© mikeuk/iStockphoto

using on-board aircraft weight sensors "as a cross check against weight and center of gravity calculations." In addition, flight crews should refuse to accept load sheets while the aircraft is still being loaded, the ATSB said.

Avionics Compartment Fires

The French Bureau d'Enquêtes et d'Analyses (BEA), citing fires in the avionics compartments of two Boeing 747-400s, has recommended that the European Aviation Safety Agency (EASA) and the U.S. Federal Aviation Administration (FAA) require the installation of a key part on the 747's ground power unit (GPU).

The fires occurred March 18, 2010, in a Thai Airways International 747 and April 8, 2010, in a Cathay Pacific Airways 747; both airplanes were at the gate at Paris Charles de Gaulle Airport.

In each instance, the fire began as passengers were disembarking, soon after the GPU was connected. Also in each instance, connectors and electric cables were severely damaged, and the structural characteristics of the fuselage were distorted by the heat from the fire, the BEA said.

The BEA concluded that the fires were caused by short circuits in the avionics compartment. Investigators determined that in the Cathay Pacific airplane, "one of the two GPU electrical connectors was incorrectly connected" and that the same problem likely occurred in the other airplane.

"The incorrect connection, associated with inappropriate actions by ground technicians, was the cause of the two

Adrian Pingstone/Wikimedia

incidents," the BEA said. "The design of the electrical connector guides, installed on Boeing 747-400s before 2003, allows this incorrect connection to occur."

Boeing developed a solution that calls for installing a different guide, and the company is unaware of any cases of misalignment in airplanes in which that guide has been installed. The BEA recommendation asks the EASA and the FAA to mandate the replacement.

Recommendations on Aviation's Future

An advisory committee has recommended to U.S. Transportation Secretary Ray LaHood that the federal government help pay for installation of NextGen equipment on airplanes as part of a plan for addressing the challenges facing the aviation industry in the United States.

The recommendation was one of 23 submitted to LaHood by the Future of Aviation Advisory Committee, established in April 2010 to identify ways of bolstering aviation safety, as well as the strength and competitiveness of the aviation industry.

Other recommendations included proposals to incorporate safety standards into the planning for NextGen — the plan to overhaul the National Airspace System formally known as the Next Generation Air Transportation System — and to expand the sources of safety data available to the U.S. Federal Aviation Administration. Another recommendation calls for improving methods of predicting safety risks.

© Hkratky/Dreamstime.com

The Department of Transportation will review the recommendations to determine if and how they should be implemented.

Firefighter-Transport Standards

Mission-specific operating standards should be developed for operations involving the transport of firefighters, including requirements for compliance with aircraft operating limitations, the U.S. National Transportation Safety Board (NTSB) says.

Scott Lin/U.S. Forest Service

The NTSB cited the Aug. 5, 2008, crash of a Sikorsky S-61N after takeoff, when the helicopter lost power and crashed into trees and then into the ground near Weaverville, California, U.S. The pilot and eight passengers were killed, and the copilot and three other passengers were seriously injured in the crash, which destroyed the helicopter. The accident occurred as the helicopter crew was transporting firefighters out of the Trinity Alps Wilderness.

The NTSB issued 10 recommendations to the U.S. Forest Service, which had a contract with the helicopter operator for fire-fighting services. The recommendations included development of the mission-specific operating standards and a requirement that Forest Service contractors comply with these standards, as well as establishment of an oversight program to ensure contractor compliance.

The NTSB's 11 recommendations to the U.S. Federal Aviation Administration included a call for clarification of oversight responsibilities for public aircraft.

In Other News …

The European Commission's 16th update of the list of airlines **banned** in the European Union (EU) has been expanded to include all carriers from Afghanistan, along with Mauritania Airways; CAAS, based in Kyrgyzstan; and Afric Aviation, certified in Gabon. At the same time, nine carriers based in the Republic of Kazakhstan were removed from the list, and operating limitations were eased for one operator based in Ghana. … The Australian Civil Aviation Safety Authority has finalized its overhaul of aviation **maintenance regulations** for regular public transport operations, which will be phased in beginning in June 2011. **Corrections …** An accident reported in the October 2010 issue ("Too Heavy to Fly," p. 59) incorrectly stated the location of a fatal crash involving a Cessna 208B. The accident occurred at Eros Airport in Windhoek, Namibia. … In the November 2010 issue, an incomplete photo credit appeared on p. 10. The credit line should have read Dylan Ashe/Flickr. **We're Moving** … Flight Safety Foundation is moving. Our new address, effective Jan. 31, 2011, is:

801 N. Fairfax Street, Suite 400
Alexandria, VA 22314-1774 USA

Telephone numbers will remain the same.

Compiled and edited by Linda Werfelman.

© Chris Sorensen Photography

Delving Into IOSA

BY WAYNE ROSENKRANS

When the International Air Transport Association (IATA) Operational Safety Audit (IOSA) program came on line 10 years ago, government and airline industry attention primarily focused on its introduction of a common audit standard for international code-sharing agreements and its commitment to restrict IATA membership to IOSA-registered airlines. By most accounts during a recent symposium held by the U.S. National Transportation Safety Board (NTSB), the program has become the agenda-setter for safety specialists within the world's airlines while earning endorsements from civil aviation authorities.

As a proprietary program, however, IOSA also has elicited questions from the NTSB about the potential for influence — that is, as a force parallel to government oversight — that could inhibit official awareness of safety issues by limiting release of information solely to current or prospective airline code-share partners. NTSB questioners asked whether IATA leaders have any similar concerns at the meeting on Oct. 26–27, 2010, in Washington.

"IOSA has evolved so that it has many uses beyond code-sharing, which was the original driver … [but] was never meant to be 'pseudo-regulatory,'" said Jim Anderson, senior audit adviser, IATA. "It has been clear from the get-go that these are voluntary audit standards … and IOSA is nothing more than a tool that can be used to complement

what the regulator does by law … that can be used by state authorities outside their own purview or jurisdiction."

IATA's position is that IOSA offers possibilities for civil aviation authorities to "complement regulatory oversight (i.e., access to audit reports)," citing as an example the U.S. Federal Aviation Administration's (FAA's) acceptance of IOSA registration as equivalent to a U.S. airline's own audit of a non-U.S. code-share partner (*ASW,* 11/10, p. 37). "Some states use IOSA in their … air operator certificate–approval process," Anderson added. "Some states … mandate IOSA for all operators."

The evolution of IOSA has involved input from the FAA from its inception. "We accept the IOSA protocols, and FAA is on every committee with IATA," said John Barbagallo, manager, International Programs and Policy Division, FAA Flight Standards Service (see "FAA's IASA Visits Gauge Political Will," p. 14). "We perform assessments of every code-share audit conducted by IATA, and we conduct audits of IATA itself … to ensure that they are up to date on the latest processes."

IATA's global airline audit program evolves in ways not envisioned by U.S. accident investigators.

NTSB Chairman Deborah Hersman, noting parallels between IOSA and FAA oversight activities, asked airline/alliance presenters, "Why do we need the IOSA audits? Why isn't the regulatory standard sufficient? Is it because the regulatory structure isn't nimble enough?" She also inquired whether civil aviation authorities routinely request, and succeed in obtaining, IOSA audit reports.

Currently, airlines typically do not ask regulators for their assessments of other airlines, and in turn, regulators typically do not ask for proprietary airline audit reports, some presenters replied.

"In the overwhelming number of cases, it is in the auditee's best interest and [to its] benefit to authorize release," said IATA's Anderson. Nick Lacey, COO of Morten, Beyer & Agnew, one of eight IOSA-accredited audit organizations, added that the same principle applies among code-share partners. "It may be very important for a U.S. mainline carrier to see that the code-share partner actually addresses runway incursions [although not required to do so], for example," he said.

"Some [airlines] share, and some may be inhibited from doing so," said Mark Lennon, head of operational risk and compliance at British Airways, representing the Oneworld Alliance. "[We would share] U.K. Civil Aviation Authority audit reports of British Airways with a prospective code-share partner … It is very unusual for me to ever have a reason to deny access to an IOSA audit report."

Michael Quiello, vice president, corporate safety, security and environment at United Airlines, concurred that IOSA audit reports generally are released to another airline, not a civil aviation authority. "I sign a compliance statement saying that [partners] have passed the IOSA audit, and send it over to the FAA," he said. "We don't send the whole report."

Addressing Hersman's other questions, Lennon and Quiello said that IOSA fills a gap in areas that regulatory structures do not address. "The regulatory structure was built at a different time with a different approach," Lennon said, emphasizing that IOSA also provides a common frame of reference and "auditable" language as opposed to international regulatory vagary and variation.

Barriers to Awareness

Hersman summarized part of the NTSB's final report on the February 2009 crash of Colgan Air Flight 3407 near Buffalo, New York, which said that the airline had been placed on the IOSA registry. In September 2007, the airline completed a corrective action plan to close IOSA findings, some later considered relevant to the accident investigation. FAA principal operations inspectors for the airline apparently had minimal awareness of the corrective actions before the accident and assumed that they were inconsequential to FAA oversight, she noted.

"The principal operations inspector said he was aware of the audits, but he did not have copies of the [IOSA or U.S. Department of Defense (DOD) audit reports], and he added that findings from the [IOSA] audit were minor and DOD

FAA's IASA Visits Gauge Political Will

The U.S. Federal Aviation Administration (FAA) International Aviation Safety Assessment (IASA) program annually checks relevant records for countries that have air carriers operating to the United States, currently 53. Ten countries are selected, using a scoring system, for on-site audit visits the following year. Their scores quantify risk factors such as prior discrepancies in ramp inspection reports, grounding of aircraft, FAA inspectors' placement of airlines on the agency's heightened surveillance list, accident/incident investigation reports and reports on the financial health of countries and airlines, said John Barbagallo, manager, International Programs and Policy Division, FAA Flight Standards Service.

After an IASA visit, FAA inspectors render judgments about the country's aviation oversight capacity based on factors such as national air law; aviation regulations; structure, funding and responsibility of the civil aviation authority; qualification and guidance of aviation inspectors; licensing of aviation professionals; aircraft and airline certification; proven effectiveness in resolving safety issues; and, especially, quality of oversight of operations to the United States.

"We check to see if the country has the political will for [compliance with global standards] — without political will, nothing else is going to work," Barbagallo told the U.S. National Transportation Safety Board's October 2010 symposium titled *Airline Code-Sharing Arrangements and Their Role in Aviation Safety,* in Washington. "We give [officials in] the candidate country the questions and the answers. The only thing that countries have to prove is that they have implemented these [standards] … for a long period of time."

Entering 2011, the FAA has designated 22 of 102 audited countries as Category 2 — that is, in the judgment of the FAA's inspectors, they did not meet International Civil Aviation Organization (ICAO) standards.[1] This means that if the Category 2 country's air carriers did not already conduct air carrier operations to the United States, such flights could not subsequently be approved.

If a country has Category 1 status (i.e., meets ICAO standards) and one or more of its air carriers already operate flights to the United States, consequences of a downgrade include a freeze on operational changes, placement on FAA's heightened surveillance list and immediate suspension of all code-sharing arrangements between U.S. carriers and partner carriers from that country.

"[The United States] does not have direct authority over foreign air carriers [or] countries that they come from … but we have created some programs that get us to where we want to go regarding safety," he said. "[IASA] probably has had the most effect in international aviation safety [compared with] any other program. … We have pulled more than 100 countries up into compliance … because the program has teeth." Potentially high economic gains/losses for states, airlines and other stakeholders typically are the strongest safety-compliance incentives, Barbagallo explained.

The FAA's legal right to assess civil aviation oversight in specific countries under IASA stems from bilateral air safety agreements, he noted. If a country has signed an agreement with the United States but declines to admit FAA inspectors within 60 days of notification of an IASA visit — which typically involves one week on site — the FAA automatically rates the country as Category 2, Barbagallo said.

The Flight Standards Service in 2010 initiated a training course that provides a path for any of some 5,000 inspectors to become certified to participate in IASA. "FAA also will offer [a Category 2] country technical assistance," Barbagallo said. "We will send inspectors to help them. … We will do anything to get them back into compliance."

— WR

Note

1. As of Dec. 1, 2010, countries designated as Category 2 by the FAA were Bangladesh; Belize; Côte d'Ivoire; Croatia; Democratic Republic of Congo; Gambia; Ghana; Guyana; Haiti; Honduras; Indonesia; Israel; Kiribati; Nauru; Nicaragua; Paraguay; Philippines; Serbia and Montenegro; Swaziland; Ukraine; Uruguay; and Zimbabwe.

issues were not within the scope of his responsibility," Hersman said. "But one of the things that [IATA and the DOD] found in the audits was that Colgan's internal evaluation program was ineffective. [NTSB's] concern was that if this internal evaluation program had been effective, [the airline] might have caught some of the issues and concerns with [pilot] training records."

De-Identified Sharing

During 2011, de-identified information from IOSA audits will be shared for the first time among IATA, the International Civil Aviation Organization (ICAO), the U.S. Department of Transportation and the Commission of the European Union. IATA initially contributed this information from its Global Safety Information Center representing 345 airlines — now 347 — that have completed IOSA audits. ICAO coordinates this information exchange, which involves representatives from IATA, ICAO, the FAA and the European Aviation Safety Agency (EASA).

"When it comes to safety, there is no room for secrets and silos," Giovanni Bisignani, IATA director general and CEO, said in September 2010 during the signing of a memorandum of understanding that had been announced in late March. "There is no competition when it comes to protecting our passengers. Safety is a constant challenge, and information is the key to driving improvements … [and will] help us to identify trends and potential threats. … IOSA sets the standard of safety for airlines, and aggregated IOSA audit information will complement audit information from the other partners in developing global safety priorities."

IATA also said it has positioned the IOSA program to "drive worldwide implementation of proven safety/security practices, significantly reduce the number of industry audits conducted and complement the [ICAO] Universal Safety Oversight Audit Program, which assesses individual states."

NTSB also inquired about the possibility of some role for IOSA findings about specific airlines in regulatory oversight. At present, principal operations inspectors' awareness varies from carrier to carrier, said John Duncan, manager, Air Transportation Division, FAA Flight Standards Service. "The carrier has to authorize [an IOSA audit report's] release to whoever wants to see it. [The answer] really depends on the relationship between the carrier and the [FAA] certificate management office, and how they're dealing with those issues." Principal operations inspectors receive no training or policy guidance as to a relationship between the IOSA program and their duties, he said.

Audit Process

The process of becoming an IOSA-registered airline begins with obtaining the latest *IOSA Standards Manual* from the IATA Web site and familiarizing operations personnel with about 900 IOSA standards and recommended practices (ISARPs, including some 2,000 subparts) in eight airline operational areas (Table 1). IATA provides information about the commercial IOSA audit organizations, whose 200

IOSA Audit Scope

Airline Operational Area	Significance/Recent Issues
Organization and management system	IOSA Oversight Committee task forces monitor industry changes and safety trends, such as ICAO's SMS mandate, enabling the IOSA program team to develop annual updates to audit standards — rapid compared with government rulemaking.
Flight operations	ISARPs set a common level of practice — i.e., embedding voluntary flight operations–related programs such as LOSA, ASAPs and FOQA into core safety functions — said Michael Quiello of United Airlines.
Operational control and flight dispatch	ISARPs, unlike some CAA regulations, require IOSA-registered airlines to implement contemporary best practices in dispatch functions, procedures and flight following, said John Barbagallo of the FAA.
Aircraft engineering and maintenance	IOSA — based on conformity to ICAO standards such as those in Annex 8, *Airworthiness of Aircraft* — is more comprehensive than [U.S. government] safety guidelines for audits of non-U.S. code-share partners, said Paul Morell of US Airways.
Cabin operations	The IOSA Oversight Committee creates task forces, such as a flight dispatch task force that addressed runway incursions, when "knotty issues" resist rapid consensus on recommended solutions, said Jim Anderson of IATA.
Ground handling operations	ISARPs apply because, in most countries, CAAs do not exercise regulatory oversight of ground handling operations, making airline oversight of them essential.
Cargo operations	Beyond passenger flights, ISARPs apply to operators of one or more two-pilot, multi-engine aircraft that have a maximum certificated takeoff mass more than 5,700 kg (12,566 lb) for the conduct of commercial cargo flights with or without the carriage of supernumeraries or cargo attendants.
Operational security	To IOSA auditors, security falls under the umbrella of safety because unlawful interference can affect operations in ways similar to human errors or aircraft issues.

ASAPs = aviation safety action programs; CAA = civil aviation authority; FOQA = flight operational quality assurance; ICAO = International Civil Aviation Organization; IOSA = International Air Transport Association (IATA) Operational Safety Audit; ISARPs = IOSA standards and recommended practices; LOSA = line operations safety audit; SMS = safety management system

Note: Information and comments were presented during the U.S. National Transportation Safety Board's October 2010 symposium titled *Airline Code-Sharing Arrangements and Their Role in Aviation Safety.*

Source: Flight Safety Foundation

Table 1

IOSA-accredited auditors can offer consulting during a preparatory visit before conducting the actual, or registry, audit.

The candidate airline selects the audit organization, and schedules the audit. If completed successfully, the airline and IATA receive the final IOSA audit report and IATA posts only the airline's name on the IOSA registry Web page.[1] Registered status is valid for 24 months, assuming that audit findings of problems are corrected and documentation and implementation have been verified within 12 months of audit completion. To remain on the registry, each airline must successfully complete a new IOSA audit prior to the end of the validity period.

'We have had airlines with over 400 findings — that's a lot.'

IATA then functions as the official repository of IOSA audit reports and updates the IOSA registry as changes occur. Each IOSA audit report remains the property of the airline audited, and disclosure of the contents remains under the control of that airline, Anderson said. IATA handles requests for IOSA reports and provides them only if authorized by the airline.

At IOSA's core is a common set of standards. "IATA does not introduce [audit] specifications that are not already in the ICAO standards and recommended practices, U.S. Federal Aviation Regulations or EU–OPS — unless we are able to make sure that there is a legitimate safety issue," Anderson said. "When we make changes, they are based on something that is going to improve safety. … We have to be careful that we don't … make a requirement that a large population of the world's airlines can't meet." Most changes therefore are recommended best practices not covered by the primary sources of regulations. One such change was that airlines should maintain a runway incursion risk reduction program.

The typical audit generates some "audit findings" of nonconformity to the standards and "audit observations" of nonconformity to recommended practices within ISARPs. "The number of findings, generally, is directly related to [the airline's] preparation," Anderson said. "Airlines that are extremely diligent in preparing for the audit will have very few findings; airlines that don't prepare have a lot of findings. We have had airlines with over 400 findings — that's a lot." The high level of voluntary commitment by IOSA candidate airlines to adopt recommended practices has surprised IATA, he said.

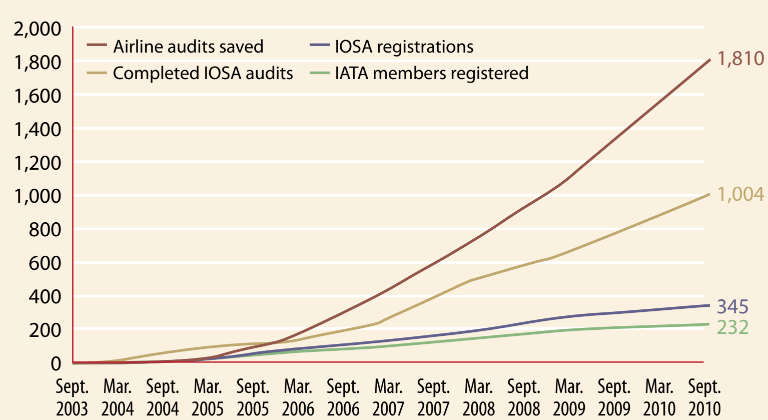
IOSA audit reports prepared by one audit organization also have indicated a wide range in total findings per audit. "As an audit organization, we have seen from zero findings to over 200 findings on an initial audit," Morten's Lacey said. "The operator that had over 200 findings did not meet the timetable for closing those findings. … [Preparation] probably is the major benefit of the audit. … It typically takes an airline three or months to conduct and document corrective actions."

The IOSA program's cumulative results (Figure 1) reflect the multiple audits undergone by airlines currently on the IOSA registry, but do not indicate airlines that did not get past the first steps toward an IOSA registry audit. "We have done a lot of IOSA preparation visits, never to have the operators return [to request the IOSA registry audit]," he said. "They just said, 'No, it's not for us — at least not now.'"

Reliance on IOSA

Several presenters said that IOSA has become "integral" to their safety management systems

IOSA Program Reduces Safety Audits by Airlines



Note: Data were compiled through Sept. 30, 2010. Airline audits saved are IATA's estimate of the reduction in airline audits by code-share partners that resulted from global acceptance of IOSA registrations, which signify successful audit completions.

Source: International Air Transport Association (IATA)

Figure 1

(SMSs), internal evaluation programs and/or operating functions. United Airlines requires all branded code-share partners — those that operate aircraft in the United Airlines livery — to be IOSA-registered, Quiello said. This complements the airline's own program of quality and safety review of all mainline and express code-share partners.

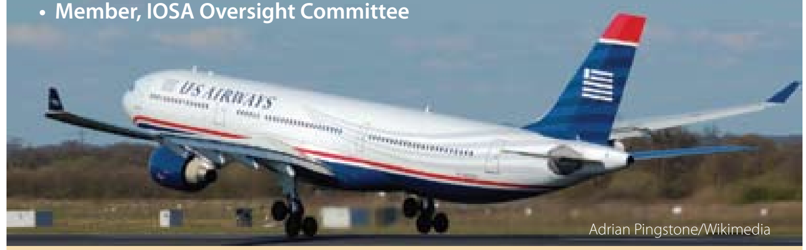
"On non-branded carriers, we look for IOSA registration, [but] sometimes because of fleet requirements, they might not meet IOSA standards because of equipage," he said. "They will not be able to meet an IOSA registration, but we do expect them to meet [another form of ICAO-based] audit … We use the IOSA audits, and on the off years, we do an audit ourselves [of code-share partners]. We also do [smaller-scale] ad hoc audits if the circumstances warrant."

Before considering prospective code-share partners, American Airlines first reviews their IOSA audit reports and their DOD reports on voluntary safety programs and internal evaluation programs pertaining to charter airlift, said Dave Campbell, vice president, safety, security and environment for the airline.

In May 2011, US Airways expects its fourth IOSA audit to validate successful implementation of ICAO-derived standards not yet required in the United States, especially its Level 4 SMS, which was developed under the FAA's SMS demonstration program. "IOSA is more comprehensive than the U.S. Department of Transportation and FAA safety program guidelines for foreign code-share audits, which require conformity to ICAO standards and to ICAO Annex 1, *Personnel Licensing;* Annex 6, *Operation of Aircraft;* Annex 8, *Airworthiness of Aircraft;* and Annex 18, *Safe Transport of Dangerous Goods by Air,*" said Paul Morell, vice president, safety and regulatory compliance. "IOSA is nimble and allows us to be nimble. … We merged with America West Airlines in 2005. IOSA [auditors] came in two years after that integration process to validate [the safety aspects] for us. When the audit was over, I could say we didn't miss anything, and that we did a good job."

An IOSA Snapshot: US Airways

- First IOSA audit September 2003
- Latest audit, SMS only, January 2011
- Fourth IOSA audit scheduled May 2011 (five auditors/five days)
- Full-time staff prepares six to eight months for each audit
- IOSA now integral to internal evaluation program
- Member, IOSA Oversight Committee



Adrian Pingstone/Wikimedia

IOSA = International Air Transport Association Operational Safety Audit;
SMS = safety management system

Source: US Airways

British Airways' Lennon added, "IOSA is a key tool. … We clearly have no desire to go and audit again should [the air carrier already] have an IOSA [registration]. In fact, depending upon our assessment of the operator, it might be that we entirely base our judgment on the IOSA registration of the operator and our individual interaction with them, and we may never need to audit them."

That does not exclude follow-up activities, however. British Airways reviews how code-share partners have closed their IOSA audit findings and the performance of their SMS, including how they conduct voluntary incident reporting programs, the quality of ongoing self-assessment of risks, the stability and effectiveness of management organization, and fleet stability. Qualitative assessments of partners' SMSs and internal evaluation programs reveal whether the partner airline resolves safety issues at the structural, root-cause level or only at the symptom level, he added.

Note

1. The link is <www.iata.org/ps/certification/iosa/Pages/registry.aspx>.

BY PETER V. AGUR JR.

Co-Responsible *for* Safety

Passengers and aviation departments must close the gap between safety expectations and actual performance.

Patients and passengers have a lot in common. Everyone wants to believe their physicians and their pilots are the best. In the vast majority of cases, that deep trust is well earned. But is trust enough?

The medical profession has pushed for patients to be directly involved in their health care decisions. It works — despite the fact that most patients have little medical expertise. It works because most doctors are professionals and openly welcome their patients' involvement. Accidental death rates of patients have declined.

Like patients, business aviation passengers need to be directly involved with their aviation service providers.

I recently was talking with the CEO of a major company about the parallels between the trust we put in our aviation departments and that in our doctors. He smiled and said, "There is one major difference. If my pilots make a mistake, they die, too. And my pilots are not suicidal." He said aloud what many passengers trust to be true.

Trust was not enough, according to Robert L. Sumwalt III, one of the five members of the U.S. National Transportation Safety Board. One of the board members' jobs is to deliberate and determine findings and probable causes of aircraft accidents. Sumwalt recently shared with me the story of a construction company that had a private plane. Their chief pilot was a retired Navy commander. Over the years, he earned the owners' trust through his professionalism and performance.

Unfortunately, a downturn in the economy required that they sell the airplane. With better times came a new plane and a new chief pilot. The company's owners invested a deep trust in their new chief pilot, too. This time it was not justified.

One foggy morning they were on approach into Hot Springs, Virginia, U.S. In an effort to complete the landing, the pilot chose to descend below the approach minimums. They flew into trees short of the airport. A post-crash fire began to engulf the airplane as the two pilots and all four passengers scrambled to safety. Among the stunned survivors was one of the owners of the company: Sumwalt's father. Sumwalt's dad lived to learn that trust is *not* enough.

© Chris Sorensen Photography

Best practices, not a generalized "safety," is the goal.

As an NTSB member, the younger Sumwalt is in a unique position to be intimately familiar with the facts of many professionally flown aircraft accidents. He sees a significant gap between the level of safety, or risk management, that passengers expect and what is actually delivered by their aviation service providers. He cites the Challenger 600 accident at Montrose, Colorado, U.S. (*ASW*, 7/06, p. 10), and the Platinum Jet chartered Challenger 600 accident in Teterboro, New Jersey, U.S. (*ASW*, 10/07, p. 38) as examples. These accidents garnered a great deal of media and industry attention. Each had passengers who probably assumed they were in great hands. Each passenger was wrong. But were they uniquely unlucky or is there a pervasive gap between expectations and performance?

To find out, I reviewed the data from dozens of audits our firm has conducted in recent years. Our clients, who tend to be large companies and very high-net-worth individuals, are demanding. This means our clients have a bias toward high performance *and* they have the ability to pay for those results. Their aviation service providers work hard to exceed those expectations. Knowing this, I examined the data surrounding several key issues:

What standard of safety do most owners, customers and passengers of business aviation expect?

Answer: The vast majority expects best practices, or better (see sidebar, page 20). Best practices is a typical standard in their core businesses. It assures intended outcomes through proactive application of resources, processes and procedures. It exceeds standard practices, or compliance with regulations designed to prevent failure.

What standard is actually achieved by most business aviation providers?

Answer: The average audit was scored in the standard practices or compliance range, at 3.3, compared with a top score of 4.0 for best practices. To validate our findings, we routinely ask our clients if our observations are fair and accurate. The overwhelming reply is, "yes."

Is there a correlation between the size of a company or the wealth of an individual and the quality of their aviation services?

Answer: No.

Actual performance fell into two distinct groupings: those who got what they expected and those who did not.

I conducted formal research to determine if these observations were accurate. The results of that study were presented in a paper titled "Selling Safety Uphill" at Flight Safety Foundation's 2010 Corporate Aviation Safety Seminar. The subjects of that study were 48 companies whose average annual revenues were nearly $15 billion, as well as nine individuals whose net worth averaged about $8 billion. The results confirmed that there is a gap between what many passengers say they want (safety best practices) and what is actually being delivered.

Who is responsible for this gap? The data clearly show that the aviation manager has the greatest influence on safety. Analysis confirms that the aviation manager directly affects the performance of his or her service delivery team, positively or negatively. Not so obvious is the finding that a highly capable aviation manager also can have a strong positive impact on how the company's senior management supports aviation safety through proper funding, policies and practices.

Based on the data, you could assume the performance of the aviation leader is the primary avenue to closing the gap between safety expectations and actual performance. However, Michael Mescon, dean (emeritus) of the school of business at Georgia State University, often said, "If you don't like what you see at the bottom, look at the top."

He was right. In reviewing 57 case studies, it was found that the vast majority of passengers expected the same standard for safety: best practices. However, actual performance fell into two distinct groupings: those who got what they expected and those who did not. The difference between these groups was how proactive and consistent the company leaders were about safety.

The four most common managerial errors in the underachieving group were:

1. Lack of clarity about expectations
   - If you aren't clear, concise and explicit about what you want, you are not likely to get it. Most aviation departments don't get routine feedback about their performance. They hope that "no news is good news." But that is like looking for landmines with your toes while you plug your ears. Any news is likely to be bad for both the customer as well as the service delivery team.
   - If you say you want your operation to be "safe," you will get a "motherhood and apple pie" response: We are safe. No reasonable person, passenger or pilot, wants to believe otherwise. But if you say you want your operation's risks to be aggressively managed, you will prompt a much more productive dialogue. Ask your aviation manager to give you his or her list of the five most important things that could be done to reduce your operation's risks. Then be prepared to address the list.
2. Executive-imposed variances from best practices standards
   - Do you push for extended crew duty days?
   - Do you have a cabin safety attendant on your large-cabin airplane on every passenger leg?
   - Do you not allow your crew to give you a full safety briefing on at least the first leg of the day and when each new passenger comes aboard?
   - Do you not require all frequent passengers to go through a couple of hours of cabin safety training at least once each year?

Scoring of Safety Practices

4.0 Best practices — *Assures* outcomes through a proactively applied balance of resources, processes and procedures.

3.0 Standard practices — *Prevents failure* by meeting the basic standards established by the FAA, the U.S. Occupational Health and Safety Administration, the original equipment manufacturer, etc.

2.0 Substandard practices — *Assumes some slight or moderate risks* of failure, typically to achieve service or cost goals.

1.0 Unacceptable practices — *Deliberately takes unnecessary significant risks* that can lead to catastrophic failure.

If you religiously demand and comply with safety best practices, you are demonstrating your commitment as well as your expectations for others' performance. If you do not, you are declaring that the performance of safety is a variable rather than a constant. This is confusing to your aviation staff. They will be constantly trying to guess where the line really is drawn.

3. Under-investment

Many companies and high-net-worth individuals invest heavily in their aviation hardware (aircraft and avionics). But they skimp on the aviation staff and their training. Yet, the people side is where you want to be most deliberate about your investment because about 70 percent of accidents are human-sourced. The most common under-investments are:

- Pilot staff — Too few or not high enough quality.
- Staff training and development — The airlines require training twice each year in a full-motion simulator. Business aviation crews need even more training and development because so much more is demanded of them.
- Cabin safety attendant — The passengers of a large cabin aircraft should not be flying solo.

4. Inappropriate reporting structure

Private aviation is typically a critical strategic service for the company. Its passengers tend to be top executives. Deciding who the department reports to is like the story of the three bears.

Having the department report to a mid-level manager (Baby Bear) is likely to lead to slow or tactical decision making (i.e., high focus on costs over strategic outcomes).

Having the department report to Papa Bear sounds great, except that the CEO rarely has the time to effectively oversee the aviation department. Plus, there is no point of appeal in the case of a critical difference of opinion between the leader of the company and the leader of aviation services.

Mama Bear is just right. This is someone who is a top leader within the company, has policy and budgetary authority, and can also, if necessary, challenge the CEO on critical points.

Robert Turknett, founder of Turknett Leadership Group, is a respected executive leadership coach and psychologist. He has worked with a number of major corporations and their aviation services teams. He observes, "Most corporate executives do not know business aviation. They trust their lead aviation expert (chief pilot or director of aviation) to take care of everything involving aviation. Without stimulus to the contrary, the executive perceives all is well. Interestingly, the pride of personal professionalism often prevents the crews from letting the passengers see the real condition of the organization.

"Pilots often see their reference of professional excellence to be their stick-and-rudder skills, as well as their ability to please their passengers. But it is very rare for pilots to have a natural aptitude for business, plus the career development that truly prepares them to be effective business unit leaders."

Turknett also points out, "Most pilots and technicians are intellectually open to continuous improvement but tend to be comfortable with the status quo." In other words, to achieve continuous improvement, an aviation team must be well led.

To illustrate Turknett's point, few hospitals are run by physicians. They are normally run by professional business managers. Not so with aviation departments. Most are managed by aviation professionals. Many of them struggle because they do not have the benefit of the structured and rigorous career development invested in other business unit leaders.

Why are aviation departments not overseen as well as other business units? Jerry Dibble, a California-based organization design consultant who has worked with numerous companies with aviation services, says, "Many companies manage their core businesses very differently than they do their aviation unit. The aviation department's business and operational standards and practices are not closely monitored, the budget is handled separately, executive oversight is sporadic and audits are rare.

"Why? Because they believe aviation is 'different.' This happens because CEOs aren't usually as expert about aviation as they are about their core business. They tend to trust their aviation staff implicitly. After all, they are passengers and by definition, not in a position of control when they are in the aircraft. A complicating dynamic occurs when senior executives welcome close personal relationships with flight crewmembers. After all, friends don't harm friends."

Dibble recommends that executives look at the investment in aviation services as one made to create strategic results: getting key people to critical meetings for the benefit of the enterprise. With that goal of aviation safety oversight, service and costs can then be put into appropriate perspective. It can be viewed as a "strategic service unit" and managed accordingly.

Dibble also indicates that most successful businesses have become very sophisticated in the way they measure their critical goals, processes and outcomes. Historically, aviation safety was measured by "no damage, no injuries," or the number of takeoffs equaling the number of landings. Today aviation safety is measured by the probability and severity of risks and how well those risks are mitigated.

A quick way to measure any gap between your expectations for safety and their actual performance is to take the following short test. Each question focuses on a near- or long-term area of high risk. Each is an industry best practice. Give yourself 10 points for each "yes" answer.

1. Is your aviation department immersed in implementing its safety management system (SMS)? This includes cultural processes and tools for identifying and proactively managing risks. Minimum compliance with SMS is becoming a regulatory standard in the European Union and elsewhere. Organizational commitment to SMS is best.

2. Have you had an aviation services audit within the past two years? You audit your core business functions routinely. But don't settle for a mere "regulatory compliance audit." Insist that you audit for best practices.

3. Does your aviation department routinely use a change management process to assure safe performance? The first 100 hours of flying a new aircraft have the highest accident rate because the change is often managed casually. An effective change management process greatly reduces risks.

4. Do your pilots train as a crew? Almost everyone trains in full-motion simulators. Sending your crews to train as a team takes it to the next level because they practice as a team.

5. If you have a large-cabin aircraft, do you have a cabin safety attendant aboard every passenger-carrying leg? Privacy in the cabin is nice, but the safety of your passengers and the aircraft is critical.

6. Do you have an active succession plan for your aviation department's key leaders? Retirement may be fast approaching for some of your pilots and technicians. Be certain your aviation department is set up to continue its legacy of success through an effective leadership transition.

7. Do you know the data behind your crew fatigue management? There are three key metrics with their potential consequences to focus on: maximum length of crew duty day (acute fatigue); crew rest minimum between duty days (acute fatigue); and maximum crew workdays in a row (chronic fatigue). You should know what variances from the fatigue policies have occurred, how frequently and how the risks were mitigated.

8. Is your aviation department properly staffed? Pilot work units are flight days, not flight hours. The normal number of pilot duty days available (flight and standby) can be as few as 200. A 365-day operation needs three pilots plus substantial contract pilot support per aircraft. And a "five days a week" operation needs three pilots because the plane typically flies 10 to 15 percent of weekend days, too. In addition, the aviation manager shouldn't be considered as part of the core pilot pool. How can a manager fly a full load and also have the time to effectively manage a multi-million-dollar business unit?

9. Is your aviation staff properly experienced and being developed to become the best and brightest? Your aviation services are one of the highest-risk endeavors of your company. The qualifications of your aviation staff and their continual development are critical. Are your managers seeking the National Business Aviation Association certified aviation manager (CAM) qualification? Is your scheduler seeking a U.S. Federal Aviation Administration (FAA) aircraft dispatcher certificate? Do your people routinely attend industry conferences and workshops?

10. Do your most frequent travelers go through passenger safety training at least bi-annually? A cabin safety briefing is only a minor refresher. Cabin safety training is a proactive step in assuring that your people are as well prepared as they can be if an event does occur.

If you score 80 points or higher, your trust is likely to be well matched by your aviation department's performance. A score of 70 or lower indicates you should take action to confirm your aviation department's strengths and opportunities for even higher performance.

So, now you know the score: you are co-responsible for your personal and corporate safety. Today, the best practice is to trust *and* verify.

Peter v. Agur Jr. is managing director and founder of The VanAllen Group, a management consulting firm to business aviation with expertise in safety and security. A member of the Flight Safety Foundation Corporate Advisory Committee, he has an airline transport pilot certificate and an MBA. He is an NBAA certified aviation manager.

NEW PROPOSAL, OLD RESISTANCE

Airlines fault latest U.S. attempt to revise rules designed to combat fatigue.

BY MARK LACAGNINA

History seems to be trying to repeat itself on the current effort by the U.S. Federal Aviation Administration (FAA) to overhaul its hodgepodge of flight crew duty, flight and rest requirements. Changes proposed 15 years ago were blasted by the airlines as costly and lacking the support of data. That rule-making effort languished until the FAA scrapped it in 2009 and established another committee to formulate recommendations.

Again, the labor and industry representatives on the committee reached no consensus on several key items, and the FAA had to choose among various recommendations. Again, the resulting proposal drew more than 2,000 public comments that included barbs from the airlines.

Comments by several airlines echoed those of the Air Transport Association of America (ATA) — the largest airline trade group in the United States — which summarized its 270-page response by saying that the proposal should be withdrawn because it goes "well beyond what current scientific research and operational data can support." Moreover, the ATA said that the FAA's estimated cost of $1.3 billion for compliance with the new rules over 10 years "is off by a magnitude of 15."

The appearance of déjà vu in the current rule-making effort, however, must be viewed in the light of an important new factor: pressure by the U.S. Congress, which in August 2010 passed legislation directing the FAA to have new regulations in place within one year.

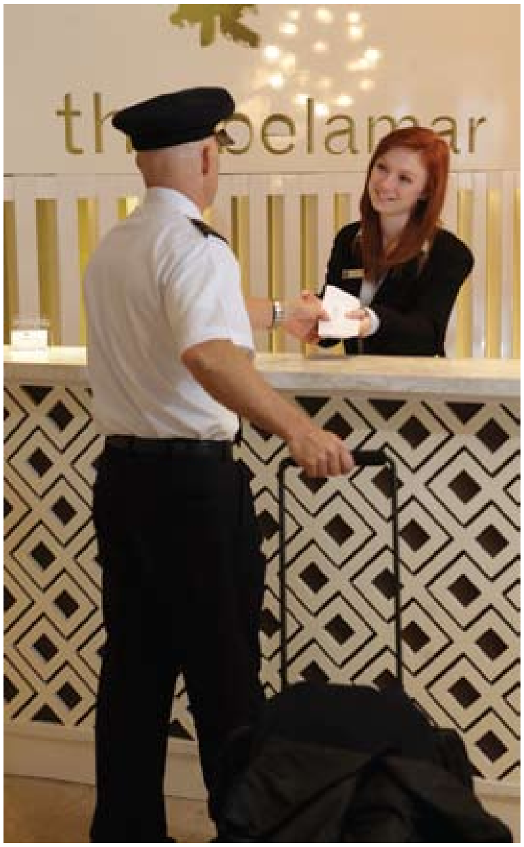
'No Time to Decompress'

In a notice of proposed rule making (NPRM) published in September 2010, the FAA said that the current regulations do not adequately address the risk of fatigue. "Presently, flight crewmembers are effectively allowed to work up to 16 hours a day, with all of that time spent on tasks directly related to aircraft operations," the agency said. "The regulatory requirement for nine hours of rest is regularly reduced, with flight crewmembers spending rest time traveling to or from hotels and being provided with little to no time to decompress."

The crux of the proposal is to establish a unified set of duty, flight and rest requirements for airline pilots in a new body of U.S. Federal Aviation Regulations called Part 117.

The FAA said it believes that the proposed requirements "sufficiently accommodate the vast majority of operations conducted today, while reducing the risk of pilot error from fatigue leading to accidents." It noted that some current requirements would be relaxed, while others would be strengthened "to reflect the

© Sava Alexandru/iStockphoto



© Chris Sorensen Photography

latest scientific information" (Table 1).

Although the FAA had intended to propose common requirements for both Part 121 air carrier pilots and Part 135 air taxi and commuter pilots, the NPRM addresses only air carrier pilots. "The agency has decided to take incremental steps in addressing fatigue," the NPRM said. However, Part 135 operators and pilots were put on notice: "The FAA does not intuitively see any difference in the safety implications between the two types of operations. … Accordingly, the Part 135 community should expect to see an NPRM addressing its operations that looks very similar to, if not exactly like, the final rule the agency anticipates issuing as part of this rule-making initiative."

That got the attention of several air taxi operators and the organizations representing them. The National Air Transportation Association, for example, said that the FAA's plan does not account for the different nature of air taxi operations, which often are conducted on short notice without the benefit of advance scheduling, and ignores substantial work performed by the industry five years ago to formulate flight, duty and rest requirements suitable to Part 135 operations.

Summary of Current and Proposed Requirements

	Current[1]	Proposed[2]
Rest time		
Minimum prior to duty (domestic)	8–11 hours, depending on flight time	9 hours
Minimum prior to duty (international)	8 hours to twice the number of hours flown	9 hours
Duty time		
Maximum (unaugmented)	16 hours	9–13 hours, depending on start time and number of flight segments
Maximum (augmented)	16–20 hours, depending on crew size	12–18 hours, depending on start time, crew size and aircraft rest facilities
Flight time		
Maximum (unaugmented)	8 hours	8–10 hours, depending on duty period start time
Maximum (augmented)	8–16 hours, depending on crew size	None

Notes

1. U.S. Federal Aviation Regulations Part 121
2. Notice of proposed rulemaking, Sept. 14, 2010

Source: U.S. Federal Aviation Administration

Table 1

'Slurred Speech, Droopy Eyes'

Part 117 would prohibit pilots from accepting or continuing a flight assignment if they know they are too fatigued to fly. However, the NPRM cites research showing that individuals typically underestimate their level of fatigue. Thus, fitness assessment would be a responsibility shared by a pilot's airline and by his or her colleagues.

Each airline would be required to "assess a flight crewmember's state when he or she reports to work" and ground the pilot if he is showing signs of fatigue, the NPRM said. In addition, pilots would have to keep an eye on each other and report to airline management any colleague who shows signs of fatigue such as "slurred speech, droopy eyes [or] requests to repeat things."

The airlines would be allowed to take punitive action against pilots who are blatantly responsible for their own fatigue. "It is unfair to place all the blame for fatigue on the carriers," the NPRM said. "Pilots who pick up extra hours, moonlight [work at other jobs], commute irresponsibly, or simply choose not to take advantage of the required rest periods are as culpable as carriers who push the envelope by scheduling right up to the maximum duty limits, assigning flight crewmembers who have reached their flight time limits additional duties under Part 91, and exceeding the maximum flight and duty limits by claiming unreasonably foreseeable circumstances that are beyond their control."

The reference to Part 91 applies to ferry flights. The NPRM notes that airlines regularly exceed Part 121 duty time limits by assigning pilots to conduct positioning and maintenance flights under the general operating and flight rules, which do not include duty limits. The proposal would allow such flights to be continued under Part 91, but they would be governed also by the new flight, duty and rest requirements in Part 117.

Flight Duty Periods

The proposed requirements are extensive and, in some cases, complex. Basically, the cornerstone is a set of flight duty period limits based on the time of day a trip starts, whether the pilot has become "acclimated" to the area, whether he or she is part of an "augmented" or "unaugmented" flight crew, and the number of segments to be flown (Table 2).

According to the FAA's definitions, a pilot is considered "acclimated" if he has been in the area for at least 72 hours or has been free from duty for at least 36 consecutive hours, and an "augmented" flight crew comprises more than the minimum number of pilots required for the aircraft type.

The data in Table 2 would apply to a pilot who is acclimated and is part of an unaugmented flight crew. The maximum flight duty periods would be reduced by 30 minutes if the pilot is not acclimated or has been assigned to a flight crossing more than four time zones.

The start times are not local times; they correspond to the current time at the pilot's home base or at another area to which the pilot has become acclimated. For example, if a pilot is based in Chicago, a flight duty period beginning at 1000 in London would be treated as if it began at 0400 because of the six-hour time difference. The period ends when the aircraft is parked after the last flight.

Proposed Flight Duty Periods

	Maximum Flight Duty Period (Hours) Based on Number of Flight Segments[2]						
Start Time[1]	1	2	3	4	5	6	7+
0000-0359	9	9	9	9	9	9	9
0400-0459	10	10	9	9	9	9	9
0500-0559	11	11	11	11	10	9.5	9
0600-0659	12	12	12	12	11.5	11	10.5
0700-1259	13	13	13	13	12.5	12	11
1300-1659	12	12	12	12	11.5	11	10.5
1700-2159	11	11	10	10	9.5	9	9
2200-2259	10.5	10.5	9.5	9.5	9	9	9
2300-2359	9.5	9.5	9	9	9	9	9

Notes

1. Local time at the flight crewmember's home base or at a location in another time zone to which the crewmember has become acclimated. The maximum flight periods are reduced by 30 minutes for a crewmember who has not become acclimated to the time zone.
2. Applies to unaugmented flight crews.

Source: U.S. Federal Aviation Administration

Table 2

A different set of flight duty periods has been proposed for augmented crews.

The FAA also has proposed limits on the number of hours that can be flown during a flight duty period (Table 3).

Airlines would be required to provide a minimum of nine hours of rest before a pilot begins a flight duty period. The time required for transportation to or from a duty station would not be included in a rest period, and no contact between the pilot and the airline would be allowed.

Any airline that would not be able to operate under the new rules could submit, as an alternative, a fatigue risk management system (FRMS) tailored to its operations. The FAA in August published Advisory Circular 120-103, which provides guidelines for developing an FRMS.

'Sorely Needed'

Not all the public comments were brickbats; the proposal also drew support from many organizations and individuals. The Air Line Pilots Association, International said that the changes are "sorely needed." Like most organizations, however, it did recommend several specific revisions and clarifications.

The U.S. National Transportation Safety Board said that it "strongly supports most aspects of the proposed rule" but noted "important issues that remain to be addressed," such as fatigue factors in short-haul operations, for which little data exist.

Proposed Flight Time Limits

Start Time[1]	Maximum Flight Time (hours)[2]
0000-0459	8
0500-0659	9
0700-1259	10
1300-1959	9
2000-2359	8

Notes

1. Local time at the flight crewmember's home base.
2. Applies to unaugmented flight crews.

Source: U.S. Federal Aviation Administration

Table 3

Too Tired

Wake, sleep and alertness measurements reveal a serious underestimation of cabin crew fatigue.

BY WAYNE ROSENKRANS

Less-than-optimal fatigue and alertness levels prevail among U.S. flight attendants even before they report for duty, says a new report. The independent research team behind a field study of 202 cabin crewmembers at 28 airlines collected, for the first time, objective data that corroborate subjective perceptions of "ubiquitous fatigue across the U.S.-based flight attendant community," reported in 2009 by a separate national survey.[1]

"On average, seemingly few, if any, flight attendants begin their workday at their well-rested best," the latest report concludes. Few differences were found among study participants from network, low-cost and regional airlines, or between domestic and international operations when the study was conducted in May–November 2009 and February–June 2010 for the Civil Aerospace Medical Institute (CAMI) of the U.S. Federal Aviation Administration (FAA).

Left for future research, however, was the question of exactly how the newly measured impairments of vigilant attention and neurocognitive performance induced by fatigue — the so-called functional consequences — affect everyday cabin safety. "That is, what does a 20 percent increase in reaction time or doubling of lapse rate [on a psychomotor vigilance test (PVT)] mean in terms of routine passenger safety, crisis prevention and management, and employee health?" the researchers asked.

An assumption that flight attendant fatigue is inconsequential to airline safety historically has influenced a low level of attention from fatigue scientists, the report notes. Fatigue in this context means "a state of tiredness due to prolonged wakefulness, extended work periods and/or circadian misalignment … characterized by decreased alertness, diminished cognitive performance and impaired decision making." A consensus has been growing that safety/security duties of cabin crews have intensified in the past decade.

"In addition to routine safety procedures and negotiating passenger welfare during acute emergencies due to weather, mechanical problems or human error, the heightened threat of organized terrorist events and other disruptive passenger activities, coupled with a generally increasing workload, requires today's cabin crew to possess an unprecedented level of perceptiveness, interpersonal skill and sustained vigilance," the report said.

The latest study is groundbreaking within the scope of research mandated in 2005 and 2008 by the U.S. Congress. It introduced wristwatch-like actigraphy devices — worn by participants to measure sleep/wake patterns — and PVT inputs and other participant responses to customized software prompts on personal digital assistant/smartphones. The devices captured what typical flight attendants experienced during three to four consecutive weeks of real-world flight operations and off-duty rest periods.

"The objective sleep/wake and PVT performance data echo and extend previous survey work suggesting that fatigue is a pervasive condition across the flight attendant community," the report said. "In fact, with sleep/wake patterns similar to those of industrial shift-workers, U.S.-based flight attendants appear to share a state of chronic sleep restriction and fatigue that is considerably worse than their own perceptions. … Regardless of workday activities, virtually all [participating] flight attendants reported for duty in an already compromised state, compared with their own individualized optimal performances. … Sleep/wake parameters and performances across the workday were still systematically affected to some extent by the broad factors of [air] carrier type, seniority and flight operations."

Most important, the study's results fill gaps in the scientific groundwork that informs discussions involving flight attendant unions, airlines and the FAA regarding specific risks, mitigations, resource investments, quantification of fatigue, and design of fatigue risk management systems. Stakeholders also are better positioned to apply the same terminology, scientific knowledge and empirical rigor to addressing fatigue in flight attendants that already has led to science-driven proposals for addressing fatigue in airline pilots (see "New Proposal, Old Resistance," p. 23) and maintenance technicians.

Specific Findings

The report mainly paints a picture of the quantity and quality of sleep obtained, and the impairment of neurocognitive performance. "On average, flight attendants slept 6.3 hours per sleep episode on days off and 5.7 hours on workdays, fell asleep 29 minutes after going to bed, awoke four times per sleep episode, and spent 77 percent of each episode actually sleeping," the report said. "After statistically controlling for any effects of reserve status, gender and age, junior-level flight attendants [relative to mid-level and senior-level flight attendants, as self-reported] had the shortest sleep latencies [that is, time to fall asleep] during their days off, and flight attendants working international operations slept significantly less per episode (4.9 hours versus 5.9 hours) and less efficiently [75 percent of the time available per sleep episode versus 79 percent] during work trips compared to their colleagues working domestic operations.

"In terms of performance, all flight attendants exhibited significant impairments during pre-work PVT test sessions when compared to their own optimum baseline performance, including a 21 percent increase in reaction times, a 14 percent decrease in response speed, and three more lapses [reactions taking 500 milliseconds or longer] on average."

Methodology

Sleep/wake data were collected automatically with devices worn 24 hours a day, seven days a week, with few exceptions. PVT components included timed responses to various types of visual and aural stimulus signals, subjective mood self-assessments and speech analysis, all validated in the field of sleep science. "Participants were required to complete up to four [five-minute PVT] test sessions per day: pre-sleep, post-sleep,

Flight attendants wore a Fatigue Science ReadiBand (previous genration) and performed tests on an AT&T Tilt.

© Fatigue Science

© AT&T (Tilt 2 by HTC Corp. shown)

pre-work and post-work [the latter two sessions only on work days]," the report said. "[They] were informed that safety and fulfilling their professional duties supersede all research requirements, and were explicitly instructed to never engage in study-related activities (data entry, testing, etc.) while actively engaged in or responsible for any work-related activities."

All sleep/wake data were analyzed using mathematical formulas that identify which main effects or interaction effects among multiple factors are statistically significant.

Statistical Insights

Carrier type proved to be a factor in sleep amount. "This was presumably due to the network [flight attendants] losing more sleep from off-days to workdays [a decrease from 6.4 to 5.3 hours] compared to their low-cost colleagues [a decrease from 6.0 to 5.8 hours] and regional colleagues [a decrease from 6.4 to 5.9 hours; Figure 1]," the report said.

Another statistical insight was that time to fall asleep increased from off-days to workdays among senior flight attendants (29 to 31 minutes) and junior flight attendants (26 to 30 minutes) but decreased among the mid-level flight attendants (32 to 27 minutes). "[Mid-level participants'] latencies were significantly longer than their junior-level colleagues on off-days," the report said.

Analysis of sleep amount and sleep efficiency showed that flight attendants on domestic and international routes slept less during work trips than on off-days at home. "The international flight attendants slept significantly less than their domestic counterparts while away on work trips (4.9 versus 5.9 hours)," the report said. "Interestingly, sleep efficiency shifted significantly in both groups from off-days to workdays … but increased for the domestic group (76 to 79 percent), while decreasing for the international group (78 to 75 percent) such that sleep efficiency during work trips was significantly lower for the international flight attendants compared to their domestic colleagues."

Mean reaction times were significantly higher (by 21.3 percent), response speeds were significantly slower (by 14.1 percent) and lapses were significantly more frequent (2.8 per test session) during pre-work sessions compared with mean optimum baseline performance. "These data suggest that, regardless of variations in on-duty activities, all flight attendants manifest some degree of fatigue-relevant performance impairment even before the start of the workday," the report said.

Analysis of false starts revealed a main effect of the carrier type. "Whereas flight attendants from network and low-cost carriers were more likely to [have] false starts on workdays relative to [their mean] optimum baseline … simple contrasts revealed that regional flight attendants, who committed fewer false starts on workdays relative to [their] baseline … did so significantly less than their colleagues from network and low-cost carriers."

Analysis of pre-work to post-work reaction times showed effects attributable to seniority. "Mean reaction times significantly increased from pre-work to post-work [sessions] in flight attendants of mid-level … and junior seniority … whereas their senior-level colleagues were not affected," the report said. "Although the groups did not differ from each other at pre-work [sessions] … post-work reaction times were significantly higher in the [junior-level flight attendants] compared to their senior-level counterparts."

Pre-work and post-work neurocognitive performance also varied significantly for domestic versus international flight attendants. "Mean reaction times increased from pre-work to post-work [sessions] … however, pre-work reaction times were significantly higher in flight attendants working domestic operations compared to their international counterparts," the report said.

Sleep/wake data also documented "significantly less sleep and reduced sleep efficiency while away on trips in flight attendants working international operations versus their domestic colleagues. … [This] is likely a function of circadian misalignment as international crews attempt to sleep under light/dark schedules that differ radically from their own endogenous circadian rhythms," the report said.

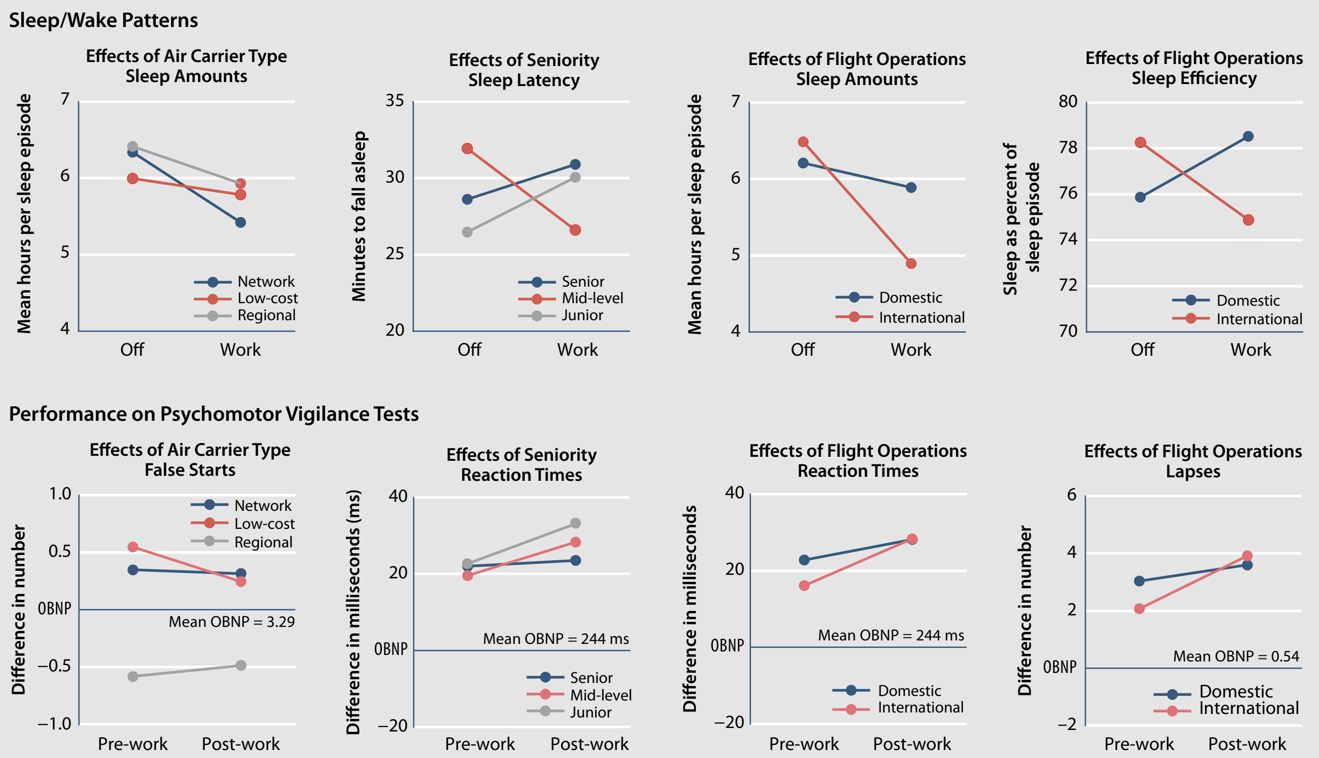
The research team was puzzled, however, by evidence that — despite obtaining less sleep than those working domestic routes — the international flight attendants had the best reaction times and fewest lapses before flight duty. "[These] performance results suggest a superior recovery process in between trips for the international group, yet the groups did not differ from each other in average sleep amounts during off-days," the report said.

Next Steps in Research

Based on what CAMI has learned to date from research under way on suitability of mathematical modeling of fatigue for redesigning FAA's cabin safety guidance and regulations, the report said that "validated evidence-based fatigue modeling tools are available to predict operational safety risks associated with variations in sleep/wake patterns, work schedules and circadian factors."

"Informed by insights from the flight attendant survey results and the current field study findings, the stage is now set

Statistically Significant Fatigue Indicators for U.S. Flight Attendants



Off = sleep during day off at home; Work = sleep during work trip; OBNP = optimum baseline neurocognitive performance

Notes: Actigraphy device–derived data were available from a total of 172 study participants. The sleep/wake pattern graphs use means for the subgroups.

Blue OBNP lines indicate mean individualized optimum baselines — the best neurocognitive performance measured during the study — on these selected components of the psychomotor vigilance test. False starts are reactions prior to stimulus onset. Lapses are reactions delayed by more than 500 ms. These means for subgroups reflect data available from a total of 201 study participants.

Source: U.S. Federal Aviation Administration Civil Aerospace Medical Institute

Figure 1

for in-depth analyses of the predictive relationships between specific operational variables and sleep/wake patterns and performance effectiveness across our entire sample of field study participants regardless of carrier type, seniority or flight destinations," the report added.

The research team is especially interested in total length of duty day, number of flight legs/segments per day, recovery time in the hotel during a trip, consecutive duty days/trip length, and number of days off in between trips.

"The [new] data also underscore the relevance of off-duty time when flight attendants are not under direct supervision, so a number of other issues beyond regulatory control and corporate management — such as distance between home and work base (initial commute) and the responsible use of off-duty time for adequate recovery sleep — are also worthy of consideration," the report said.

This article is based on Flight Attendant Fatigue Recommendation II: Flight Attendant Work/Rest Patterns, Alertness, and Performance Assessment *by Peter G. Roma, Melissa M. Mallis and Steven R. Hursh of the Human Performance Center, Institutes for Behavior Resources, Baltimore, Maryland, U.S.; and Andrew M. Mead and Thomas E. Nesthus of the FAA Civil Aerospace Medical Institute.*

Roma and Hursh also are affiliated with the Department of Psychiatry and Behavioral Sciences, Johns Hopkins University School of Medicine. The recommendation, Report no. DOT/FAA/AM-10/22, was published in January 2011 by the FAA Office of Aerospace Medicine, and is available from <www.faa.gov/library/reports/medical/oamtechreports/2000s/media/201022.pdf>.

Note

1. This sample of active flight attendants — from 6,454 online applications submitted by interested volunteers — was selected first according to the field study's eligibility criteria, then refined to balance demographic subgroups and types of airline operations.

© Szymon Kaczmarek/iStockphoto

New Approach

Transponder landing systems are designed for airports in areas with insufficient space for an ILS.

BY LINDA WERFELMAN

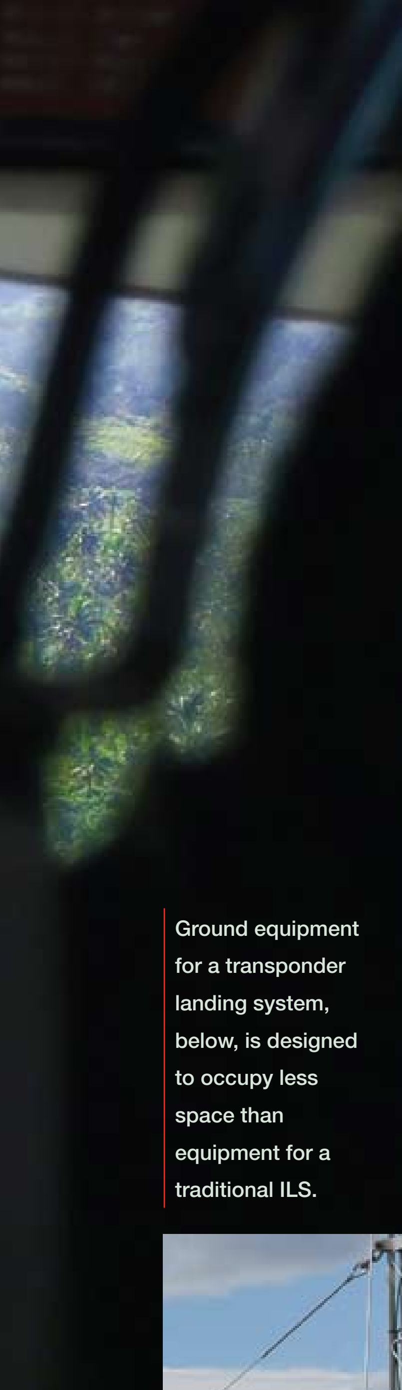
Jeff Mains is on the lookout for what he calls "terrain-challenged airports."

Airports with short runways or those surrounded by rugged terrain are considered ideal sites for a transponder landing system (TLS), a precision approach system manufactured by the Advanced Navigation and Positioning Corp. (ANPC), of which Mains is the CEO.

"There are many airports that would love to have an instrument landing system (ILS) but can't for a variety of reasons, usually because of the surrounding terrain or runway length," Mains said. "These make up 80 to 90 percent of the world's airports."

ANPC, the only manufacturer in the world of the TLS, received approval in mid-2010 from the International Civil Aviation Organization (ICAO) as a supplier of the system.

Both the ILS and the TLS are designed to provide pilots an approach path with exact



lateral alignment and vertical descent guidance on final approach to a runway.

An ILS uses ground equipment consisting of two directional transmitters — the localizer and the glideslope — as well as two or three marker beacons to provide additional positioning information.

However, the glideslope equipment sometimes is difficult or impossible to install at airport sites that are on or near rough terrain, "and in some cases, cannot be used without extensive earth removal to reduce errors induced by multipath [radio wave propagation], or ground-based reflections," ANPC says. "Additionally, ILS localizer performance can be diminished by multipath from large buildings located on the airport property. … At some airports where the runway is shorter and ends at obstacles like water, an ILS localizer installation may not be possible that achieves the ICAO-required tailored width of 700 ft at threshold and a maximum 6.0-degree localizer course width."[1]

A TLS can overcome these problems, ANPC says, because it uses existing airborne ILS localizer, glideslope and transponder equipment, and basic ground equipment — a transponder interrogator, sensors to detect an aircraft's lateral and vertical positions and an ILS frequency transmitter. The ground-based TLS sensors detect an aircraft's position by interrogating its transponder; the ILS frequency transmitter then guides the aircraft along the approach path.

"The pilot can then fly a precision approach to Category 1 minimum decision heights, just like flying an ILS," ANPC says.[2]

ANPC also manufactures a transportable TLS — characterized by Mains as "a complete airport in a box" — which is intended primarily for use in military operations or in humanitarian relief operations after natural disasters in which airport infrastructure has been heavily damaged. The system can be set up by two trained people in less than 10 hours, the company says. When the system is no longer needed, it can be uninstalled and prepared for shipment in less than two hours.

TLS operators must attend a 20-day training course, which includes discussion of equipment site selection and installation, how to configure the monitor, maintenance and diagnostic techniques for identifying system problems and replacing faulty systems.

Mains said that a TLS is now being used in civilian operations at King George Island in Antarctica, where, in addition to its "substantially smaller footprint at the airfield, it provides scientists and other humanitarians more access to Antarctica to research environmental trends and explore the ecological richness" of the continent.

A TLS approach can provide similar site-selection and safety benefits at other airports, Mains said.

Ground equipment for a transponder landing system, below, is designed to occupy less space than equipment for a traditional ILS.

Advanced Navigation and Positioning Corp.

"The flexible siting of TLS allows it to work in the most constrained real estate environments," he said. "The TLS provides a full precision approach, which allows pilots to safely access an airport with both lateral and vertical guidance to minimums as low as 200 ft above ground level (AGL) and 1/2-mi [0.8-km] visibility. This allows higher safety and accessibility of these airports and communities.

"Pilots will always tell you that it is safer and they prefer to fly into airports that provide lateral and vertical guidance to the runway."

Aviation safety advocates, including Flight Safety Foundation, have for years stressed the superiority of conventional precision approaches such as ILS — and newer satellite navigation-based precision-like approaches — over nonprecision approaches and visual approaches. Data compiled by the Foundation's Approach and Landing Accident Reduction Task Force showed that nonprecision approaches have been five times more hazardous than precision approaches and that more than half of all accidents and serious incidents involving controlled flight into terrain (CFIT) have occurred during step-down nonprecision approaches.

The transportable TLS is being operated by the Spanish Air Force, which first used the systems in Afghanistan and then deployed them for training in Spain, and by the Royal Australian Air Force, which uses the TLS in training operations. Other systems have been commissioned for use in Brazil, and oil companies have discussed installing them on offshore platforms, Mains said.

In the past, a TLS was used by FedEx at Subic Bay in the Philippines, but it was decommissioned when the company moved its Asian operations to China, Mains said.

Within the next two years, ANPC expects a substantial increase in the number of systems in use, especially in the Arctic, Asia, Europe and South America, Mains said, estimating that the company probably will deliver 30 systems for use in civilian operations and 40 for military use. Additional deliveries are likely in Africa, he said.

The only civilian TLS in the United States is a Federal Aviation Administration (FAA) test system at the agency's technical center in Atlantic City, New Jersey. However, although the FAA in 1998 certified the TLS as at least meeting ICAO standards for Category I ILS signals and in 2001 granted type acceptance to ANPC's TLS, the systems are not likely to be widely used in the United States.

A TLS is intended to help pilots fly into airports surrounded by mountains or other difficult terrain.

Advanced Navigation and Positioning Corp.

In recent years, the FAA has instead emphasized the development of instrument approach procedures using the wide area augmentation system (WAAS), a space-based navigation system with a ground-based network of reference stations and master stations that the agency says will not only enhance safety by adding precision-like approach capability but also eliminate the need for installation and maintenance of local airport-based approach equipment.

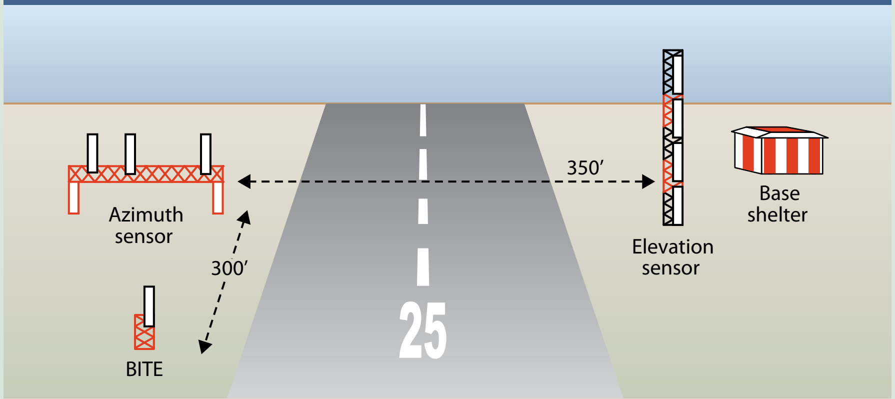
FAA data show that, in mid-November, there were 2,341 WAAS-based localizer performance with vertical guidance (LPV) approaches in the United States.[3] The FAA's goal is to publish 500 new WAAS-based instrument approach procedures annually "until every qualified runway in the [national airspace system] has one."[4]

WAAS was commissioned in 2003 to enhance the accuracy of information obtained from global positioning system (GPS) satellites. It has been described by the FAA as "a core element in transitioning to the satellite-based air traffic control system of the future."

Common Configuration

The most common configuration for a TLS installation features an azimuth sensor on one side of a runway and an elevation sensor on the other, connected by underground cables (Figure 1), ANPC says. However, the configuration can vary, according to the requirements

TLS Ground Components



BITE = built-in test equipment

Source: Advanced Navigation and Positioning Corp.

Figure 1

of a specific site, and in some cases, all components can be placed on the same side of a runway. In addition, some components — because of their frangible design — can be installed within airport obstacle areas.

Regardless of configuration, the components occupy relatively little space.

An aircraft can be flown on a TLS approach without the installation of any additional equipment or avionics, as long as it already is equipped with an ILS localizer and glideslope receiver, a horizontal situation indicator or a course deviation indicator, and a Mode 3/A or Mode S transponder.

Minimal Training

Pilots fly a TLS approach just as they would an approach using an ILS, ANPC says, so "to the pilot, there is virtually no difference." For example, TLS approach charts look like ILS approach charts; a failure of ground-based equipment to provide lateral or vertical guidance results in a red flag on a cockpit instrument, as it would in an ILS or other instrument approach; and a TLS approach always includes a missed approach procedure — although the TLS itself does not provide missed-approach guidance.

Minimal training is required before a pilot can use a TLS and includes briefings on TLS approach plates and ground operator communications.

ANPC's outline of the operational sequence begins with tuning in the TLS frequency, "just as the pilot would do for an ILS," and following TLS guidance to the decision height.

To begin, a pilot or air traffic control (ATC) must call the TLS operator — located either in an air traffic control tower or offsite — to confirm that the system is available. Typically, the pilot then tells ATC that he or she wants to fly the approach and receives ATC vectors to the initial approach fix. (In some cases, however, the pilot conducts an approach intercept procedure depicted on the TLS approach plate.) After ATC clears the pilot for the TLS approach, either the pilot or ATC informs the TLS operator of the aircraft's transponder code. The TLS operator confirms the code and instructs the TLS "to acquire the aircraft." Then the TLS broadcasts guidance for the approach, and the pilot follows that guidance, maintaining the final approach path in accordance with a course deviation indicator (CDI) and glideslope indicator.

"By measuring the angle- and time-of-arrival of aircraft transponder replies, the TLS is able to obtain significantly more accurate positioning information than other multilateration systems," ANPC says. "The minimum decision height and visibility for a given approach procedure are determined using TERPS/PAN-OPS [*United States Standard for Terminal Instrument Procedures*/ICAO *Procedures for Air Navigation Services–Aircraft Operations*] analysis and must be in accordance with the available runway markings and approach lighting."

The FAA, in its *Aeronautical Information Manual*, likens the concept of a TLS approach to that of "an air traffic controller providing radar vectors, and just as with radar vectors, the guidance is valid only for the intended aircraft."[5]

Notes

1. ANPC. *TLS — Transponder Landing System*. <www.anpc.com/prod_tls.cfm>.
2. The Category I minimum decision height can be as low as 200 ft AGL, with a runway visual range as low as 1,800 ft (550 m), provided that the runway has touchdown zone and centerline lighting or the pilots are using an autopilot with an approach coupler or a head-up display.
3. FAA. *Navigation Services — Global Navigation Satellite System*. <www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/approaches/index.cfm>.
4. FAA. *Fact Sheet — Wide Area Augmentation System (WAAS)*. <www.faa.gov/news/fact_sheets/news_story.cfm?newsld=6283>.
5. FAA. *Aeronautical Information Manual*, 2011 Edition. Chapter 1, "Air Navigation," 1-1-22, "Precision Approach Systems Other Than ILS, GLS and MLS."

Windshield Weakness

BY LINDA WERFELMAN

The S-76 crashed, killing eight people, after a hawk shattered the windshield and curtailed fuel flow to both engines.

The 2009 accident resulted in a slew of safety recommendations from the NTSB.

© Chris Sorensen Photography

© Andrew Helwick/iStockphoto

A Sikorsky S-76C++ that crashed into a Louisiana marsh after an en route bird strike was equipped with lightweight acrylic windshields — installed in place of the original bird-strike-resistant laminated glass, the U.S. National Transportation Safety Board (NTSB) said in its final report on the Jan. 4, 2009, accident.

The crash killed both pilots and six of the seven passengers, who had been on their way from Amelia, Louisiana, U.S., to an oil platform in the Gulf of Mexico when the helicopter struck a red-tailed hawk and plunged into the marsh at 1409 local time, about seven minutes after departure. The remaining passenger was critically injured, the report said.

The NTSB said that maintenance records showed that about two years before the accident, the operator, PHI, had replaced the original windshields with cast acrylic windshields.[1]

The NTSB, in its final report on the accident, said that the probable causes were "the sudden loss of power to both engines that resulted from impact with a bird … , which fractured the windshield and interfered with engine fuel controls, and the subsequent disorientation of the flight crewmembers, which left them unable to recover from the loss of power."

Contributing causes included the absence of U.S. Federal Aviation Administration (FAA) regulations or guidance — at the time the helicopter was certificated — to require bird-strike-resistant windshields.

In addition — noting that the impact had initiated a chain of events that jarred the T-handles that held engine fire extinguishers in place and pushed the engine control power levers (ECLs) aft, reducing fuel flow to the engines — the NTSB cited the "lack of protections that would prevent the T-handles from inadvertently dislodging out of their detents" and the "lack of a master warning light and audible system to alert the flight crew of a low-rotor-speed condition."

The T-handles were located about 4 in (10 cm) aft of the windshields. The NTSB said that the handles are "normally in the full-forward position during flight and are held in place by a spring-loaded pin that rests in a detent; aft pulling force is required to move the handles out of their detents."

In the event of an in-flight engine fire, the pilots are told to move the T-handle for the affected engine full aft, "so that a mechanical cam on the T-handle pushes the trigger on the ECL out of the wedge-shaped stop, allowing it to physically move aft with the T-handle," the NTSB said. "Fuel to the affected engine is then reduced."

The accident flight took off from PHI's Lake Palourde Base Heliport in Amelia at 1402 local time, carrying workers from two oil companies to the South Timbalier oil platform in the Gulf of Mexico. At 1409, the helicopter crashed in a marsh 12 nm (22 km) southeast of the heliport. There had been no distress calls or emergency transmissions to the PHI Communications Center or to air traffic control.

The U.S. Air Force received the helicopter's emergency locator transmitter (ELT) distress signal and began a search at 1414. The helicopter was found soon afterward, partially submerged in the marsh.

The report said that data and audio recordings from the cockpit voice recorder (CVR) and flight data recorder (FDR) showed that the helicopter had been in cruise flight at 850 ft and 135 kt "when a loud bang occurred. Immediately following the bang, sounds were recorded consistent with rushing wind, engine power reductions on both engines and main rotor rpm decay."

The captain of the accident flight had 15,373 flight hours, including 14,673 hours in rotorcraft and 5,423 hours in S-76s. The copilot had 5,524 flight hours, including 1,290 hours in helicopters and 962 hours in S-76s. Both men held airline transport pilot certificates for helicopters, commercial certificates for airplanes, instrument ratings for both helicopters and airplanes, and first class medical certificates, and both had flown more than 200 hours in helicopters during the 90 days before the accident. The copilot also held a flight instructor certificate for single/multi-engine airplanes and helicopters.

Both had completed all required training, along with initial and recurrent emergency training in ground school and in an S-76C++ simulator.

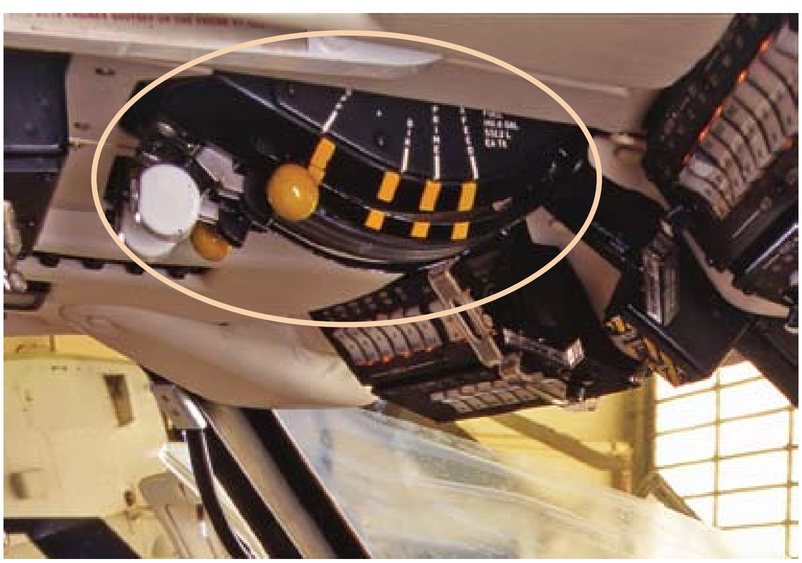
Two-Year-Old Helicopter

The twin-engine helicopter was two years old at the time of the accident and had a glass cockpit, a combination CVR and FDR, an enhanced ground proximity warning system, a solid-state quick access recorder, a vibration recorder, and Turbomeca Arriel 2S2 turboshaft engines with digital engine control units — all of which were evaluated by accident investigators.

The helicopter was manufactured with laminated glass windshields, which PHI removed in 2007 and replaced with lighter-weight cast acrylic windshields. The replacement was approved by the FAA under a supplemental type certificate issued in 1997 to the windshield manufacturer, Aeronautical Accessories Incorporated (AAI).[2] In 2008, PHI again replaced the windshields because of cracks at the mounting holes.

Weather conditions at Amelia at 1430 included scattered clouds at 1,500 ft and 3,500 ft and broken clouds at 10,000 ft, visibility of 10 mi (16 km), wind from 160 degrees at 6 kt, and a temperature of 24 degrees C (75 degrees F).

The impact of a bird strike caused a chain reaction that forced the engine control power levers — shown at the top of the photo — aft and reduced fuel flow.



© Chris Sorensen Photography

'A Bang … and a Loud Air Noise'

Examinations of the wreckage revealed no precrash problems that might have caused the accident. A review of the non-volatile memory from the digital engine electronic control units revealed no anomalies. The CVR recorded "the sound of a bang and a loud air noise," followed by an increase in background noise and "the sound of decreasing rotor and engine rpm," the report said, adding that the recording stopped 17 seconds later.

Although there was no evidence of a bird strike during initial visual examinations of the helicopter, subsequent tests revealed the microscopic remains of a bird. The remains were found on the pilot side of the windshield; subsequent tests revealed additional bird remains on the right windshield and the engine air filters, and parts of feathers under a windshield seal and in the right engine inlet air filter, the report said.

The bird subsequently was identified as a female red-tailed hawk — a bird with an average weight of 2.4 lb (1.1 kg).

Windshield Replacement

When the S-76 was certificated in 1978, the FAA had no specific requirements concerning bird strikes. In 1996, U.S. Federal Aviation Regulations (FARs) Part 29.631 took effect, requiring transport category helicopters to be capable of a safe landing after an impact with a 2.2-lb (1.0-kg) bird. However, because the requirement took effect after the S-76 was first certificated, any approved replacement windshield did not have to meet subsequent bird-strike requirements, the report said.[2]

The report cited a 2006 FAA study that found helicopters — and helicopter windshields — are more likely than airplanes to be damaged by bird strikes and that helicopter bird strikes are more likely to result in injuries.[3]

Nevertheless, the FARs impose stricter requirements for transport category airplanes, which must be capable of withstanding "without penetration, the impact of a 4.0-lb [1.8 kg] bird" and be designed in a way that minimizes the risks of flying windshield fragments. In contrast, the FARs require that windshields on normal category helicopters, including those used for emergency medical services (EMS) and sightseeing flights, "must be made of material that will not break into dangerous fragments." The term "dangerous fragments" is not defined, and the regulations do not include guidance on how manufacturers should demonstrate compliance with the requirements, the NTSB report said.

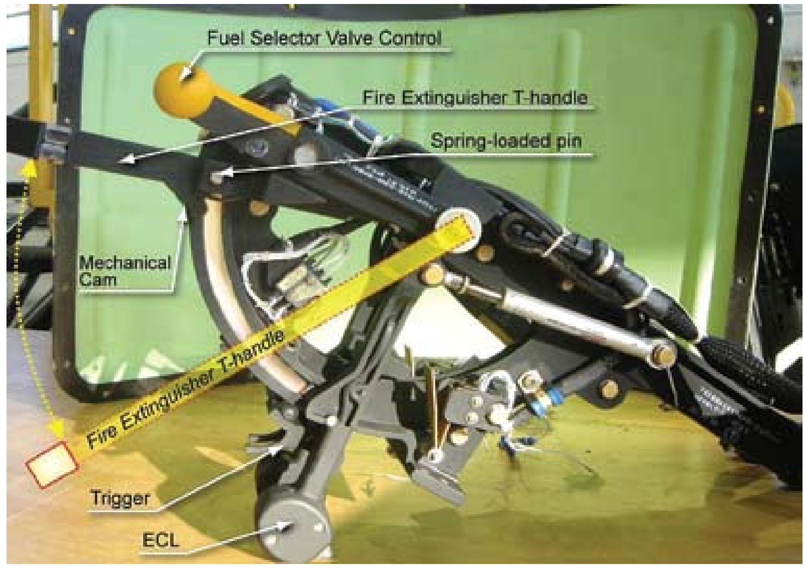
Because Sikorsky intended to market S-76s to North Sea oil operators, it installed laminated glass windshields to meet British Civil Aviation Requirements (BCARs), which "required the windshield to resist penetration of a 2-lb bird at 160 kt," the report said.

"Thus, in 1978, the Sikorsky-installed windshields had already exceeded the FAA's requirements that would have been imposed on a new aircraft at the time of the S-76C certification in 1991," the report said.

PHI had what the report characterized as "delamination issues" with the original windshields and, in the mid-1980s, began replacing the glass-laminated windshields on most of its S-76s with cast acrylic windshields manufactured by AAI. At the time of the accident, all of PHI's 46 S-76s had cast acrylic windshields; by September 2009, cast acrylic windshields were still in place in 14 of PHI's older S-76s.

AAI had performed no bird-impact tests on the S-76 windshields, the report said.

The report cited two bird-strike incidents that were similar to the 2009 accident. The first occurred in West Palm Beach, Florida, U.S., on Nov. 13, 1999, in an S-76C+ with a laminated-glass windshield. In that incident, the bird did not penetrate the windshield, although the impact cracked the windshield's outer ply and forced the T-handles supporting the fire extinguisher out of their detents. The four people in the helicopter for that EMS flight were not injured.



U.S. National Transportation Safety Board

The fire extinguisher T-handle and ECL on an S-76C++

The second incident occurred April 19, 2006, in a PHI S-76A++ with a cast acrylic windshield identical to the windshield in the accident helicopter, the report said, noting that a bird came through the windshield and "pushed the right throttle to idle." The pilot landed the helicopter safety, although "the trapped remains of the bird prevented the right throttle from being re-engaged." The two pilots — the only people in the helicopter — were not injured.

The report said that after the 2009 accident, on May 19, Sikorsky issued Safety Advisory SSA-S76-09-002 expressing concern about the reduced safety of acrylic windshields and notifying S-76 operators that the S-76 laminated-glass windshield "demonstrated more tolerance to penetrating damage resulting from in-flight impacts such as bird strikes."

In a Nov. 23, 2010, letter accompanying a series of safety recommendations to FAA Administrator Randy Babbitt, the NTSB cited two U.S. Army reports that concluded that cast acrylic windshields are "incapable of defeating a bird strike" and that cast acrylic would have to be three times thicker than a windshield of stretch acrylic[4] or polycarbonate to provide the level of protection afforded by those windshields.

"The 2009 PHI bird strike accident, the 2006 PHI bird-strike incident, Sikorsky's field experience and U.S. Army reports indicate that cast acrylic windshields are inadequate to prevent bird penetration," the NTSB said. "The superiority of laminated glass was demonstrated in the 1999 … bird-strike incident.

"The NTSB concludes that cast acrylic windshields such as those installed in the accident helicopter offer less protection from bird impacts compared to the original laminated glass windshields supplied by Sikorsky. The NTSB also concludes that, because Sikorsky developed the laminated glass windshields for the S-76 as a result of testing to satisfy a foreign bird-strike requirement, other helicopter manufacturers might also equip their helicopters with windshields with demonstrated bird-strike resistance."

Among the NTSB's 12 safety recommendations was a call to the FAA to prevent operators from replacing bird-strike-resistant windshields with windshields that are not resistant to bird strikes.

The NTSB also expressed concern that helicopters certificated before 1996 might have windshields that provide insufficient protection against bird strikes. The agency recommended that the FAA "evaluate the feasibility of retrofitting helicopters manufactured before 1996 with windshields that meet the current bird-strike requirements." Another recommendation asked the FAA to extend the evaluation to the feasibility of requiring the installation of windshields that meet current requirements in new helicopters that were built under old certification requirements.

In addition, the NTSB said that the FAA should revise FARs Part 27 "to specify a bird weight and velocity of impact that the helicopter must withstand and still be able to land safely and that the windshield must withstand without penetration." Revisions also should be incorporated into Part 29 to ensure that bird-strike standards for transport category helicopters are "consistent with the latest military and civilian bird-strike database information and trends in bird populations," the NTSB said.

Other recommendations called on the FAA to "require that Sikorsky redesign the S-76C++ model helicopter fire extinguisher T-handles and/or engine control quadrant to ensure that the T-handles do not inadvertently dislodge out of their detents due to any external force on the canopy or windshields that could cause unintended movement of the engine power control levers."

Other helicopter models with similar engine control quadrant designs also should be modified to ensure that an impact on the canopy or windshields does not result in the unintended movement of the levers, the NTSB said.

The NTSB also recommended that the FAA require helicopter manufacturers to develop guidance to aid pilots in "devising precautionary helicopter operational strategies for minimizing the severity of helicopter damage sustained during a bird strike … when operating in areas of known bird activity."

This article was based on NTSB accident report no. CEN09MA117, accompanying public docket material and NTSB Safety Recommendations A-10-136 through A-10-147.

Notes

1. Cast acrylic windshields are made by allowing acrylic resin to harden in a mold.
2. In 1998, the FAA issued parts manufacturer approval to AAI for the manufacture of the windshields.
3. Dolbeer, R.A.; Wright, S.E.; Cleary, E.C. "Bird Strikes to Civil Helicopters in the United States, 1990–2005," Appendix A, p. 45–50 in Cleary, E.C.; Dolbeer, R.A.; Wright, S.E. *Wildlife Strikes to Civil Aircraft in the United States, 1990– 2005.* U.S. Department of Transportation, FAA Office of Airport Safety and Standards, Serial Report No. 12, Washington. Available online at <http://wildlife-mitigation.tc.faa.gov>.
4. Stretch acrylic windshields are made by heating sheets of cast acrylic and stretching them.

© Chris Sorensen Photography

SPEAK UP

New requirements call for increased global cooperation to improve proficiency in aviation English.

BY LINDA WERFELMAN

The International Civil Aviation Organization (ICAO), while refusing to extend its official March deadline for compliance with English language proficiency requirements for pilots and air traffic controllers, is nevertheless urging a "flexible approach" toward governments that have yet to comply.

ICAO's stance has prompted calls from aviation safety advocates and specialists in aviation English for increased cooperation among governments and the aviation industry, as well as for a shift in corporate safety culture that recognizes the importance of English language training in improving safety.

Member states should 'take a flexible approach toward states that do not yet meet the language proficiency requirements.'

The March deadline had been established by a vote of the 36th session of the ICAO Assembly in 2007, after it became apparent that many ICAO member states would miss the original March 2008 deadline for pilots and controllers to be proficient enough in the English language to conduct radio communications in English. The requirements also specify that English "shall be available on request at all stations on the ground serving designated airports and routes used by international air services." The 2007 vote also directed states that did not meet proficiency requirements by the original 2008 deadline to develop implementation plans by that date, including a timeline for compliance, and to post their plans on an ICAO Web site.[1]

In October 2010, at its 37th session, the Assembly passed a resolution recognizing that, although the member states had made "substantial efforts" to comply with the requirements, some had encountered difficulty and wanted extra time. In response, the Assembly again urged member states to have their pilots and controllers use "ICAO standardized phraseology" in their communications.

But the resolution also urges member states to "assist each other in their implementation of the language proficiency requirements." It calls on those that have not complied with the language proficiency requirements to post on the ICAO Web site "their language proficiency implementation plans, including their interim measures to mitigate risk … for pilots, air traffic controllers and aeronautical station operators involved in international operations."


© Chris Sorensen Photography

Member states should "take a flexible approach toward states that do not yet meet the language proficiency requirements yet are making progress as evidenced in their implementation plans," the resolution says. It recommends the waiver, when necessary, of an ICAO requirement that calls for states to restrict their aircraft operators from entering the airspace of any countries where controllers and radio station operators have not met the English language proficiency requirements, "provided that those states have made their implementation plans available to all other contracting states and have notified ICAO of the differences pertaining to language provisions."

Flight Safety Foundation President and CEO William R. Voss said that the Assembly's willingness to give struggling states more time to meet ICAO's requirements "should not be taken as an indication that English language proficiency has become any less important.

"Aviation English remains an important safety issue even though ICAO has had to soften some of the deadlines. This just reflects the fact that the world is understanding the enormity of the task."

Minimum Requirements

The aviation English proficiency rating scale established by the International Civil Aviation Organization (ICAO) encompasses six levels, ranging from Level 1 "pre-elementary" to Level 6 "expert." Pilots, air traffic controllers and aeronautical station operators must demonstrate at least Level 4 "operational" proficiency by meeting the following criteria:[1]

- "Pronunciation, stress, rhythm and intonation are influenced by the first language or regional variation but only sometimes interfere with ease of understanding."
- "Basic grammatical structures and sentence patterns are used creatively and are usually well controlled. Errors may occur, particularly in unusual or unexpected circumstances, but rarely interfere with meaning."
- "Vocabulary range and accuracy are usually sufficient to communicate effectively on common, concrete and work-related topics. Can often paraphrase successfully when lacking vocabulary in unusual or unexpected circumstances."
- "Produces stretches of language at an appropriate tempo. There may be occasional loss of fluency on transition from rehearsed or formulaic speech to spontaneous interaction, but this does not prevent effective communication."
- "Comprehension is mostly accurate on common, concrete and work-related topics when the accent or variety used is sufficiently intelligible for an international community of users."
- "Responses are usually immediate, appropriate and informative. Initiates and maintains exchanges even when dealing with an unexpected turn of events. Deals adequately with apparent misunderstandings by checking, confirming or clarifying."

—LW

Note

1. ICAO. Document 9835, *Manual on the Implementation of ICAO Language Proficiency Requirements, Second Edition — 2010*; Section 4.6, "Explanation of Rating Scale Descriptors." Montreal, 2010.

'Momentous Endeavor'

Philip Shawcross, president of the International Civil Aviation English Association (ICAEA) and director of curriculum for Aviation English Services, a training provider based in New Zealand, said that the 2011 deadline always had been optimistic.[2]

"It was never feasible that such a momentous endeavor as fully achieving operational Level 4 [characterized by ICAO as the minimum level for language proficiency] for such a vast population of pilots and controllers could be achieved in much under a generation," Shawcross said (see "Minimum Requirements").

He assessed worldwide progress toward Level 4 proficiency as "outstanding" and added, "A greater pragmatism about the time scale required to achieve and then maintain proficiency, and the extent of regional differences, which should be the positive outcome of the recent discussions, could foster a more realistic and better informed approach to aviation English training and an awareness that language acquisition is a lifelong process."

The Assembly's approval of the resolution followed its review of papers submitted by representatives of several member states, including China, which had recommended extending this year's compliance deadline until March 2014, or adopting "other transition measures" to help ease the effort to ensure English proficiency.

"China has consistently made unremitting efforts to implement ICAO requirements for English language used for radiotelephony communications," the paper said. "The majority of China's pilots engaged in international operations have met ICAO language requirements. … However, due to the fact that a number of pilots are aging and their basic English language knowledge is limited, it still foresees some difficulties in the improvement of their language proficiencies within a short period of time."

China asked the Assembly to take into account "the specific difficulties currently existing in states where English is not the mother tongue."

For example, a paper submitted by Nepal discussed that country's difficulty in identifying people qualified to teach aviation English and to test language students to assess their proficiency.

When, in response to 2008 ICAO requirements, the country posted plans on ICAO's Web site describing how it would meet the English language requirements, the posting noted the "acute shortage of manpower." Since then, the country has identified three basic aviation English trainers.

'A majority of states expect to be compliant by 5 March 2011.'

A paper submitted by Russia also referred to "certain difficulties" in meeting the English proficiency requirements. The paper said that new language training programs have been developed for pilots, with classes being taught by 150 instructors at 30 certified aviation training centers. Classes also are offered for controllers, and of nearly 5,500 controllers who have been cleared to provide air traffic services in English, 88 percent have received language tests; of that number, 41 percent demonstrated at least Level 4 proficiency, the paper said.

A paper submitted by Cuba said that compliance with the proficiency requirement involved "a significant investment of time and financial resources by license holders, air transport operators, air transport service providers, training centers and the national economy," along with the Institute of Civil Aeronautics of Cuba and the country's Civil Aviation Authority.

The paper characterized the results of the effort as "encouraging," noting that, of the "target population" of 309 pilots and 247 controllers, 99.02 percent of pilots and 98.78 percent of controllers tested at Level 4 or better.

"At this stage, we are prioritizing periodical refresher courses in English for aeronautics, which are taught annually to each license holder involved … so that they may practice and refresh their English periodically and thereby maintain the requirement for operational level proficiency or achieve a higher level," the paper said.

A report presented to the Assembly by the Council of ICAO said that 147 member states have provided information on ICAO's Flight Safety Information Exchange Web site about their plans for achieving compliance with the language proficiency requirements; 42 states did not provide implementation plans or statements of compliance with the requirements. By July 2010, some 54 states reported that they were in compliance and 106 said that they would be compliant by March 2011.

"It is recognized that the implementation of language provisions has been challenging, in part because the aviation language training and testing industry is unregulated," the Council said. "Data gathered thus far, however, indicates that significant progress has been achieved and that a majority of states expect to be compliant by 5 March 2011."

Testing Endorsements

ICAO officials and aviation English specialists have for several years criticized the lack of standards for aviation English instruction and testing. The ICAEA and other organizations have worked with ICAO to develop an endorsement process for aviation language proficiency tests. ICAO said in late 2010 that the goal is to "provide a pool of testing systems of appropriate design and content and which additionally meet well-defined standards of good practice from which states can then choose."[3]

ICAO, in a discussion of the testing endorsement plan, noted that development of the plan was prompted by reports of substandard testing practices.

Under the new plan, ICAO said, "testing providers will generally be subject to a two-phase process consisting of an initial review and, if needed, a final review. Endorsement will be granted only if recommendations made during the initial review have been implemented by the test provider."

Participation in the endorsement process, which will include feedback to test providers about how to improve their exams, will be voluntary, ICAO said, adding that the process is "expected to gradually but durably enhance and extend standards of good practice across the board."

Also in 2010, ICAO published the second edition of its *Manual on the Implementation of ICAO Language Proficiency Requirements*, elaborating on the 2004 first edition's guidance for achieving operational proficiency.[4]

New Landscape for Training

Elizabeth Mathews, a specialist in applied linguistics who led the international group that developed ICAO's English language proficiency requirements, said the standards have "changed the landscape" for all aviation training — not just aviation English training.

"The ICAO language standards … are impacting aviation training in a fundamental way that the industry will not be able to go back on," said Mathews, now a consultant, in a presentation prepared for Flight Safety Foundation's International Air Safety Seminar, held in November 2010 in Milan, Italy.

"Whether it takes us three years or six years or a dozen years, the ICAO [language standards] have set the industry on an inevitable march toward continuous improvement in aviation communication safety."

To acquire more data on the role of language in aviation accidents and incidents, she recommended that accident investigation reports be more specific in their descriptions of what often is referred to simply as a "breakdown in communication."

She added, "If we do not have the tools and training to appropriately investigate the possible role of language in aviation incidents or accidents, then we cannot know the extent of any problem. At a minimum, investigators should note [whether a breakdown in communication involves] inadequate plain language proficiency, incorrect or careless use of ICAO phraseology, pronunciation issues, grammar issues or lack of comprehension."

Mathews called on the aviation industry and government regulators to perform a three-part "course correction" to enhance aviation English training and testing.

First, she said, increased regional cooperation is needed to establish test-assessment programs, compare training programs and host teacher-training workshops. Some of these programs already are being implemented, especially in Europe, but more are needed in other parts of the world, she said.

Second, a shift is needed in corporate culture as to "how English training is perceived, conceived and implemented," she said. "English [has] long been thought to be a standalone item that could be covered by one or two four-week stints in a training program." However, she added that this is a "false conception of how language acquisition happens."

A crucial factor that sometimes is lacking is corporate commitment to long-term efforts for English-language learning by pilots, controllers and aeronautical station operators, she said.

The third element, Mathews said, is industry leadership to press for continued progress in improving language proficiency training and testing programs.

"Commercial efforts can only take us so far," she said, "and in the unregulated language industry, a purely commercial solution is not wholly effective."

Notes

1. The information is available at ICAO's Flight Safety Information Exchange (FSIX) Web site at <www.icao.int/fsix/lp.cfm>.
2. ICAEA. *A Word From the President*. <www.icaea.pansa.pl>.
3. ICAO. "ICAO to Endorse Testing for Language Proficiency." *ICAO Journal* Volume 65 (No. 4–2010): 30–31.
4. ICAO. Document 9835, *Manual on the Implementation of ICAO Language Proficiency Requirements, Second Edition — 2010*; Section 4.6, "Explanation of Rating Scale Descriptors." Montreal, 2010.

Further Reading From FSF Publications

Mathews, Elizabeth; Gill, Alan. "Can They Talk the Talk?" *AeroSafety World* Volume 3 (November 2008): 34–37.

Werfelman, Linda. "Language Barrier." *AeroSafety World* Volume 3 (August 2008): 41–43.

Melnichenko, Sergey. "Do You Speak English?" *AeroSafety World* Volume 3 (July 2008): 23–27.

Werfelman, Linda. "Speaking the Same Language." *AeroSafety* World Volume 2 (November 2007): 25–29.

Werfelman, Linda. "Simplifying the Technicalities." *AeroSafety World* Volume 2 (August 2007): 16–21.

© Kris Mogford/Airliners.net

Rapid Depressurization

An oxygen cylinder burst and tore a hole through the fuselage of a 747.

BY MARK LACAGNINA

The Boeing 747-400 was cruising 29,000 ft over the South China Sea the morning of July 25, 2008, when an emergency oxygen cylinder burst and ripped a hole through the right side of the forward cargo hold, causing a rapid depressurization of the aircraft. The flight crew conducted an emergency descent to 10,000 ft and diverted to Manila, Philippines, where they landed the aircraft safely despite damage to several navigation systems and the anti-skid braking system. Damage to the 747 was substantial, but none of the 350 passengers or 19 crewmembers was injured.

In a final report issued in November 2010, the Australian Transport Safety Bureau (ATSB) said that the oxygen cylinder "had burst in such a way as to rupture the adjacent fuselage wall and be propelled upward, puncturing the cabin floor and impacting the frame and handle of the R2 door [the second main door on the right side of the cabin] and the overhead cabin paneling."

Only the valve assembly was found; the remainder of the cylinder likely was ejected from the aircraft during the depressurization. Thus, investigators were unable to determine conclusively why the cylinder failed. "While it was hypothesized that the cylinder may have contained a defect or flaw, or been damaged in a way that promoted failure, there was no evidence found to support such a finding," the report said. "Nor was there any evidence found to suggest that the cylinders from the subject production batch, or the [cylinder] type in general, were in any way predisposed to premature failure."

In a media release on Nov. 22, the ATSB said that the cylinder failure "was a unique event and highly unlikely to happen again."

'Loud Bang'

The 747, operated by Qantas Airways as Flight QF30, departed from Hong Kong International Airport at 0922 local time for a scheduled flight to Melbourne, Australia.

The captain had 15,999 flight hours, including 2,786 hours in type.

The first officer, the pilot flying, had 12,995 flight hours, including 5,736 hours in type. The second officer had 4,067 flight hours, with 2,292 hours in type; he left the cockpit for a rest break after departure.

The flight crew said that the aircraft had been airborne about 55 minutes when they heard a "loud bang or cracking sound" and felt a jolt. The autopilot disengaged, and the first officer took manual control of the aircraft. Warnings about cabin altitude and the status of the R2 door were among several messages that appeared on the engine indicating and crew alerting system. Although the cylinder had forced the R2 door handle to move 120 degrees from the closed-and-locked position, the plug-type door had not opened.

The second officer returned to the cockpit, and all three pilots donned their oxygen masks. They conducted the "Cabin Altitude Non-Normal" checklist, declared an emergency and reduced power and extended the speed brakes to initiate an emergency descent. A minimum cabin pressure of 5.25 psi, which corresponds to a cabin altitude of 25,900 ft, was recorded a few seconds after the descent was initiated. The 747's pressure vessel — which includes the cabin, cockpit and forward cargo hold — had been pressurized to about 12.5 psi before the depressurization occurred.

The pilots leveled the aircraft at 10,000 ft about seven minutes after initiating the descent. Visual meteorological conditions, with scattered clouds and good visibility, prevailed throughout the area. "After reviewing the aircraft's position, the crew elected to divert to Ninoy Aquino International Airport, Manila," which was about 475 km (257 nm) southeast, the report said. "As part of the landing preparations, excess fuel was jettisoned to ensure that the aircraft's landing weight was within safe limits."

Masks Misused

The cabin crew and passengers also had heard a "very loud bang" and saw the passenger oxygen masks deploy, the report said. "Many of the cabin crew reported feeling air moving and seeing light debris flying about."

Many passengers did not properly use their oxygen masks. "Cabin crew reported that most passengers grabbed a mask and held it over their mouth," the report said. The public address system had been disabled, and "many crew had

Australian Transport Safety Bureau

The accident aircraft (above) received substantial damage to its fuselage and other exterior and interior components when the cylinder burst.

The explosion ripped open the forward cargo hold and propelled the cylinder upward through the cabin floor, where it struck the door latch and overhead cabinets.

to shout or point instructions to passengers to pull down on the mask to activate the flow of oxygen. Some crew also had to tell passengers to secure the mask by the elastic strap instead of just holding the mask over their mouth and nose. Crew also shouted instructions to passengers with babies/children to wake them up and keep the mask on their child's face. Some young children were fidgeting and resisting their parents' efforts to put or keep the mask on."

The cabin crew, who had been providing meal service when the depressurization occurred, took seats at their stations or unoccupied passenger seats and used portable oxygen systems or spare passenger masks during the descent. "One crewmember reported that she had observed two elderly passengers whose masks had not deployed and who seemed to be having trouble breathing," the report said. "She moved through the cabin to the passengers, breathing through spare oxygen masks on the way. She then deployed the masks and ensured they were fitted and working before returning to her seat.

Photos: Australian Transport Safety Bureau

"Another cabin crewmember, who was using portable oxygen, reported that upon seeing her colleague assisting passengers, she also proceeded to move around the cabin, checking on children and infants in her area."

After the aircraft reached 10,000 ft, all the cabin crewmembers used portable oxygen systems while moving about the cabin and checking on the passengers. "The use of portable oxygen at that time was compliant with procedures to guard against hypoxia due to exertion," the report said.

Ear Pain and Stress

Although none of the passengers reported any physical injury, a subsequent survey by ATSB indicated that several passengers had experienced symptoms of rapid depressurization, including ear pain and/or "popping" of the ears, temporary loss of hearing and headaches.

"Many passengers also reported high levels of anxiety and feelings of panic, with associated physiological symptoms such as a 'racing heart,'" the report said. "Several passengers reported feelings of faintness, lightheadedness and/or tremors. However, it was unclear as to whether those symptoms were associated with hypoxic effects or the anxiety brought upon by the situation."

Several crewmembers said that they had experienced ear discomfort and "ringing" of the ears. "However, none sustained any injury or physical condition that incapacitated them in any way," the report said. "Several cabin crewmembers had become very distressed during the depressurization and were initially unable to carry out emergency tasks. Senior cabin crew reported that the affected staff were withdrawn from duty for a period, after which they were able to resume their duties and assist passengers."

Big Hole

The failed oxygen cylinder was fourth in a bank of seven cylinders installed on the right wall of the forward cargo hold. The energy released when the cylinder burst had torn a hole about 2.0 m (6.6 ft) high and 1.5 m (4.9 ft) wide, just forward of the right wing root. "Fuselage materials, wiring and cargo from the aircraft's forward hold were protruding from the rupture," the report said. The excess pressure created when the cylinder burst also opened the two pressure relief valve blowout doors on the left side of the cargo hold.

Although the cylinder itself was not recovered, the damage it caused enabled investigators to assemble a likely failure scenario. "It was evident that the cylinder had failed by bursting through or around the base, allowing the release of pressurized contents to project it vertically upward," the report said. The cylinder severed 85 electrical wires and the first officer's aileron control cables[1] before it penetrated the cabin floor, struck the R2 door frame and smashed the overhead paneling and storage cabinets. Investigators believe the cylinder then dropped back through the hole in the cabin floor and was swept out of the aircraft through the tear in the fuselage.

No one was near the R2 door when the cylinder penetrated the cabin floor. A Qantas engineer, who was aboard as a passenger, examined the damage and recommended that the cabin crew keep themselves and the passengers away from the area.

The cylinder burst had disabled all three instrument landing systems, the left VHF omnidirectional navigation system, the left flight management computer and the anti-skid braking system for the landing gear on the right side of the lower fuselage. "Despite the apparent failure of multiple aircraft systems, the flight crew reported that the descent and approach into Manila were uneventful," the report said. "The aircraft landed safely on Runway 06 at 1111 local time," or about 54 minutes after the depressurization occurred. The aircraft was inspected on the runway by aircraft rescue and fire fighting personnel and then towed to the terminal.

A cut and a small dent were found in a panel on the no. 3 engine. "The aircraft operator reported that an internal boroscopic inspection of the engine identified some damage to the turbine components, although the nature of the damage suggested that it was unrelated to the depressurization event," the report said. "The engine was changed as a precaution."

'Improbable Failure'

The failed cylinder was manufactured in 1996 and had undergone four required three-year inspections and requalifications, the last of which was about eight weeks before the accident. Investigators examined and tested the other 12 oxygen cylinders that were aboard the aircraft, as well as five cylinders from the failed cylinder's production batch.

The oxygen cylinders conformed to U.S. Department of Transportation (DOT) 3HT-1850 specifications for "seamless steel cylinders for aircraft use." The cylinders aboard the 747 were 75 cm (30 in) long and 23 cm (9 in) in diameter. They were constructed of chromium-molybdenum steel with a minimum wall thickness of 2.9 mm (0.1 in). Each cylinder holds 3,256 L (115 cu ft) of oxygen when charged to 12,755 kPa (1,850 psi). "The cylinder overpressure protection system was designed to operate in the event that cylinder pressure rises to between 17,237 and 19,133 kPa (2,500 and 2,775 psi)," the report said. Examination of the valve assembly from the failed cylinder showed no sign that overpressurization had occurred.

Investigators found no record of similar oxygen cylinder failures. "Aviation oxygen cylinders have failed aboard aircraft previously; however, all of the known events have been attributed to external influences, such as onboard fires or damage sustained during accident impacts," the report said.

The report said the absence of the failed cylinder was a "significant obstacle to the investigation." Nevertheless, "a comprehensive program of testing and evaluation of cylinders of the same type and from the same production batch as the failed item did not identify any aspect of the cylinder design or manufacture that could represent a threat to the operational integrity of the cylinders. In light of these findings, it is the ATSB's view that passengers, crew and operators of aircraft fitted with DOT3HT-1850 oxygen cylinders can be confident that the ongoing risk of cylinder failure and consequent aircraft damage remains very low."

Among the actions taken by ATSB after the accident were the publication of two bulletins providing information to passengers and cabin crew on aircraft depressurization.[2]

This article is based on ATSB Aviation Occurrence Investigation AO-2008-053, "Oxygen Cylinder Failure and Depressurisation; 475 km North-West of Manila, Philippines; 25 July 2008; Boeing Company 747-438, VH-OJK." The full report is available at <atsb.gov.au/publications/investigation_reports/2008/aair/ao-2008-053.aspx>.

Notes

1. Interlinks with the captain's control cables, routed on the left side of the cargo hold, allowed the first officer to maintain aileron control.

2. The passenger bulletin, *Staying Safe During an Aircraft Depressurisation*, is available at <atsb.gov.au/publications/2008/AR2008075.aspx>. The cabin crew bulletin, *Aircraft Depressurisation*, is available at <atsb.gov.au/publications/2009/AR2008075_2.aspx>.

BY RICK DARBY

Ground Effect

Pilot fatigue takes off before the aircraft does.

Flight crew fatigue has become a front-line issue since being implicated as a possible factor in the Colgan Air Flight 3407 accident (*ASW*, 3/10, p. 20). The increasing adoption of fatigue risk management systems and the U.S. Federal Aviation Administration's (FAA's) current notice of proposed rule making for flight and duty time (see "New Proposal, Old Resistance," p. 23) also drive industry interest. Various factors have been cited as contributing to fatigue, including time since awakening, poor-quality sleep, time on duty and circadian disruption. Many studies have focused on the alertness effects of in-flight workload on the flight crew, particularly in takeoff, approach and landing, as well as from extra demands such as bad weather and equipment malfunction.

Dimensions of Workload: Flight Phase vs. Ground Phase

	Flight	Ground	Difference
Mental demand	10.2	13.0	27%
Performance	15.3	14.5	–5%
Physical demand	7.3	7.0	–4%
Effort	8.9	10.9	22%
Temporal demand	10.9	14.9	37%
Frustration level	5.0	7.2	44%

minimum = 0; maximum = 20

Source: Kristjof Tritschler and Steve Bond

Table 1

Although workload is commonly associated with flight time, a recent study suggests that pilot workload on the ground may contribute more to fatigue than workload during flight. In a paper presented at the FSF International Air Safety Seminar in November 2010,[1] Kristjof Tritschler and Steve Bond reported that 82 percent of the study participant pilots "rated the work on the ground to be equally or more exhaustive than the flight phase."

The researchers conducted a field study with 40 pilots of a German low-cost carrier (LCC), using a questionnaire.

The first part compared the flight and ground phases in six dimensions of workload: "mental demand," "physical demand," "temporal demand," "performance," "effort" and "frustration level."

In four of the six dimensions, participants rated workload higher on the ground than in flight, with the greatest difference being in "frustration" (Table 1). The researchers expressed surprise at the findings, saying, "The task of flying a complex aircraft is accepted to be a set of highly demanding tasks. The higher values for 'effort' and 'mental demand' therefore were remarkable, since task demands on the ground are rather low. However, the subjective perception of higher workload on the ground expresses the strong engagement of the pilots between flights during this study."

The second part investigated "factors that occur during a normal working day," which the researchers called "workaday factors." Twenty-one of these were assessed under five classifications: "more work," "effort," "time pressure," "frustration" and "fatigue." Measurement was on a scale from 1 to 5, minimum to maximum.

Turning to ground time workaday factors, the researchers found that the pilots scored factors related to time pressure dominant in five of them: "critical fuel status," "late documentation," "aircraft change," "tight slot" and "tight schedule" (Table 2).

"The shortest resource in this operator's efficient operation was time," said the paper. "According to LCC principles, turnaround times were scheduled to be 25 to 30 minutes. If there are disturbances during the turnaround like late documentation, frustration levels rise. The assumption of limited time available, and no margin for disturbances, seems to intensify the feeling of high workload."

Six workaday factors dominated by higher effort or more work mostly applied to flight time rather than ground time (Table 3). One exception was "no ramp agent," which 70 percent of the pilots agreed results in more work for them, with a mean score of 3.86 on the scale. "Ramp agents are the coordinators for ground services around the aircraft," the paper said. "Today, they frequently have to handle several aircraft at the same time. This leads to the delegation of tasks to the flight crew."

All workaday factors in which "frustration" registered highest were related to pilots' non-flying tasks (Table 4, p. 50). Although frustration is not the same as fatigue, the paper said that "in this mood, frustration … may be experienced as a subjective feeling of fatigue."

"High frustration levels resulted during ground operation, especially with 'sluggish ground operation,'" the paper said. "Examples of sluggish ground handling include late availabilities of servicing equipment — stairs, buses, loading, refueling, pushback — or late arrival of passengers." That factor and "deficient documentation" are frustrating because the pilot is not in control or has limited influence, the paper said.

Deficient documentation, such as erroneous weight and balance data or mistaken aircraft-performance calculations, is frustrating because it can affect safety and because it may not be obvious, so that pilots must be extra alert to catch any anomalies, the researchers said.

"Pilots in general have a low tolerance for failure, probably founded by the nature of risks inherent in their work of flying," the paper said. "This is reflected in rather high frustration ratings for 'deficient documentation.'"

It seems logical that inadequate paperwork would increase workload as well as frustration, and indeed, while 90 percent of pilots agreed that "frustration" was a workaday factor compared with 88 percent who agreed that "more work" was a factor, the mean values assigned were nearly identical, 3.64 and 3.63, respectively.

Time Pressure in Workaday Factors

	Agree	Mean	Std. Dev.
Critical fuel status			
More work	98%	3.41	0.97
Higher effort	98%	3.67	0.98
Time pressure	98%	4.36	0.90
Frustration	95%	2.55	1.22
Contributes to fatigue	98%	3.31	1.17
Late documentation			
More work	80%	2.63	1.34
Higher effort	83%	2.91	1.07
Time pressure	83%	4.15	0.71
Frustration	80%	3.13	1.01
Contributes to fatigue	83%	2.64	0.99
Aircraft change			
More work	90%	3.97	0.74
Higher effort	90%	3.53	1.06
Time pressure	90%	4.14	0.83
Frustration	93%	2.62	1.21
Contributes to fatigue	90%	3.33	1.07
Tight slot			
More work	83%	2.27	1.10
Higher effort	85%	3.24	0.85
Time pressure	85%	4.12	0.81
Frustration	83%	2.39	1.03
Contributes to fatigue	83%	3.06	1.00
Tight schedule			
More work	85%	2.41	1.10
Higher effort	85%	3.59	0.96
Time pressure	85%	3.94	0.95
Frustration	88%	2.91	1.17
Contributes to fatigue	88%	3.66	1.03

minimum = 1; maximum = 5

Source: Kristjof Tritschler and Steve Bond

Table 2

The researchers said, "Fifteen additional comments were given by the pilots in this questionnaire to the issue of a duty change. These showed strong emotional expressions. Most of these

Higher Effort, More Work in Workaday Factors

	Agree	Mean	Std. Dev.
High density airspace			
More work	88%	3.26	1.20
Higher effort	88%	4.06	0.54
Time pressure	85%	1.71	0.87
Frustration	85%	2.26	1.19
Contributes to fatigue	88%	3.66	1.06
Special airport			
More work	88%	3.31	1.16
Higher effort	88%	3.94	0.91
Time pressure	85%	1.79	1.04
Frustration	85%	1.38	0.82
Contributes to fatigue	85%	3.18	1.14
Bad weather			
More work	100%	3.53	1.01
Higher effort	100%	3.78	0.83
Time pressure	98%	2.33	1.03
Frustration	98%	1.69	0.86
Contributes to fatigue	100%	3.68	1.10
Major airport			
More work	93%	3.38	0.79
Higher effort	93%	3.62	0.83
Time pressure	90%	2.19	1.12
Frustration	90%	1.67	0.86
Contributes to fatigue	93%	3.27	0.96
Supplementary procedures			
More work	80%	3.84	0.85
Higher effort	80%	3.53	1.05
Time pressure	80%	2.94	1.08
Frustration	80%	1.84	0.88
Contributes to fatigue	80%	3.19	1.18
No ramp agent			
More work	70%	3.86	0.89
Higher effort	70%	3.46	1.07
Time pressure	70%	3.22	1.25
Frustration	70%	2.93	1.33
Contributes to fatigue	70%	3.14	1.24

minimum=1; maximum=5

Source: Kristjof Tritschler and Steve Bond

Table 3

comments emphasized difficulties and frustration due to disturbance of their private life after a change of duty. Fifty-eight percent of the pilots agreed that 'no break' was a relevant factor."

New FAA Study: 'Laser Strikes'

In a separate report, the FAA Civil Aerospace Medical Institute recently analyzed a total of 2,492 incidents of laser illumination of aircraft in flight that occurred in the United States between 2004 and 2008.[2]

"The principal concern is the effect laser illumination may have on flight crew personnel during landing and departure maneuvers when procedural requirements are critical," the report said. "Federal Aviation Regulations require a 'sterile cockpit' (i.e., only operationally relevant communication) below 10,000 ft to minimize distractions and reduce the potential for procedural errors. Laser illumination during these critical operations can create unsafe conditions by distracting or visually impairing flight crewmembers, thus disrupting cockpit procedures and crew coordination."

Exposure to laser illumination in the airspace around airports can include annoyance, distraction and transient visual effects. These effects may involve:

- Glare — momentary loss of view of an object in a person's field of vision because of a bright light, as motorists can experience at night if headlight beams from an oncoming car have not been lowered.
- Flash blindness — a temporary visual interference effect that persists after the source of illumination ceases.
- Afterimage — A color-reversed image left in the visual field after exposure to bright light, which can persist for several minutes.

The study on which the report is based stratified laser illumination events into 1,000-ft increments, divided into zones "equivalent in altitude" to flight hazard zones around airports.[3] "Additionally, data from the laser illumination reports were used to evaluate the adverse visual and operational effects experienced by pilots within the range of altitude[s] corresponding to the flight hazard zones," the report said.

Of the 2,492 laser events, the cockpit was illuminated in 1,676, or 67 percent. "From 2004 to 2008, the [annual] number of aircraft illuminations increased from 46 to 988, which included an increase from 27 to 767 in cockpit illuminations," the report said.

Altitude information was available for 1,361 of the 1,676 events in which the cockpit was illuminated. For the five-year period, 325 cockpit illuminations occurred within the laser-free flight zone, up to 2,000 ft altitude.[4] The majority of the events, 848, occurred within the critical flight zone, from 2,001 ft to 10,000 ft. The rest, 188, occurred above 10,000 ft.

Information about the phase of flight was provided for 1,218 — 73 percent — of the cockpit illumination events. Of those events, 69 percent happened during the approach (Figure 1). Departure events were about 8 percent of this total. The large proportion of

Frustration in Workaday Factors

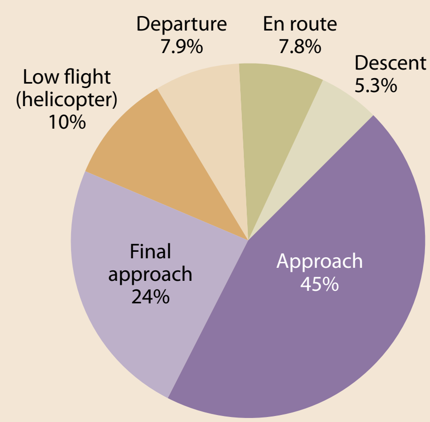
	Agree	Mean	Std. Dev.
Sluggish ground handling			
More work	83%	2.70	1.19
Higher effort	83%	2.88	1.22
Time pressure	85%	3.71	1.14
Frustration	85%	3.94	0.85
Contributes to fatigue	85%	3.06	1.01
Change of duty			
More work	83%	2.30	1.29
Higher effort	83%	2.15	1.28
Time pressure	80%	2.31	1.26
Frustration	93%	3.89	1.15
Contributes to fatigue	85%	2.82	1.36
Deficient documentation			
More work	88%	3.63	0.81
Higher effort	90%	3.39	0.80
Time pressure	88%	3.29	1.07
Frustration	90%	3.64	1.10
Contributes to fatigue	90%	2.67	1.07

minimum =1; maximum = 5

Source: Kristjof Tritschler and Steve Bond

Table 4

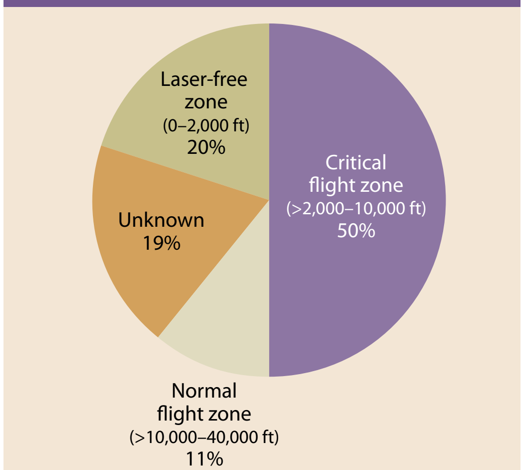
Percentage of Cockpit Illuminations, by Phase of Flight, 2004–2008



Source: U.S. Federal Aviation Administration

Figure 1

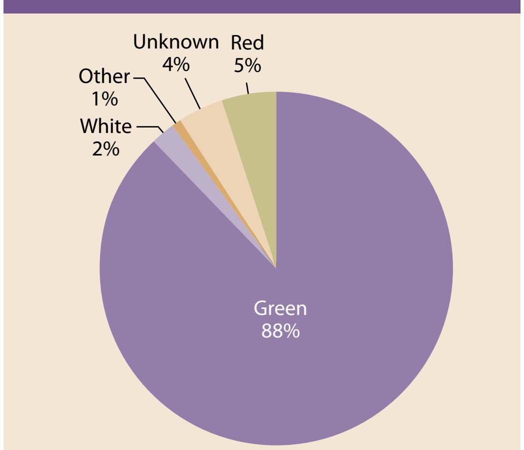
Percentage of Cockpit Illuminations, by Flight Zone, 2004–2008



Source: U.S. Federal Aviation Administration

Figure 2

Percentage of Cockpit Illuminations, by Color, 2004–2008



Source: U.S. Federal Aviation Administration

Figure 3

cockpit illuminations occurring during approach versus departures is a concern, the report said, because "distraction and/or disruption occur when the flight crew is busy performing critical flight operations at low altitude, and [the aircraft] is most vulnerable."

About 70 percent of the cockpit illumination events were reported to be at or below the 10,000-ft altitude limit of the critical flight zone, and about 20 percent within the laser-free zone (Figure 2). In the laser-free zone, the percentage of cockpit illuminations doubled during the study period, from 13 percent to 27 percent.

Laser illuminations can be particularly hazardous for helicopter pilots, the report said: "The flight crews in these aircraft are susceptible to visual impairment … due to their low-altitude flight profile and the large, wrap-around bubble canopies on helicopters that can allow more light to enter and scatter throughout the cockpit. Furthermore, these aircraft frequently have a single pilot, which adds to the danger of sudden incapacitation from a laser strike."

Although red and red-orange lasers have been in use among the public for more than a decade, green lasers have grown in popularity as their technology has become more affordable. Green lasers were used in the great majority of illuminations during the study period (Figure 3).

"Another reason for the increased number of reports is that a green laser beam may appear as much as 28 times brighter than an equivalently powered red laser beam," the report said.

The report offered recommendations to minimize the effects of laser illumination, based on reports from flight crewmembers and international civil aviation authorities. Among the recommendations were:

- "Engage the autopilot, check the aircraft's configuration, and re-establish a normal flight profile, if necessary."
- "Use the body of the aircraft to block the light by climbing or turning 90 degrees to the beam, if practical."
- "If one crewmember has avoided exposure, consider handing over control to the unexposed crewmember."

Air traffic control should be notified of the incident, including the location and direction of the beam and the aircraft's position.

Notes

1. Tritschler, Kristjof; Bond, Steve. "The Influence of Workload Factors on Flight Crew Fatigue." *Proceedings of the FSF 63rd annual International Air Safety Seminar, Milan, Italy*. Alexandria, Virginia, U.S. 2010.
2. FAA Civil Aerospace Medical Institute. *The Illumination of Aircraft at Altitude by Laser Beams: A 5-Year Study Period (2004–2008)*. DOT/FAA/AM-10/21, December 2010. <www.faa.gov/library/reports/medical/oamtechreports/2010s/2010/201021>.
3. Flight hazard zones consist of specified protected airspace around airports. In a two-runway airport, the zone extends 2 nm (4 km) in all directions from the runway centerline, plus an additional 3-nm (6-km) extension beyond the 2 nm along the extended centerline.
4. In 1995, FAA Order 7400.2, *Procedures for Handling Airspace Matters*, established protected zones around airports including the laser-free flight zone and the critical flight zone.

ATOSpheric Conditions

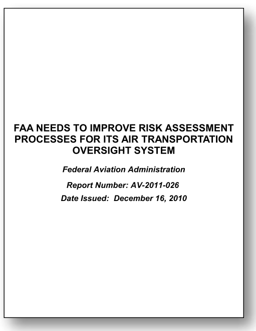
Auditors call the FAA air carrier oversight system conceptually sound but flawed in execution.

REPORTS

Untimely Action

FAA Needs to Improve Risk Assessment Processes for Its Air Transportation Oversight System

U.S. Department of Transportation Office of Inspector General. Report no. AV-2011-026. Dec. 16, 2010. 36 pp. Figures, tables, appendix. <www.oig.dot.gov/library-item/5468>.


FAA NEEDS TO IMPROVE RISK ASSESSMENT PROCESSES FOR ITS AIR TRANSPORTATION OVERSIGHT SYSTEM

Federal Aviation Administration

Report Number: AV-2011-026

Date Issued: December 16, 2010

Quis custodiet ipsos custodes? asked the Roman poet Juvenal: Who will guard the guards themselves? Had he been living today, he might ask how to oversee those who oversee aviation safety.

The U.S. Federal Aviation Administration (FAA) needs to provide more oversight of its Air Transportation Oversight System (ATOS), the Office of Inspector General (OIG) says. The latest report reaches essentially the same conclusion as OIG reports in 2002 and 2005.

The FAA uses the ATOS to conduct surveillance of nearly 100 airlines that transport more than 90 percent of U.S. airline passenger and cargo traffic. "We have consistently reported that ATOS is conceptually sound because it is data-driven and intended to target inspector resources to the highest risk areas," the report says. In the earlier reports, however, "we reported that FAA needed to strengthen national oversight of ATOS to hold field managers more accountable for consistently implementing effective oversight practices."

The objectives of the most recent OIG audit were "to determine (1) whether FAA has completed timely ATOS inspections of air carriers' policies and procedures for their most critical maintenance systems; (2) how effective ATOS performance inspections have been in testing and validating that these critical maintenance systems are working properly; and (3) how well FAA implemented ATOS for the remaining [U.S. Federal Aviation Regulations (FARs)] Part 121 air carriers and what, if any, oversight challenges FAA inspection offices face." The audit was conducted from May 2008 through July 2010.

The ATOS has three primary functions, the report says. All involve FAA inspector oversight of airlines. The first function is assessments of air carrier system design — policies and procedures, typically analyzed through reviews of operational manuals. Second are performance assessments that confirm that the system is producing the intended results. Third is evaluation of risk management. Inspectors look at air carriers' ways of dealing with hazards, as well as FAA enforcement actions and rule making.

The report says that "FAA has not completed timely ATOS inspections of air carriers' policies and procedures for key maintenance systems."

Incorporating the findings of the earlier audits, the report says that "over an eight-year period, inspectors at all eight major air carrier inspection offices in our review did not complete 207 key inspections of air carriers' maintenance policies and procedures on time. This is despite changes FAA made to ATOS over the last 10 years that actually decreased the number of maintenance programs inspectors were required to review and increased the intervals between inspections."

From federal fiscal year (FY) 2002 through FY 2009, each from Oct. 1 to Sept. 30, none of the eight FAA major air carrier inspection offices completed systemic ATOS reviews of maintenance policies and procedures — called design assessments — on time. "Four … completed less than 50 percent of their inspection workload at the required interval," the report says. "As a result, any risks in the air carrier systems would remain 'unknown' until inspections are completed."

The most common overdue inspection was "required inspection item training requirements" at seven offices. "Availability [of manuals]," "manual currency," "supplemental operations manual requirements," "parts/material control/suspected unapproved parts" and validation of the qualifications of the people holding the positions of chief inspector and director of maintenance were each overdue at six offices.

"Principal inspectors stated that they missed inspection intervals due to confusion over FAA's guidance on when they should complete ATOS design assessments," the report says. "According to these inspectors, the guidance only 'suggested' a five-year inspection cycle for this type of assessment. While this may have been the case when FAA issued guidance in 2001, it reissued the guidance in July 2007, in part, to clarify inspection requirements. The revised guidance explicitly stated that these assessments must be completed every five years."

The FAA has a system to monitor field office inspections, known as the Quarterly ADI (Action, Determination and Implementation) Completion Report. But the OIG audit found that the FAA "does not track overdue and unassigned ATOS inspections. … We examined FAA's quarterly reports from June 2008 through June 2009 and identified 237 scheduled inspections that were left unassigned and uncompleted. However, FAA did not use the Quarterly ADI Completion Report to track any of these to ensure they would be rescheduled and completed."

Some inspection programs had previously been identified by the FAA inspectors as involving "elevated risk." Of those, "engineering/major repairs and alterations" was four years past due; "other personnel with operational control" was three years and three months past due; "training of flight attendants" and "major repairs and alterations records" were each 18 months in arrears.

"ATOS was envisioned to be a risk-based oversight system, but we found the risk assessment process — the basis for prioritizing inspections for timely completion — does not give priority to maintenance programs where FAA inspectors found increased risk," the report says. "Also, inspectors we interviewed were not analyzing voluntary disclosure data (i.e., maintenance errors that air carriers self-report) or industry events that could impact a carrier's performance and stability. Voluntary disclosure data and changes in the airline industry are important indicators of whether air carriers are properly maintaining their aircraft during times of economic downturn."

As examples of "high-criticality" inspections most often missed at major air carriers, the report cited 30 continuing analysis and surveillance system (CASS) inspections, 28 aircraft reliability program inspections and 21 airworthiness directive management inspections. At small carriers, these included 20 engineering/major repairs and alterations program inspections; 15 maintenance control program inspections; 15 CASS inspections; and 12 aircraft airworthiness inspections.

The report identifies what OIG considers a flaw in the ATOS system design: Prompting inspectors "to place priority on programs that are not necessarily high risk. This is because ATOS disproportionately weights maintenance programs designated as high-criticality over lower-criticality maintenance programs, even though inspectors have identified deficiencies in the lower-criticality programs" based on "inspectors' analyses of air carrier data and inspection reports, which indicate that the individual maintenance program is experiencing problems."

The report cites as an example an air carrier's general maintenance manual, which "by itself,

'Principal inspectors stated that they missed inspection intervals due to confusion over FAA's guidance on when they should complete ATOS design assessments.'

will not result in an unsafe condition on an aircraft. However, as the foundation for an effective aircraft maintenance program, without accurate manuals, maintenance errors can occur. We agree that high-criticality programs warrant vigilant FAA oversight, but they may not always present the highest risk to safe air carrier operations if inspectors have not identified any hazards in the programs. … More emphasis on prioritizing programs with increased risk, regardless of the criticality designation, would allow FAA to better target inspector resources."

ATOS can be a poor fit for smaller Part 121 air carrier inspectors, the report says: "Managers and inspectors at 12 FAA inspection offices for smaller air carriers that recently transitioned to ATOS cited concerns with the system's design, such as inspection checklist questions, air carrier staffing limitations, confusion over how to record inspection findings, and insufficient data to effectively support the ATOS 'data-driven' approach."

In addition, inspectors at smaller offices "expressed frustration with the gap between the time [when] they received system safety training and when they actually began using ATOS to oversee their assigned air carrier." In some cases, the report says, the training occurred as much as six years before they began inspections under the system. "For those inspectors who had a gap of three or more years, nearly 70 percent reported being unable to recall and apply system safety concepts to answer ATOS inspection questions. Understanding and applying system safety principles is key to ensure that air carriers' maintenance programs work effectively and that ATOS contains accurate data."

OIG recommends that the FAA:

- "Redesign the Quarterly ADI Completion Report to include cumulative roll-up data from previous quarters and conduct trend analyses that could be used to hold regional and local inspection offices accountable for scheduling uncompleted inspections;
- "Develop procedures to document justification for significant changes to ATOS (i.e., planned changes to alter the number of data collection tools or prescribed inspection time intervals);
- "Redesign the current risk assessment process within ATOS so that it appropriately prioritizes maintenance programs with the greatest percentage of increased risk (regardless of criticality level) for inspector resources;
- "Provide training to inspectors to help them more accurately interpret data from all available sources … and apply the results more consistently when planning risk assessments;
- "Evaluate ATOS to determine if it is designed to accurately record inspection findings unique to smaller air carrier operations;
- "Evaluate whether ATOS is scalable across all Part 121 air carriers; [and,]
- "Expedite enhancement of ATOS training methods … to assist inspectors in understanding how to use ATOS data collection tools and increase their proficiency in using ATOS."

The FAA concurred with four of the recommendations and partially concurred with three.

— Rick Darby

Variations on a Theme

U.S. Airline Transport Pilot International Flight Language Experiences, Report 5: Language Experiences in Native English-Speaking Airspace Airports

Prinzo, O. Veronika; Campbell, Alan; Hendrix, Alfred M.; Hendrix, Ruby. U.S. Federal Aviation Administration (FAA) Civil Aerospace Medical Institute. Report DOT/FAA/AM-10/18. December 2010. 23 pp. Tables, references. <www.faa.gov/library/reports/medical/oamtechreports/2010s/2010/201018>.

Previous reports in this series have documented experiences of U.S. international airline pilots where the native language is other than English (*ASW*, 3/09, p. 49; 5/10, p. 54). But U.S. international pilots also fly in airspace of countries such as Australia, Canada, Ireland, New Zealand and the United Kingdom where English is the primary native language. There, too, local dialects may differ in pronunciation and even grammar from U.S. English. And regional variations in English speech are common within the United States.

"The [48] pilots who participated in this study were instructed to think about how hearing other native dialects of the English language affected their safety and communications between them and air traffic controllers," the report says. As with the earlier reports, pilot responses were combined and condensed for the sake of readability.

Seventy-nine percent of the pilots said that they "rarely" had communication problems in native-English-speaking environments, while 15 percent "occasionally" had problems. Two pilots "frequently" experienced communication difficulty, one in the United Kingdom, the other in the eastern Caribbean. One pilot "often" had difficult interactions with controllers — on opposite coasts of the United States. That pilot mentioned differences in dialect between controllers in Los Angeles and Washington.

Asked which English dialect was hardest to understand, participating pilots mentioned U.K. English most often, perhaps because of greater frequency of flights compared with other native-English-speaking countries. The British Isles have many sub-dialects. One pilot mentioned particular trouble understanding Welsh, Scottish and Irish pronunciation as well as "a thick Southampton accent" — probably meaning East London speech, formerly called "Cockney."

"I notice that sometimes the controllers in New England talk too fast, as do the New Yorkers," said a pilot. "I've experienced New York Approach fire instructions nonstop, and I know they're not going to be happy if we miss one. When at [Chicago] O'Hare, I perceive controllers speaking like auctioneers, but I understand them. I think it would be difficult to operate in that environment as a foreign pilot."

Said another: "I've made quite a few trips to Delhi [India] and was unprepared for the particular cadence in their speech."

Although pilots who experienced difficulty mostly regarded it as an annoyance, one suggested a possible safety concern: "There are quite a few pilots [with seniority] who avoid flying to some parts of the world because of language concerns — they're afraid of miscommunication. This forces junior pilots with the least experience to fly into these sections."

Another pilot said, "The rigors of flying to Delhi or other destinations, going through Russia and all the [bordering nations] to get there, is professionally satisfying because it involves meters, QFE instead of QNH [altimeter settings], different accents and carbon microphones. But I no longer want to be challenged in that way."

Pilots were asked how often controllers in native-English-speaking countries slipped out of standard International Civil Aviation Organization phraseology into "common" English, that is, normal or conversational speech. Eight percent answered "without fail," 21 percent "often" and 19 percent "frequently."

One pilot commented, "We get colloquial in the U.S. because we have that common understanding. After the initial clearance, we'll ask for other stuff and it's frequently in common English. It's just easier to communicate in your native tongue. I think that's why, internationally, controllers sometimes switch to their native language — it's quicker and easier."

The report recommends that "controllers should be discouraged from using local jargon, slang, idiomatic expressions and other forms of conversational communications when transmitting messages to pilots. Although colorful and fun, they have no place in air traffic control and diminish situational awareness, can lead to requests for [a] repeat and otherwise disrupt information transfer."

One pilot dissented from that view, saying, "First of all, I'm building a bit of a rapport, should I need something. Second, since we're human beings, we like to treat each other with some amount of respect, and that's the way to do it on the radio."

— Rick Darby

Although pilots who experienced difficulty mostly regarded it as an annoyance, one suggested a possible safety concern.

‘Unprofessional Behavior’ Cited in Overrun

An arrestor bed saved a regional jet from plunging down a steep slope.

BY MARK LACAGNINA

The following information provides an awareness of problems in the hope that they can be avoided in the future. The information is based on final reports by official investigative authorities on aircraft accidents and incidents.

JETS

Takeoff Rejected Above V_1

Bombardier CRJ200. Minor damage. No injuries.

The flight crew’s “unprofessional behavior” and “lack of checklist discipline” were among the probable causes of the Jan. 19, 2010, incident in which the CRJ overran the runway during a rejected takeoff at Yeager Airport in Charleston, West Virginia, U.S., said the U.S. National Transportation Safety Board (NTSB). A recently installed engineered material arresting system (EMAS) stopped the airplane short of a steep slope, and none of the 34 people aboard the regional jet was injured.

“Cockpit voice recorder (CVR) information revealed that the flight crew began a personal conversation — that is, a conversation not pertinent to the operation of the airplane — during a departure delay,” the NTSB report said. “The flight crewmembers continued the nonpertinent conversation throughout the entire taxi, which was not in accordance with company procedures and federal regulations regarding ‘sterile cockpit.’ CVR information also revealed that although the flight crew completed all of the required checklist items during the taxi, each item was read and responded to in a very quick and routine manner.”

Of particular relevance is that after the captain called for “flaps 20,” the first officer called out “flaps eight” and “eight degrees” while conducting the “Taxi” checklist. The captain did not notice the error, and he responded “set” and “eight,” respectively, to the first officer’s callouts. Recorded flight data confirmed that the flaps were set to eight degrees, rather than 20 degrees, for takeoff.

“The rapid and perfunctory manner in which the flight crew conducted the ‘Taxi’ checklist resulted in the captain not visually comparing the airplane’s flap position with the aircraft communications addressing and reporting system [ACARS] data, which was his normal practice,” the report said. “After rapidly completing the ‘Taxi’ checklist, the flight crew continued the nonpertinent conversation until the captain called for the ‘Before Takeoff’ checklist.”

The pilots, who were beginning their fifth flight on the first day of a three-day trip sequence, also conducted the “Before Takeoff” checklist rapidly and did not conduct a proper takeoff briefing before the airport traffic controller cleared them for takeoff from Runway 23, the report said.

Yeager Airport is on a plateau in mountainous terrain. Runway 23 is 6,300 ft (1,920 m) long, and the terrain beyond the end of the runway ends with a steep, 350-ft (107-m) slope. An EMAS was installed 50 ft (15 m) beyond the end of the runway in September 2007. With a length of 455 ft (139 m), it is shorter than the 600-ft (183-m) standard specified by the U.S.

Federal Aviation Administration. However, the EMAS manufacturer told investigators that the arrestor bed is capable of stopping airplanes of similar size and weight to the CRJ200 that enter it at 70 kt or less.

The takeoff weight of the incident airplane was 44,400 lb (20,140 kg). ACARS performance data included a flap setting of 20 degrees, a reduced thrust setting, 127 kt for V_1 — the maximum speed at which action must be taken to reject a takeoff — and 128 kt for rotation.

Calculations by Bombardier, based on airplane flight manual data and the conditions that existed at Yeager Airport, indicated that the CRJ could have been stopped on the runway about 5,730 ft (1,747 m) from the beginning of the takeoff roll if the takeoff was rejected at V_1. The calculations assumed a flap setting of 20 degrees.

Visual meteorological conditions, with calm winds, prevailed as the captain, the pilot flying, initiated the takeoff. He was 38 and had 9,525 flight hours, including 4,608 hours as pilot-in-command in type. The first officer was 44 and had 3,029 flight hours, including 1,981 hours in type.

The captain apparently noticed the flap misconfiguration and attempted to change the flap setting during the takeoff roll. "The takeoff was normal until the airplane reached an airspeed of about 120 kt," the report said. "At this time, FDR [flight data recorder] data showed the flaps beginning to move from the flaps 8 [position] to the flaps 20 position. Shortly thereafter, the first officer stated, 'V one.' … The CVR then recorded the sound of the airplane master caution and flaps and spoilers configuration aural alerts. The captain initiated a rejected takeoff (RTO) about five seconds after he started moving the flaps [from eight degrees to 20 degrees] and when the airplane was at an airspeed of about 140 kt, which was 13 kt above V_1." The pilots reduced thrust to idle, extended the flight and ground spoilers, and applied wheel braking.

The report said that the captain should have initiated the RTO when he noticed that the flaps were not configured properly: "As a result of the captain's decision to attempt to reconfigure the flaps and delay the RTO, the airplane overran the runway end and entered the [EMAS] at an airspeed of about 50 kt." The CRJ came to a stop after traveling through 128 ft (39 m) of the arrestor bed. The flaps, landing gear and landing gear doors received minor damage.

The EMAS "contributed to the survivability of the incident," the report said. "If this incident had occurred before the installation of the EMAS, the airplane most likely would have traveled beyond the length of the original safety area and off the steep slope immediately beyond its end."

Panic Hinders Upset Recovery

Boeing 737-800NG. No damage. No injuries.

The aircraft was cruising at Mach 0.76 at Flight Level 370 (approximately 37,000 ft) during a charter flight with 113 passengers from the United Arab Emirates to India on May 26, 2010, when the commander left the cockpit to use the forward lavatory. He found the lavatory occupied, however, and was returning to the cockpit when he noticed that the 737 was entering a steep nose-down attitude, said the report by the Indian Directorate General of Civil Aviation.

The senior cabin crewmember, who was in the forward galley, also noticed that the aircraft had entered a steep descent. She attempted to "buzz" the cockpit but received no reply, the report said.

The commander attempted unsuccessfully to hail the copilot on the interphone and ask him to open the cockpit door. He then used the emergency access code to open the cockpit door, a process that took 30 seconds to accomplish. The commander then rushed into the cockpit, shouting, "What are you doing?" He found that the aircraft was in a 26-degree nose-down pitch attitude and was banked 5 degrees left, and that airspeed was in the "red band," the report said.

The passengers were 'very much scared and were shouting loudly.'

The commander manually recovered control and returned the aircraft to the assigned flight level and course. All the passengers were seated during the incident, and although they were "very much scared and were shouting loudly," The copilot said that he had become 'panic stricken.'

there were no injuries, the report said. The commander subsequently used the public address system to tell the passengers that the aircraft "went through an air pocket … but now everything is safe."

The 737 was landed without further incident at the scheduled destination — Pune, Maharashtra, India — about an hour and a half later. A postflight examination revealed no noticeable damage. However, the aircraft had experienced loads of plus 2.02 g (i.e., 2.02 times standard gravitational acceleration) and minus 0.2 g, which required structural inspections to be performed according to the aircraft maintenance manual. No damage was found during the inspections, and the aircraft was returned to service.

Analysis of recorded flight data showed that after the commander left the cockpit, the copilot's control column moved forward. "This was due to the copilot adjusting his seat forward and inadvertently pressing the control column forward," the report said. This caused the aircraft to pitch about five degrees nose-down and the autopilot mode to change to control wheel steering. The force on the control column, which had reached 20 lb (9 kg), then was relaxed, and the aircraft entered an unspecified nose-up pitch attitude for about four seconds. The copilot responded by "sharply" moving the control column forward, the report said. The force on the column reached 60 lb (27 kg). The overspeed warning sounded when airspeed exceeded the 0.82 Mach limit as the aircraft descended through 34,900 ft.

The FDR data indicated that after the commander re-entered the cockpit, opposing forces were applied to the control columns. However, the commander then "yanked the control column with approximately 125 lb [57 kg] of pull force," the report said. Airspeed increased to 0.9 Mach and the g-loading increased to the maximum recorded before the captain recovered control at 30,200 ft.

The report said that if the rapid descent had continued, catastrophic structural failure would have occurred. It also said, "The yanking of the control column by [the commander] could have also resulted in loss of pitch control surfaces."

The commander told investigators that when he asked the 25-year-old copilot, who had 1,310 flight hours, including 968 hours in type, why he did not open the cockpit door when he was hailed, the copilot said that he had become "panic stricken."

The copilot told investigators that he was doing paperwork when the commander left the cockpit. He said that the control wheel steering mode engaged suddenly, and he tried to control the rapidly increasing airspeed by reducing thrust and selecting the autopilot altitude-hold mode. When the altitude-alert chime and the overspeed warning sounded, "he got into a panic situation and couldn't control the aircraft … open the cockpit door [or] answer the cabin call," the report said. The copilot said that the situation lasted about 30 to 40 seconds before the commander entered the cockpit and assumed control of the aircraft.

The copilot "probably had no clue [how] to tackle this kind of emergency," the report said. "The jet upset exercise is carried out during simulator check in manual mode and not done with the autopilot engaged."

Deicing Fluid Fouls Cabin Air

Airbus A320-233. No damage. No injuries.

Heavy snow fell while the A320 was on the ramp at Sweden's Stockholm-Västerås Airport the night of March 2, 2009. During a verbal exchange in English, the commander told the deicing vehicle operator to apply Type I deicing fluid and Type II anti-icing fluid to the aircraft. The deicing vehicle operator said, "Are you ready for deicing?"

The commander replied, "Be ready for deicing." However, the deicing vehicle operator understood this as meaning that the commander was ready for the aircraft to be deiced, said the report by the Swedish Accident Investigation Board (SHK).

The A320's auxiliary power unit (APU) and air conditioning system had not been shut down, as required, before the vehicle operator began deicing the right side of the aircraft. As a result, deicing fluid entered the APU and the air conditioning system. The flight crew noticed the odor of deicing fluid and told the vehicle operator to stop deicing the aircraft. "The aircraft doors were opened, and the aircraft was ventilated, also with assistance from the air conditioning system at a high temperature, for about 20 minutes," the report said. "The aircraft was then deiced again and treated with [anti-icing] fluid before takeoff."

After departing from Västerås with 79 passengers for a scheduled flight to Poznan, Poland, the flight crew detected an "unpleasant odor" in the cockpit at cruise altitude and donned their oxygen masks as a precaution. One passenger and two cabin crewmembers experienced slight difficulty in breathing, as well as eye irritation. They also used supplemental oxygen to alleviate the symptoms.

The commander considered diverting to the nearest alternate airport but decided that the odor was not a safety risk and that the time gained in diverting the flight would be marginal compared with continuing to the destination, the report said. The A320 was landed at Poznan without further incident.

The SHK concluded that although the flight crew "took reasonable action" to ventilate the aircraft after smelling deicing fluid before departure, some deicing fluid likely remained in the air conditioning system. "One possible reason could be that the ventilation was carried out only with the air conditioning system set for maximum heating and not, in addition, with maximum cooling of the cabin air," the report said.

Fatigued Crew Lands on Taxiway

Boeing 767-300ER. No damage. No injuries.

Three pilots were required for the scheduled flight from Rio de Janeiro, Brazil, to Atlanta Hartsfield International Airport the night of Oct. 19, 2009. The flight crew comprised a check airman, a captain and a first officer.

During preflight preparations, the check airman experienced gastrointestinal distress. "After a brief time away from the flight deck, the check airman returned to the flight deck and advised the other crewmembers he was 'fine,'" the NTSB report said.

There was a 30-minute delay before the 767 departed with 182 passengers and 12 crewmembers. The captain was in the left seat, the check airman was in the right seat, and the first officer was in the observer's seat. After establishing the airplane in cruise flight, the crew discussed rest breaks and decided that the check airman should take the first break, comprising 2 hours and 50 minutes.

"At the completion of his rest break, it was determined that the check airman was ill, and the crew enlisted the aid of a physician aboard the flight," the report said. "The flight crew elected to continue the flight to [Atlanta and] requested that dispatch arrange for emergency services to meet the airplane. … The remaining two crewmembers conducted the entire night flight without the benefit of a customary break period. Throughout the flight, the crew made comments indicating that they were fatigued and identified fatigue as their highest threat for the approach, but [they] did not discuss strategies to mitigate the consequences of fatigue."

Atlanta had clear skies and calm winds, and the crew briefed for a landing on Runway 27L. However, an approach controller later told the crew to expect to land on Runway 26R. Then, shortly after they briefed for the approach to Runway 26R, the pilots were "reassigned to Runway 27L," the report said. "At about the outer marker for that runway approach, the [Atlanta] tower controller offered Runway 27R, which the crew accepted."

The first officer became preoccupied in trying to tune the instrument landing system (ILS) frequency. The crew had not briefed the approach to Runway 27R and were not aware that the ILS (instrument landing system) and the approach light system for Runway 27R were not available.

The captain told investigators that as he maneuvered for the side-step to Runway 27R, he saw the precision approach path indicator and lined up on "the brightest set of lights"

'The remaining two crewmembers conducted the entire night flight without the benefit of a customary break period.'

that he saw. "He stated that he saw 'bright edge lights and centerline lights' and thought he had the runway in sight," the report said. The 767, however, was landed on Taxiway M, which is north of, and parallel to, Runway 27R, and was unoccupied at the time.

Flight tests conducted by investigators showed that, without the aid of the approach lights and the ILS, there are several misleading visual cues for an approach to Runway 27R. "These cues included numerous taxiway signs along the side of Taxiway M, which from the air appeared to be white and could be perceived as runway edge lights," the report said. "The alternating yellow and green lights in the ILS critical area provided the appearance of a runway centerline."

These lights, the unavailability of the approach lights and the ILS, and the crew's decision to accept a late runway change were cited as factors that contributed to the taxiway landing. NTSB concluded, however, that fatigue was the probable cause of the crew's misidentification of the correct landing surface. The incident occurred at 0605 local time — more than 14.5 hours after the 767 left the gate at Rio — and the captain had been awake for more than 22 hours.

TURBOPROPS

'Look See' Ends in Excursion

Beech King Air B200. Substantial damage. No injuries.

The flight plan filed by the pilot for the business trip from Des Moines, Iowa, U.S., to Sioux City, Iowa, the morning of Jan. 19, 2010, included a destination airport and an alternate airport that had weather conditions below the minimums prescribed by the general operating and flight rules of U.S. Federal Aviation Regulations Part 91.

"While en route, the destination airport's automated observing system continued to report weather below approach minimums, but the flight crew continued the flight," the NTSB report said, noting that company procedures allowed a "look see" approach to minimums. "The allowance of a 'look see' approach essentially negates the procedural risk mitigation afforded by requiring approaches to be conducted only when [the reported] weather is above approach minimums."

The crew requested and received clearance to conduct the ILS approach to Runway 31 at Sioux City's Gateway Airport, which was reporting 1/2 mi (800 m) visibility and 100 ft vertical visibility. The airport traffic controller subsequently told the crew that the runway visual range for touchdown and rollout was 1,800 ft (550 m).

The King Air was at a height of less than 100 ft when the copilot told the pilot that the airplane was not lined up with the runway. The pilot responded, "Those are edge lights. … Oh, yeah, I see what I'm doing." The pilot increased power and attempted to realign the airplane, but the King Air touched down about 2,800 ft (853 m) beyond the threshold of the 9,000-ft (2,743-m) runway with the left main landing gear in the grass. The airplane then veered off the runway. The nose landing gear collapsed, and the nose section and lower fuselage skin were damaged, but the pilots and their two passengers escaped injury.

Broken Insulation Causes Fire

Convair 580. Minor damage. No injuries.

The aircraft was descending to land at Tamworth, New South Wales, Australia, during a training flight the night of Jan. 7, 2010, when the flight crew saw smoke emanating from beneath the instrument panel. "The crew donned oxygen masks, but the safety pilot's hose for the portable oxygen bottle was split," said the report by the Australian Transport Safety Bureau. "The safety pilot moved to the rear of the aircraft to avoid the smoke."

The smoke intensified, and flames appeared. The pilots used a portable fire extinguisher to suppress the flames, declared an emergency and landed the Convair without further incident.

Investigators found that a piece of insulation material had detached and fallen onto a panel light rheostat and surrounding wires. "The rheostat had developed a 'hot spot,' and, consequently, the insulation absorbed the heat and transferred it to the wires, which produced smoke and flames," the report said.

Head-to-Head on the Runway

Bombardier Q400. No damage. No injuries.

Surface winds at Exeter Airport in Devon, England, were from 150 degrees at 9 kt the night of Oct. 30, 2009, when the airport traffic controller cleared the flight crew to taxi to Holding Point Alpha, which is at the approach end of Runway 08. The taxi clearance was read back correctly; but during the pushback, the crew did not notice a radio transmission clearing a Boeing 737 crew to land on Runway 26.

As the Q400, with 58 passengers and four crewmembers aboard, neared Runway 08, the copilot told the commander that he saw moving lights on the runway. "The commander said that he believed it was a car," said the report by the U.K. Air Accidents Investigation Branch (AAIB). "Disagreeing, the copilot said it looked like an aircraft."

The commander had taxied the aircraft onto the runway when he remembered that they had been cleared only to the holding point. The controller was monitoring the 737's landing roll and did not see the Q400 move onto the runway. At this time, the 737, with only the two pilots aboard, was decelerating through about 50 kt; the crew did not see the Q400 until the 737 had slowed to taxi speed. The 737 crew then turned onto the second-to-last taxiway on Runway 26.

The report said that the Q400 crew's unfamiliarity with the airport, inadequate monitoring and fatigue likely were factors in the incident. The pilots told investigators that they had a "broken night's sleep" and had encountered delays during the first three flights of the day. "Both crewmembers were likely to have been tired after the broken night's sleep and a busy day trying to regain schedule," the report said.

PISTON AIRPLANES

Incapacitation During Test Flight

Piper P-Navajo. Destroyed. Two fatalities.

Instrument meteorological conditions (IMC) prevailed when the Pressurized Navajo took off from Oxford, England, for a postmaintenance test flight on Jan. 15, 2010. The pilot was an airline training captain with more than 12,500 flight hours; he also was active in general aviation. The passenger, who recently had purchased the aircraft, was a private pilot with 93 flight hours and was being trained for multiengine and instrument ratings.

Recorded air traffic control (ATC) radar returns showed that the Navajo climbed to about 1,500 ft and then descended in an erratic path to 900 ft, where radar contact was lost. There was no reply to several radio transmissions from ATC. Witnesses saw the aircraft emerge from the 200-ft broken ceiling, descend rapidly into a field and burn.

"The postmortem examination showed that the [54-year-old] pilot had severe coronary heart disease, and there was evidence to suggest that he may have been incapacitated, or died, prior to the collision with the ground," the AAIB report said.

The passenger had been receiving flight training in a Piper Seneca. "His instructor gave his opinion that at his stage of training and experience, he would be unlikely to have been able to successfully fly a Piper Navajo aircraft in IMC," the report said.

Control Lost on Snowy Runway

Cessna 402C. Substantial damage. No injuries.

The pilot recalled that there was a thin layer of snow on the runway when he initiated takeoff for a cargo flight from Canyonlands Airport in Moab, Utah, U.S., the afternoon of Dec. 22, 2009. However, the airport manager and other witnesses told investigators that there was 4-5 in (10-13 cm) of snow on the runway and that it was snowing heavily.

The NTSB report indicates that snow removal had been discontinued at an unspecified distance from the approach threshold. The pilot said that he rejected the takeoff after losing directional control of the 402 when it encountered the deeper snow. The nose landing gear collapsed when the airplane veered off the left side of the runway.

The airport certification manual requires no more than 2 in (5 cm) of accumulation before snow is removed from a runway and that the airport be closed if accumulation exceeds 2 in. The airport manager said, however, that he was "waiting for the snow to let up" to complete snow removal and was in the process of closing the airport when the accident occurred.

Freezing Rain Coats Windshield

Beech 58 Baron. Substantial damage. No injuries.

The Baron encountered severe icing from unforecast freezing rain during a charter flight the afternoon of Jan. 3, 2009. Airspeed began to decrease as ice accumulated rapidly on the airplane, and the pilot diverted to the nearest airport, in Brainerd, Minnesota, U.S.

"He made two low passes over the airport while trying to clear ice off of the windshield," the NTSB report said. "However, the windshield alcohol deice [system] could not keep up with the ice accumulation."

The pilot told investigators that he had to look out the side window to align the Baron on approach but was unable to judge his height above the concrete runway, which had a light color that blended with the blowing snow. The airplane touched down hard on the runway, but the pilot was able to taxi it to the ramp. Examination of the Baron revealed that the right wing spar was bent, and the wing had been pushed into the fuselage.

HELICOPTERS

Engine Switches Mispositioned

Eurocopter EC 135-P2. Substantial damage. Three minor injuries.

The emergency medical services helicopter was departing from Pottsville, Pennsylvania, U.S., to respond to a motor vehicle accident the night of May 30, 2008, when the pilot realized that something was wrong. "The helicopter would neither climb nor accelerate normally," said an NTSB report issued in October 2010.

The helicopter descended over downsloping terrain, struck the top of a truck about 100 ft from the helipad, settled to the ground and rolled onto its left side. The pilot, flight nurse and flight paramedic sustained minor injuries.

"No preimpact mechanical anomalies of the helicopter, engines or engine switches were found," the report said. "As part of the pre-takeoff confirmation check, the pilot was required to ensure that both main engine switches were in the 'FLIGHT' position; however, onboard recorded data revealed that the no. 2 main engine switch was in the 'IDLE' position during takeoff."

Corrosion Causes False Warnings

Agusta Westland 139. No damage. No injuries.

The helicopter was en route in IMC from North Denes Heliport near Great Yarmouth, England, to transport eight passengers to a North Sea drilling platform on Dec. 23, 2008, when many flight, engine and systems displays were lost. The flight crew also received several engine caution messages and a warning of fire in the rear baggage compartment, said a report issued by the AAIB in October 2010.

The crew declared an emergency and turned back to the heliport. The anomalies continued, and the crew decided to descend below the clouds, estimating that the base was at about 1,200 ft. The helicopter broke out of the clouds at 200 ft, and the crew "assessed that the sea state was suitable for ditching and briefed for such an event, in case it proved necessary," the report said.

The AW139 was met by another company helicopter whose crew reported no sign of smoke or fire. The incident helicopter then was landed safely at the heliport.

"The spurious warnings and the loss of indications were found to be due to corrosion in an avionics module," the report said. "The corrosion had occurred due to the module cabinet being cooled by unfiltered, nonconditioned air drawn from intakes on the fuselage underside. The situation was exacerbated by the helicopter being operated in a maritime environment."

Preliminary Reports, October–November 2010

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Oct. 1	Teterboro, New Jersey, U.S.	Gulfstream G-IV	minor	11 none
Winds were from 360 degrees at 12 kt, gusting to 19 kt, when the G-IV touched down long and overran Runway 06 into an engineered material arresting system.				
Oct. 1	Manteo, North Carolina, U.S.	Cessna Citation 550	substantial	7 minor
The Citation touched down long and overran the wet runway into Croatan Sound.				
Oct. 2	Nazca, Peru	Cessna 185	destroyed	6 fatal
The single-engine airplane crashed after losing power on takeoff for an air tour flight.				
Oct. 5	Nassau, Bahamas	Cessna 402	destroyed	9 fatal
An engine problem occurred on takeoff, and the 402 crashed into a lake during an attempted return to the airport.				
Oct. 6	Minatitlán, Veracruz, Mexico	Cessna Citation 501	destroyed	8 fatal
The Citation ISP descended out of control into the sea shortly after takeoff.				
Oct. 15	Lady Barron, Tasmania, Australia	Gippsland GA-8 Airvan	destroyed	7 serious
The airplane struck a mountain while returning to the departure airport due to adverse weather.				
Oct. 21	Bukavu, Democratic Republic of Congo	Let 410UVP	destroyed	2 fatal
The airplane crashed after an engine failed on takeoff for a cargo flight.				
Oct. 25	Kirby Lake, Alberta, Canada	Beech King Air A100	destroyed	3 fatal, 7 NA
The King Air crashed short of the runway during an approach in freezing rain.				
Oct. 25	Morton, Washington, U.S.	Cessna 340A	destroyed	3 fatal
The airplane crashed in mountainous terrain after the pilot reported an engine failure.				
Oct. 26	Miami, Florida, U.S.	Boeing 757-200	substantial	160 none
The 757 returned to Miami after a rapid decompression occurred at 31,000 ft. The fuselage skin above the front left door was found torn.				
Oct. 27	Wami, Indonesia	PZL-Mielek Skytruck	destroyed	5 fatal
The airplane crashed in adverse weather after delivering supplies to flood victims.				
Nov. 3	Meeker, Colorado, U.S.	Bell 206B	substantial	1 fatal, 1 serious
The observer was killed when the helicopter struck power lines and crashed during a pipeline-patrol flight.				
Nov. 4	Guasimal, Cuba	ATR 72-212	destroyed	68 fatal
The airplane crashed in mountainous terrain shortly after the pilot reported a technical problem.				
Nov. 4	Singapore	Airbus A380	substantial	459 none
The A380 returned to Changi Airport after an uncontained failure of the no. 2 engine occurred on departure.				
Nov. 5	Karachi, Pakistan	Beech 1900C-1	destroyed	21 fatal
The airplane crashed near a residential area after an engine failed on takeoff.				
Nov. 7	Solukhumbu, Nepal	Aerospatiale AS 350B-3	destroyed	2 fatal
The helicopter crashed during an attempt to rescue two stranded mountain climbers.				
Nov. 7	Zalingei, Sudan	Antonov 24B	destroyed	6 fatal, 32 NA
The airplane veered off the runway and burned after two tires burst on touchdown.				
Nov. 9	Laredo, Texas, U.S.	Boeing 787	minor	1 minor, 41 none
The flight crew conducted an emergency landing after an electric panel failed and ignited insulation in the aft electronic bay during a test flight.				
Nov. 13	Andahuaylas, Peru	Swearingen Metro III	substantial	19 none
Visual meteorological conditions prevailed when the Metro overran the runway on landing.				
Nov. 19	Birmingham, England	Cessna Citation 501	destroyed	2 serious
The Citation, which was transporting a human liver for transplant, struck antennas on approach in fog, crashed off the right side of the runway and burned.				
Nov. 24	Monterrey, Mexico	Antonov 32B	destroyed	5 fatal
The airplane banked right after lift-off and crashed on a terminal ramp.				
Nov. 28	Karachi, Pakistan	Ilyushin 76TD	destroyed	12 fatal
The cargo plane crashed into a building under construction shortly after takeoff. The fatalities included four construction workers.				
Nov. 29	Cagayan, Luzon, Philippines	Beech Queen Air A65	destroyed	13 NA
The Queen Air stalled and crashed in a river after both engines failed during a scheduled flight. No fatalities were reported.				

NA = not available

This information, gathered from various government and media sources, is subject to change as the investigations of the accidents and incidents are completed.

Selected Smoke, Fire and Fumes Events in the United States and Canada, September–October 2010

Date	Flight phase	Airport	Classification	Sub-classification	Aircraft	Operator
Sept. 4	Descent	John F. Kennedy (JFK)	Smoke in cockpit and cabin	Landing at destination	Embraer ERJ-190	JetBlue Airways
At approximately 10,000 ft, the flight crew received an emergency call from the cabin. They declared an emergency during the descent. With smoke in the cockpit and cabin, the flight crew performed memory items for smoke and started the "Smoke" checklist with the bleeds off. The smoke dissipated. The airplane was landed with no problems.						
Sept. 6	Cruise	—	Smoke in cockpit and cabin	Landing at destination	Boeing 737	Southwest Airlines
At cruise altitude with the recirculation fan on, the crew detected an odor of burned rubber. The recirculation fan was turned off and the odor dissipated.						
Sept. 16	Cruise	Halifax (YHZ)	Electrical odor in cockpit	Diversion to YHZ	Boeing 767	American Airlines
The crew reported an electrical odor in the cockpit and a forward-equipment cooling status message. An emergency was declared and the flight diverted to YHZ, where it was landed without incident.						
Sept. 24	Takeoff	Philadelphia (PHL)	Odor in cockpit	—	Boeing 757	—
During takeoff and initial climb, a "rotten" odor became apparent in the cockpit. The crew turned off the left bleed and the left pack. The odor dissipated. At 5,000 ft, they were turned back on and the odor returned. The crew turned them off again. They tried again at 20,000 ft and there was no odor. The left bleed and pack were left on. No odor was noted for the remainder of the flight.						
Sept. 25	Takeoff	Las Vegas (LAS)	Smoke in cockpit	—	Airbus A319	—
On takeoff, the crew noticed an acrid burning odor with a light haze of smoke. After lift-off, a low grinding noise was also noticed until after flap retraction; the noise returned for a short time on descent. Maintenance removed and replaced the no. 1 air cycle machine.						
Sept. 28	Climb	—	Lavatory smoke	Continue to destination	McDonnell Douglas MD-88	Delta Air Lines
During climb-out, both of the aft lavatories' smoke detector alarms sounded and there was a light haze and odor in the aft cabin. The haze cleared and the alarms stopped when climbing through 12,000 ft and the flight continued to its destination. Upon arrival, technicians found the auxiliary power unit leaking oil and replaced the unit.						
Oct. 14	Climb	Philadelphia (PHL)	Foul odor in cabin	Return for landing	Boeing 737	—
Just prior to rotation on takeoff, the aircraft was struck by multiple small birds. A foul smell was noted in the cabin. The crew declared an emergency and returned to PHL. During the emergency, all engine parameters were normal. The flight was landed without further incident.						
Oct. 14	Climb	Milwaukee (MKE)	Odor in cabin	Return for landing	Embraer ERJ-170	—
The crew reported an odor in the cabin after takeoff, and returned to MKE, where emergency equipment was dispatched. Maintenance was dispatched to the aircraft and reported that the no. 2 pack system was the cause.						
Oct. 15	—	Charlotte (CLT)	Odor in cabin	—	Boeing 737	—
A pilot reported that the cabin air had a stale odor. Maintenance replaced the cabin air recirculation filter.						
Oct. 19	Climb	Miami (MIA)	Odor in cabin	Declared emergency	Boeing 757	American Airlines
A flight attendant reported a burning plastic, oil or rubber odor in first class about 15 minutes into the flight. No fire or smoke indication was observed in the cockpit, but a flight attendant also reported warm spots on the floor at rows 1 and 2. The flight crew declared an emergency and returned to MIA without incident. Maintenance replaced the right recirculation fan and both equipment-cooling fans.						
Oct. 21	—	—	Smoke/haze in cabin	—	Boeing 777	Continental Airlines
Flight attendants reported smoke and haze with acrid smell in the "B" zone. A bulk cargo vent fan status message appeared at the same time, then went away ("cargo vent fan bulk"). The bulk cargo fan was removed and replaced.						
Oct. 24	Cruise	Stephenville, Canada (YJT)	Electrical odor in cabin	Diversion to YJT	Boeing 757	—
While en route, the flight experienced an electrical problem with seat 3C. The crew disconnected the electrical wires, but the seat remained hot. The crew elected to divert to YJT for maintenance inspection. The seat continued to exhibit an overheat condition, so it was decided to continue the flight with a different aircraft.						
Oct. 26	—	—	Electrical fumes in cabin	Declared emergency	Boeing 737	Southwest Airlines
Electrical fumes were detected in the forward and aft galley areas. The odor stopped with the recirculation fan turned off.						
Oct. 30	Climb	—	Haze and fumes in cabin	Declared emergency	McDonnell Douglas MD-80	American Airlines
A flight attendant reported light haze and fumes in the aft cabin. The crew declared an emergency and landed without incident.						

Source: Safety Operating Systems and Inflight Warning Systems