AeroSafety WORLD

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FATIGUE RULE RESISTANCE
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NEW FSF GUIDELINES REDUCE RISK

SAFE LANDINGS

THE JOURNAL OF FLIGHT SAFETY FOUNDATION

OCTOBER 2011

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Austerity and Denial

The Foundation has been working with some regulators in Europe and we have come across a big problem that is common knowledge but that no one seems willing to address.

Regulators across the world have always had a difficult time recruiting and retaining operations inspectors. It is very difficult to find someone who is qualified for the job and who is not already flying for an airline that will pay a lot more money. If they find someone to take the job, the civil aviation authority (CAA) is lucky if these recruits stay in the government for five years, unlike typical young bureaucrats that stay for 30. The problem is that these inspectors are vital. Without them, the papers move through the bureaucracy and fees are paid, but the operators can do pretty much as they please. When there is a shortage of operations inspectors, airplanes tend to crash. It is a lesson that has been learned over and over again; the International Civil Aviation Organization (ICAO) has the facts to prove it.

This leads us to the big secret that many people know but few are willing to discuss. Many of the major regulators in Europe are desperately short of operations inspectors, and the government budget austerity measures being taken across Europe likely will take the situation from desperate to dangerous.

To be completely clear, several major CAAs in Europe have staffing levels that would place a developing nation in Category 2 status with the U.S. Federal Aviation Administration, or even on Europe's own blacklist. This isn't clear from looking at the overall funding and staffing levels, but when this vital inspector category is examined, it is not unusual to see staffing levels of 20 to 30 percent of what is required.

The European Aviation Safety Agency conducts standardization audits that assess nations' safety oversight capabilities. The auditors know the truth. Theoretically, this type of shortage is supposed to set off alarms at the European Commission, where action is then taken against the CAA in question. But that process was really designed to manage shaky new entrants into the community, not to be used as a tool to deal with persistent serious problems with the core membership. So the auditors report their findings, the CAA responds by drafting action plans that cannot be executed, and the situation is gracefully ignored.

So what are the safety implications? Unlike a developing country, Europe has a network of solid carriers that will continue their safety programs because it is the right thing to do. However, I do predict that these carriers will suffer economically. The rule-making apparatus of Europe is still fully intact, so the expensive paperwork will continue to flow, but the actual implementation of new rules largely will go unmonitored. Unscrupulous operators will discover they can do anything they want if the paperwork looks good. They will compromise safety any time it saves them money and use the savings to win an edge in the marketplace.

The solution is difficult, but the issue is urgent. Europe needs a comprehensive plan that doesn't just throw money at the problem. Most of these vacant positions are funded, but CAAs lack the authority to hire, and the ability to compensate. CAAs need flexibility to solve the problem. Every state will have to craft its own solution, but first somebody is going to have to acknowledge the problem and drive corrective action.

William R. Voss
President and CEO
Flight Safety Foundation

AeroSafetyWORLD

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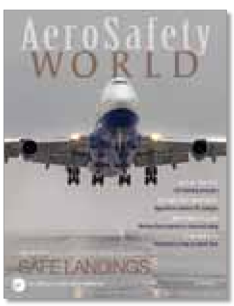

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If you have an article proposal, manuscript or technical paper that you believe would make a useful contribution to the ongoing dialogue about aviation safety, we will be glad to consider it. Send it to Director of Publications J.A. Donoghue, 801 N. Fairfax St., Suite 400, Alexandria, VA 22314-1774 USA or donoghue@flightsafety.org.

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OUR Perspective

Among the challenges of writing and producing a publication for a global market is, first, to make that publication fit the market, speaking from a global perspective, presenting global news. That, we at Flight Safety Foundation believe, is our mission and our obligation.

The second challenge is to deal with charges that the publication has a regional bias, dominated by information from and for that region. Those two issues have been part of my life for more than 31 years now, first with an airline business publication, and now with *AeroSafety World*.

That regional bias charge starts easily enough; just note the location of the publication's editorial office and, presto, you're there. Some publications have tried "neutral" sites as editorial headquarters, yet still get tarred with that regional brush, just a different region. There's no way to avoid this part of the problem.

The amount of information coming from any region alters the reporting balance. For all of my experience, that flow of information was and remains heavily influenced by the fact that still, in 2010, the largest air transport market is North America, with 31.1 percent of both the passenger and revenue passenger kilometers (RPKs) shares of the world market, according to *Air Transport World* magazine. Rapidly rising and soon to overtake North America is the Asia/Pacific market, with more than 28 percent of world passengers and RPKs, and Europe is nearly level with more than 27 percent of passengers and RPKs. In the corporate aviation market, the overwhelming majority remains in North America, but with a shrinking share.

This nearly balanced airline traffic flow is a recent development; North America primarily, followed by Europe, used to dominate, and therefore information systems in those areas were developed by the industry to feed the need to know what is going on. Those systems are not yet fully developed in Asia/Pacific, and the consequence of this unbalanced information heritage is that there simply is more information being put out by entities in the more mature markets.

In addition, the preeminent aviation regulators and safety panels were and remain in North America and Europe, with Australia coming up strong. For the rest of the world, and especially the parts that need it the most, there is precious little safety information coming out, and even though accidents may be numerous there, reports on the accidents are either insubstantial or totally absent.

Finally, there is the issue of language: We're getting better at this, but we are limited in what we can read that is produced elsewhere in the world if it isn't in English.

We are concerned about this issue: In our recent reader survey, we asked what word best describes *ASW's* coverage of aviation industry safety. We were gratified that 74.3 percent of 845 readers participating in the study said "global." Some 16.8 percent said we have a North American flavor, and 3.8 percent said European.

Then we ran a crosstab against the location of people giving us these answers. Of that group who answered "global," 34.5 percent are North America-based, but 28.2 percent are from Europe, followed by 10 percent from Australia. Of the group who believe *ASW* has a North American perspective, 41.7 percent are from Europe and 29.5 percent are from North America. Some 45.5 percent of the group who said we have a European bias are from Europe. Go figure.

Be assured that we are striving to reach a 100 percent "global" response.

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

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 1,075 individuals and member organizations in 130 countries.

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OCT. 10 ➤ Aviation Leaders Forum on Airlines and Airports Winter Operations. Keilir Aviation Academy. Keflavik Airport, Iceland. <conferences@keilir.net>, <bit.ly/nlM0jw>, +354 578 4000.

OCT. 13–14 ➤ Managing Communications Following an Aircraft Accident or Incident. U.S. National Transportation Safety Board and Airports Council International–North America. Ashburn, Virginia, U.S. <TrainingCenter@ntsb.gov>, +1 571.223.3900.

OCT. 18–19 ➤ Part 145 Maintenance Organization Approvals. Avisa/CAAi. Abu Dhabi, United Arab Emirates. <www.avisa-ltd.com/training>, +44 (0)845 0344477.

OCT. 18–20 ➤ SMS II. MITRE Aviation Institute. McLean, Virginia, U.S. Mary Beth Wigger, <mbwigger@mitre.org>, <www.mitremai.org>, +1 703.983.5617.

OCT. 21 ➤ SMS Audit. MITRE Aviation Institute. McLean, Virginia, U.S. Mary Beth Wigger, <mbwigger@mitre.org>, <www.mitremai.org>, +1 703.983.5617.

OCT. 24–28 ➤ Accident and Incident Investigation. ScandiAvia. Stockholm. Morten Kjellesvig, <morten@scandiavia.net>, <www.scandiavia.net/index.php/web/index_kurs/C7>, +47 91 18 41 82 (mobile).

OCT. 24–28 ➤ Helicopter Accident Investigation. Southern California Safety Institute. San Pedro, California, U.S. <registrar@scsi-inc.com>, <www.scsi-inc.com/HAI.php>, 800.545.3766; +1 310.517.8844, ext. 104.

OCT. 25–27 ➤ Safeskies Conference. Safeskies Australia. Canberra, Australian Capital Territory, Australia. <office@safeskiesaustralia.org>, <www.safeskies2011.com.au/registration/?IntCatId=38>, +61 2 6162 1822.

OCT. 27 ➤ Laser Illumination of Aircraft: A Growing Threat. Air Line Pilots Association, International, and Air Transport Association. Washington, D.C. <laserconference.alpa.org>, +1 703.689.2270.

OCT. 31–NOV. 3 ➤ 64th annual International Air Safety Seminar. Flight Safety Foundation. Singapore. Namratha Apparao, <apparao@flightsafety.org>, <flightsafety.org/aviation-safety-seminars/international-air-safety-seminar>, +1 703.739.6700, ext. 101.

OCT. 31–NOV. 2 ➤ Runway Safety Summit. American Association of Airport Executives. Phoenix. <AAAEMeetings@aaae.org>, <www.aaae.org/meetings/meetings_calendar/mtgdetails.cfm?Meeting_ID=111112>, +1 703.824.0500.

OCT. 31–NOV. 3 ➤ Incident Investigation/Analysis. University of Southern California Viterbi School of Engineering. Los Angeles. Thomas Anthony, <aviation@usc.edu>, <viterbi.usc.edu/aviation/courses/iia.htm>, +1 310.342.1349.

NOV. 1–3 ➤ European Cabin Safety Conference. $(L/D)_{max}$ Aviation Safety Group. Frankfurt, Germany. Chrissy Kelley, <info@ldmaxaviation.com>, <www.ldmaxaviation.com>, +1 805.285.3629.

NOV. 7–9 ➤ Flight Data Analysis. Southern California Safety Institute. San Pedro, California, U.S. <registrar@scsi-inc.com>, <www.scsi-inc.com/FDA.php>, 800.545.3766; +1 310.517.8844, ext. 104.

NOV. 7–9 ➤ Latin America and Caribbean Conference. Civil Air Navigation Services Organisation. Cancun, Mexico. Anouk Achterhuis, <anouk.achterhuis@canso.org>, <www.canso.org/lacconference2011>, +31 (0)23 568 5930.

NOV. 8–9 ➤ Sleep Apnea and Multi-Modal Transportation Conference. American Sleep Apnea Association. Baltimore. Ed Grandi, <egrandi@sleepapnea.org>, <www.samtc2011.org>, 888.293.3650, ext. 4.

NOV. 8–9 ➤ International Helicopter Safety Symposium. International Helicopter Safety Team. Fort Worth, Texas, U.S. <bit.ly/pYSM2i>.

NOV. 8–11 ➤ Aircraft Fire and Explosion in Investigation, Vulnerability and Protection Against Accidents, Combat and Terrorist Attacks. BlazeTech. Woburn, Massachusetts, U.S. Albert Moussa, <amoussa@blazetech.com>, <www.blazetech.com/firecourse.html>, +1 781.759.0700.

NOV. 15–19 ➤ Gas Turbine Engine Accident Investigation. University of Southern California Viterbi School of Engineering. Los Angeles. Thomas Anthony, <aviation@usc.edu>, <viterbi.usc.edu/aviation/courses/gtai.htm>, +1 310.342.1349.

NOV. 22–24 ➤ Aviation Safety Management Systems Three-Day Training Workshop. Webeventsolutions.com. Montreal. <www.webeventsolutions.com/aviation/sms>.

NOV. 28–29 ➤ Damage Assessment for System Safety. University of Southern California Viterbi School of Engineering. Los Angeles. Thomas Anthony, <aviation@usc.edu>, <viterbi.usc.edu/aviation/courses/dass.htm>, +1 310.342.1349.

DEC. 1–2 ➤ Aviation Safety Management Systems Overview Workshop. ATC Vantage. Tampa, Florida, U.S. Theresa McCormick, <info@atcvantage.com>, <www.atcvantage.com/sms-workshop.html>, +1 727.410.4759.

DEC. 5–16 ➤ Aircraft Accident Investigation. University of Southern California Viterbi School of Engineering. Los Angeles. Thomas Anthony, <aviation@usc.edu>, <viterbi.usc.edu/aviation/courses/aai.htm>, +1 310.342.1349.

DEC. 5–9 ➤ SMS Principles. MITRE Aviation Institute. McLean, Virginia, U.S. Mary Beth Wigger, <mbwigger@mitre.org>, <www.mitremai.org>, +1 703.983.5617.

DEC. 5–14 ➤ SMS Theory and Application. MITRE Aviation Institute. McLean, Virginia, U.S. Mary Beth Wigger, <mbwigger@mitre.org>, <www.mitremai.org>, +1 703.983.5617.

DEC. 13–15 ➤ Human Factors Analysis and Classification System Workshop. HFACS Inc. Las Vegas. <dnlmccn@yahoo.com>, <hfacs.com/store/hfacshfix-workshop-las-vegas-nv>, 800 320.0833.

DEC. 19–21 ➤ Threat and Error Management Development. University of Southern California Viterbi School of Engineering. Los Angeles. Thomas Anthony, <aviation@usc.edu>, <viterbi.usc.edu/aviation/courses/tem.htm>, +1 310.342.1349.

FEB. 7–9, 2012 ➤ Military Aircraft Accident Investigation Conference. The Boeing Co. and International Society of Air Safety Investigators. Phoenix. <www.militaryasi.webs.com>.

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. Send listings to Rick Darby at Flight Safety Foundation, 801 N. Fairfax St., Suite 400, Alexandria, VA 22314-1774 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

Warnings on NextGen Progress

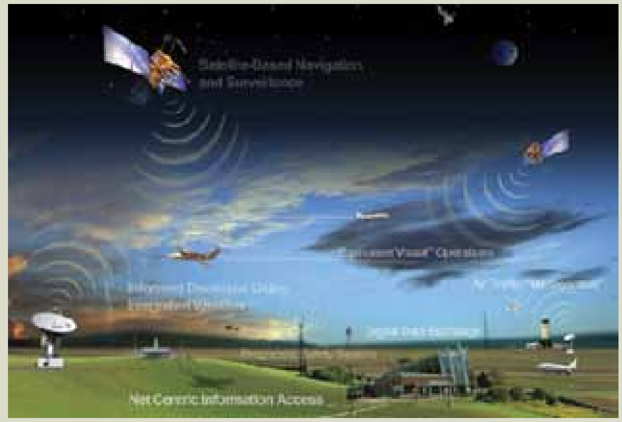
Delays by the U.S. Federal Aviation Administration (FAA) in implementing plans to modernize the National Airspace System could discourage the aviation industry from investing in the system, Calvin L. Scovel III, inspector general for the Department of Transportation (DOT), told Congress.

In testimony prepared for the House subcommittee on aviation, Scovel — whose office is responsible for oversight of all DOT programs — said the FAA faces three major challenges in implementing the Next Generation Air Transportation System (NextGen), which involves, in large part, the transition away from ground-based navigation aids in favor of a satellite-based system.

First, he cited the need for "timely execution" of key recommendations, adding, "The FAA has primarily focused its efforts on one of the most critical areas — improving airspace efficiency around major cities. However, it has not defined when users will benefit from the effort.

"As a result, industry representatives have expressed concerns over FAA's execution with this and related projects, which will ultimately make them reluctant to invest in NextGen equipage and advance NextGen at key locations."

The delays are likely to continue, Scovel said, because the FAA "has not made critical, longer-term design decisions on NextGen ground and aircraft systems."



U.S. Federal Aviation Administration

He said the FAA also faces major challenges in the resolution of technical and program management problems with the en route automation modernization (ERAM) program and the agency's management of program costs and schedules involving NextGen transformational programs.

Scovel said that, to advance NextGen and protect taxpayer interests, the FAA should emphasize three management areas: NextGen budget priorities and performance goals, problems with ERAM and "an integrated master schedule for all NextGen programs."

Global Reporting System

The European Commission (EC) and the International Civil Aviation Organization (ICAO) have approved the use of a common taxonomy for reporting aviation accidents and incidents worldwide and a single repository for storing all accident data.

The agreement calls for ICAO to encourage its 190 member states to use the European Coordination Centre for Accident and Incident Reporting Systems (ECCAIRS), which was developed by the EC Joint Research Centre.

The EC will promote the use of the ICAO taxonomy in reporting and exchanging information about accidents and incidents.

"The availability of standardized data at the global level will help to better understand the causes of aviation accidents, to better detect potentially serious safety hazards and to identify emerging safety issues before they become accidents, ultimately enhancing aviation safety everywhere," said Matthias Ruete, the EC's director general of mobility and transport.

A 2005 directive requires member states of the European Union (EU) to use ECCAIRS to collect and share information about aviation accidents and incidents. Several non-EU states also have begun using ECCAIRS as a national reporting system.

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Loss of Separation

Numerous loss of separation incidents in African airspace could have been resolved or avoided if the flight crews involved had been listening to a prescribed radio frequency, the International Federation of Air Line Pilots' Associations (IFALPA) says.

All flight crews operating in the African region are asked to "maintain a listening watch" on 126.9 MHz and follow other procedures based on in-flight broadcast procedures developed by the International Air Transport Association (IATA).

In many parts of Africa, IFALPA said in a September *Air Traffic Services Briefing Leaflet,* communications "have either not been implemented or operate well below the required reliability. This has an impact on the proper provision of air traffic services, especially the flight information service."

As a result, authorities have said that the IATA procedures should be used until communications facilities are improved.

$1.9 Million Penalty Proposed

The U.S. Federal Aviation Administration (FAA) has proposed a $1.9 million civil penalty against Colgan Air, alleging that the airline allowed flight attendants "to work on 172 revenue passenger flights when they were not properly trained to use the planes' cabin fire extinguisher system."

Some 84 new flight attendants worked on flights in Bombardier Dash 8-Q400 twin turboprop airplanes in November 2009, the FAA said, adding that the flights came after the agency had told Colgan — a Pinnacle Airlines subsidiary based in Manassas, Virginia — that the flight attendants had not undergone training in the use of the Q400's fire extinguishers. Instead, they had been trained in the operation of a different type of fire extinguisher, which is used in Colgan Saab 340s, the FAA said.

"The airlines have to properly train crewmembers on the use of emergency equipment," said FAA Administrator Randy Babbitt. "The flight attendants' primary responsibility is to know exactly how to handle emergency situations, and they can't carry out that responsibility if they're not properly trained."

Wikimedia

In a separate matter, the FAA has proposed a $1.1 million civil penalty against Aviation Technical Services (ATS), which the FAA says made improper repairs to 44 Boeing 737-300s operated by Southwest Airlines.

The FAA says ATS, based in Everett, Washington, U.S., "failed to accomplish all the work required by three FAA airworthiness directives calling for five repetitive inspections and a one-time inspection to find and repair fatigue cracks in the fuselage skins" of the airplanes.

"After the inspections, ATS allegedly failed to install fasteners in all the rivet holes within the time specified for the task."

The airplanes were returned to service between Dec. 1, 2006, and Sept. 18, 2009, the FAA said.

The FAA also proposed a $2.4 million civil penalty against Cessna Aircraft for allegedly failing to comply with its own quality control system in manufacturing the wings on a Cessna Corvalis, a high-performance, four-seat, general aviation airplane.

The FAA's action followed separation of carbon composite parts from a wing during a test flight in December 2010. The FAA said the separation occurred because high humidity in Cessna's Chihuahua, Mexico, factory "prevented the bonded materials from curing properly."

All three companies were given 30 days after receiving FAA enforcement letters to respond to the allegations.

Pilot Forecast for Asia

The Asia Pacific region will require hundreds of thousands of new pilots and maintenance technicians to support the modernization of existing air carrier fleets and growth in air travel in the next 20 years, according to projections by The Boeing Co.

Boeing projects that 182,300 new pilots and 247,700 new technicians will be required through 2030, most of them in China.

"We're already beginning to see some delays and operational disruptions due to a shortage of pilots," said Roei Ganzarski, chief customer officer for Boeing Flight Services. "To ensure the success of our industry as travel demand grows, it is critical that we continue to foster a talent pipeline of capable and well trained aviation personnel."

Ganzarski said the aviation industry must "make a concentrated effort to get younger generations excited about careers in aviation. We are competing for talent with alluring high-tech companies, and we need to do a better job showcasing our industry as a global, technological, multi-faceted environment where individuals from all backgrounds and disciplines can make a significant impact."

According to Boeing's projections, China will need 72,700 pilots and 108,300 maintenance technicians between now and 2030, North East Asia will need 20,800 pilots and 30,200 technicians, and South East Asia will require 47,100 pilots and 60,600 technicians. In addition, Oceania will need 13,600 pilots and 15,600 technicians, and South West Asia will need 28,100 pilots and 32,700 technicians.

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Ice-Detection Rule


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Scheduled airlines in the United States are being required to install ice-detection equipment in their existing aircraft or to revise flight manuals to include information on when crews should activate ice-protection systems.

A new rule from the Federal Aviation Administration (FAA) requires that, if an aircraft is equipped with an ice-detection system, the system must alert the crew when activation is required. Under the rule, the system may either activate ice protection automatically or alert the pilots so they may activate it manually.

The rule also says that, if an aircraft does not have ice-detection equipment, the crew must activate the ice-protection system "based on cues listed in their airplane's flight manual during climb and descent, and at the first sign of icing when at cruising altitude."

The rule applies to aircraft weighing less than 60,000 lb (27,216 kg). The FAA said that studies have found that these aircraft are "more affected by undetected icing or late activation of the ice-protection system." In addition, larger commercial aircraft already are required to be equipped with ice-detection equipment.

New Rules


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Australian aviation maintenance organizations have begun obtaining approval to operate under a new set of rules under Part 145 of the Civil Aviation Safety Regulations, introduced in June 2011.

Three organizations have completed the transition to the new regulations, and a total of 250 are expected to complete the transition by June 2013, the Civil Aviation Safety Agency (CASA) says.

John McCormick, CASA director of aviation safety, says the new regulations will enhance safety, provide for increased flexibility and conform to international practices.

"The regulations enhance safety because they introduce requirements for safety management systems and human factors training into the maintenance sector for the first time," McCormick says. "The new rules are also clearer, which will improve compliance with safety standards."

Mechanical Failures Cited

Mechanical failure has been the most common cause of crashes in the Gulf of Mexico of helicopters involved in oil and gas production, according to a study by researchers at the Johns Hopkins University Center for Injury Research and Policy.

The study, published in the September issue of *Aviation, Space and Environmental Medicine*, found that 178 crashes involving oil and gas production helicopters in the Gulf were recorded by the U.S. National Transportation Safety Board (NTSB) from 1983 through 2009. The crashes caused 139 fatalities.

Mechanical failure was cited as the most common cause — in 38 percent of the crashes. Bad weather was the second-most common, cited as the cause of 16 percent of the crashes. Pilot error was a "major contributor" in 47 percent, "with poor decision making the most prevalent error," the study said.

Fifteen of the 178 helicopters sank after crashes or emergency landings in Gulf waters because flotation devices were not activated, the report said.

The study found an average of 8.2 crashes per year from 2000 through 2009, compared with an average of 5.6 per year from 1983 through 1999. However, the study found that the number of crashes each year decreased after 2007.

Susan P. Baker, the lead author of the report on the study, said that, although the most recent data are encouraging, it is too soon to tell whether they represent "a temporary statistical blip or the beginning of a positive trend."


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Oxygen Mask Recommendations

The U.S. National Transportation Safety Board (NTSB), citing a fatal 2010 fire aboard a United Parcel Service (UPS) Boeing 747-400F, says operators should be required to install full-face oxygen masks on many commercial aircraft.

The NTSB said, in recommendations to the U.S. Federal Aviation Administration (FAA), that the action should be required on aircraft used in Federal Aviation Regulations Part 121 air carrier, 135 on-demand and 91 Subpart K fractional ownership operations.

A related recommendation called on the FAA to require operators of those aircraft to include, in initial and recurrent training, "tactile, hands-on training on the use of operable oxygen mask/goggle sets, including the use of the regulator's emergency selector and the venting of the smoke goggles" and aircraft-specific training on cockpit communications while oxygen masks are in use.

The NTSB cited the Sept. 3, 2010 crash of the UPS 747 as the two-member crew attempted to return to Dubai International Airport after a "FIRE MAIN DECK" warning illuminated at 32,000 ft, about 22 minutes after departure. Both crewmembers were killed, and the airplane was destroyed by the impact and subsequent fire.

The United Arab Emirates General Civil Aviation Authority is continuing its investigation, but the NTSB said that preliminary findings prompted the recommendations.

Simulations conducted during the accident investigation at UPS and Boeing training facilities showed that pilots had difficulty donning oxygen mask/goggle sets. Participants said the full-face oxygen mask was easier and faster to don and to use, the NTSB said.

Camel Scan

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Australian pilots are being recruited for what the government calls a key role in managing the country's feral camel population.

Pilots of aircraft operating in outback areas where camels are common should note their camel sightings and enter the information into an online database. The information should be entered into the database on the CamelScan Web page at <feralscan.org.au/camelscan/default.aspx>. The data will be used to aid in efforts to manage Australia's more than 1 million camels.

Feral camels are considered pests responsible for more than $10 million in damage every year, including damage to airstrips and aircraft in remote areas.

In Other News …

The U.S. Federal Aviation Administration (FAA) has approved Boeing's design of the 787 **Dreamliner** and issued a production certificate to allow the company to proceed with manufacturing. In a related move, the European Aviation Safety Agency issued a validation of the FAA type certificate. … More than 200 participants at a European Commission workshop have endorsed a call for Eurocontrol to develop a master plan for integrating **unmanned aircraft systems** into European airspace. … The U.S. Federal Aviation Administration has introduced **airport surface detection equipment, model X (ASDE-X)** at 35 major U.S. airports. ASDE-X is a surface surveillance system designed to identify ground traffic to air traffic control.

© Reuters/Navesh Chitrakar

Police personnel in Nepal surround the wreckage of a Buddha Air Beechcraft 1900, which crashed Sept. 25 during approach to Kathmandu-Tribhuvan Airport after flying foreign tourists around Mount Everest. All 16 passengers and three crewmembers were killed.

Compiled and edited by Linda Werfelman.


"Every aircraft that's been arrested has flown away."
- Rick Marinelli, FAA Manager, Airport Engineering, Oct. 2010
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Keys to a Safe Arrival

BY JAMES M. BURIN

Foundation introduces new approach-and-landing accident reduction tool.

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Touching down on the runway centerline helps ensure an uneventful landing.

Flight Safety Foundation (FSF) has developed a new tool to reduce the risk of approach-and-landing accidents, particularly those involving runway excursions. The latest product is a set of safe-landing guidelines that are intended to be used by aircraft operators to enhance existing standard operating procedures.

The Foundation began its approach-and-landing accident reduction (ALAR) effort in 1998 with the release of a report titled "Killers in Aviation."[1] This was followed in 2001 by the introduction of the *ALAR Tool Kit*, a CD-based product that includes pilot briefing notes, videos, presentations, risk-awareness checklists and other material designed to prevent approach-and-landing accidents. The Foundation completed a major update of the tool kit in 2010.[2]

More than 40,000 *ALAR Tool Kits* have been distributed worldwide, and the Foundation's CFIT and Approach-and-Landing Action Group has conducted 35 ALAR workshops around the world to help disseminate this important information.

In 2006, several international aviation organizations asked the Foundation to conduct a study of runway safety. After a comprehensive analysis of runway safety data, the Foundation determined that runway excursions, including overruns and veer-offs, pose a greater risk than other types of runway-related accidents. The data showed that one of every three turbojet airplane accidents and one of every four turboprop accidents is a runway excursion.

Because of the significance of these findings, the Foundation focused its attention on runway excursions. This effort culminated in 2009 with the publication of a report titled "Reducing the Risk of Runway Excursions," which addresses the high-risk areas of overruns and veer-offs, and provides specific tools to reduce the risks.[3]

The tools for reducing runway-excursion accidents are applicable for the full spectrum of the aviation community, including flight crews, management, air traffic control, airports and regulators.

Filling a Gap

The FSF runway safety initiative revealed a gap in the risk reduction tools provided by the *ALAR Tool Kit* — the landing itself. To fill the gap, the *Safe Landing Guidelines* (p. 16) were developed by the Foundation in conjunction with a team of experts that included representatives of aircraft manufacturers, seasoned airline pilots with training and check airman experience, aviation safety specialists and corporate aircraft operators, all with extensive backgrounds in the Foundation's ALAR effort.

The first thing to notice when looking at the guidelines is the name itself — *guidelines*. They are not rules or regulations. They are data-driven guidelines that address the key aspects of conducting a safe landing.

Taking a closer look at the guidelines, the first note is important. Data have shown that the risk of an approach-and-landing accident increases if any one of the guidelines is not met. Even more important, the overall risk of an accident is increased greatly if more than one guideline is not met. Some combinations of elements are highly conducive to a runway excursion, such as landing long and fast, or landing with a tail wind on a runway contaminated with standing water, snow, slush or ice.

The guidelines start with the basics — and number one is to fly a stabilized approach. As noted in both the Foundation's ALAR work and its runway safety initiative, this is the cornerstone of a safe approach and landing. The recommended elements of a stabilized approach developed by the ALAR Task Force have been widely adopted and adapted by aircraft operators.

The next guideline is to cross the runway threshold at 50 ft. For every 10 ft above that height, the landing distance is increased by 200 ft (61 m).

Closely related to threshold crossing height is the next guideline, which addresses speed. Acceptable airspeeds during a stabilized approach range from not less than V_{REF}, the reference landing speed, to not more than V_{REF} plus 20 kt. The *Safe Landing Guidelines* recommend that this range be narrowed to not less than V_{REF} and not more than V_{REF} plus 10 kt by the time the aircraft arrives over the runway threshold.

FLIGHT SAFETY FOUNDATION

Safe Landing Guidelines

The risk of an approach-and-landing accident is increased if any of the following guidelines is not met. If more than one guideline is not met, the overall risk is greatly increased.

1. Fly a stabilized approach.[1]
2. Height at threshold crossing is 50 ft.
3. Speed at threshold crossing is not more than V_{REF} + 10 kt indicated airspeed and not less than V_{REF}.
4. Tail wind is no more than 10 kt for a non-contaminated runway, no more than 0 kt for a contaminated runway.
5. Touch down on runway centerline at the touchdown aim point.[2]
6. After touchdown, promptly transition to the desired deceleration configuration:
   —Brakes
   —Spoilers/speed brakes
   —Thrust reversers or equivalent (e.g., lift dump)
   Note: Once thrust reversers have been activated, a go-around is no longer an option.
7. Speed is less than 80 kt with 2,000 ft of runway remaining.

Notes

1. The FSF Approach-and-Landing Accident Reduction (ALAR) Task Force developed the following recommended elements of a stabilized approach:

   All flights must be stabilized by 1,000 ft above airport elevation in instrument meteorological conditions (IMC) and by 500 ft above airport elevation in visual meteorological conditions (VMC). An approach is stabilized when all of the following criteria are met:

   - The aircraft is on the correct flight path.
   - Only small changes in heading/pitch are required to maintain the correct flight path.
   - The aircraft speed is not more than V_{REF} + 20 kt indicated airspeed and not less than V_{REF}.
   - The aircraft is in the correct landing configuration.
   - Sink rate is no greater than 1,000 fpm; if an approach requires a sink rate greater than 1,000 fpm, a special briefing should be conducted.
   - Power setting is appropriate for the aircraft configuration and is not below the minimum power for approach as defined in the aircraft operating manual.
   - All briefings and checklists have been conducted.
   - Specific types of approaches are stabilized if they also fulfill the following: instrument landing system (ILS) approaches must be flown within one dot of the glideslope and localizer; during a circling approach, wings should be level on final when the aircraft reaches 300 ft above airport elevation.
   - Unique approach procedures or abnormal conditions requiring a deviation from the above elements of a stabilized approach require a special briefing.

   An approach that becomes unstabilized below 1,000 ft above airport elevation in IMC or below 500 ft above airport elevation in VMC requires an immediate go-around.

2. *Touchdown aim point* is defined by the U.S. Federal Aviation Administration as 1,000 ft from the runway threshold. The International Civil Aviation Organization defines *touchdown aim point* in reference to the available landing area, as follows:

Available landing area	< 800 m	800–1,200 m	1,200–2,400 m	> 2,400 m
Touchdown aim point	150 m	250 m	300 m	400 m

   Touchdown aim point markings are 150-ft-long white rectangular stripes, one on each side of the runway centerline, that begin at the distances indicated above. The width of the aim-point markings varies with the width of the runway.

For every 10 kt above V_{REF}, the landing distance is increased by 20 percent. Thus, speed is a very important element of a safe landing, and being fast greatly increases the risk of a runway excursion.

Combination to Avoid

The next guideline addresses allowable tail wind. It recommends a maximum acceptable tail wind component of 10 kt. Moreover, as mentioned earlier, data show that tail winds become a greater risk when combined with contaminated runways. This is why the guidelines recommend that no landing should be attempted with any amount of tail wind when the runway is contaminated.

Exactly where the aircraft should touch down on the runway to minimize the risk of an excursion is the topic of the next guideline. In the United States, most runways used by air carrier and corporate operators, especially runways served by a precision approach, have touchdown aim point markings — a broad white stripe on each side of the runway centerline — 1,000 ft from the runway threshold. The aircraft should touch down on the runway centerline and at the touchdown aim point.

The International Civil Aviation Organization (ICAO) prescribes a more complex formula for touchdown aim points, based on the runway distance available for landing. For example, if the available landing distance is less than 800 m (2,625 ft), the touchdown aim point markings are placed 150 m (492 ft) down the runway. Runways providing a landing distance of more than 2,400 m (7,874 ft) have their aim point markings at 400 m (1,312 ft). ICAO also has set touchdown aim point ranges for intermediate landing distances.

The next guideline provides information on the process of slowing and stopping the aircraft. The order in which the aircraft's deceleration devices — wheel brakes, spoilers/speed brakes and thrust reversers (or their equivalent) — are deployed may vary from the order shown by the guideline, depending on the manufacturer's recommended procedure for the specific aircraft.

An important note that accompanies this guideline is that once thrust reversers or their equivalent (e.g., a lift-dump system) have been activated, going around is no longer an option, and the flight crew is committed to land (*ASW*, 9/11, p. 36).

Finally, the guidelines recommend that the aircraft be slowed to less than 80 kt by the time it reaches the point on the runway where only 2,000 ft (610 m) of pavement remain.

Grist for an SOP

The *Safe Landing Guidelines* tie together the Foundation's 20 years of ALAR experience and its recent work on preventing runway excursions. They provide concise, data-based information on what needs to be done to reduce the risk of a runway excursion.

They are intended to be used as their title suggests — as guidelines. The Foundation is not advocating that the guidelines be copied and handed out to flight crews. We do recommend that they be used by aircraft operators, in conjunction with information from aircraft manufacturers, to create their own rules and policies.

Every operator should have a standard operating procedure (SOP) that addresses this high-risk phase of flight, and every operator should monitor its operational data to determine the effectiveness of the SOP.

It is hoped that these guidelines will assist operational personnel in reducing the risk of approach accidents and runway excursions, and thus enable the Foundation to achieve its goal of making flying safer by reducing the risk of an accident.

James M. Burin is director of technical programs for Flight Safety Foundation.

Notes

1. The report is included in the *ALAR Tool Kit Update* and is available on the FSF website <flightsafety.org>.
2. The *ALAR Tool Kit Update* is available for purchase from FSF at <flightsafety.org>.
3. The report is available at <flightsafety.org>.

Once thrust reversers have been activated, going around is no longer an option, and the flight crew is committed to land.

An error at the factory was responsible for an area of thin fuselage skin that allowed the fuselage of an American Airlines Boeing 757 to rupture, tearing an 18-in by 7-in (46-cm by 18-cm) hole over the forward left passenger door and causing a rapid decompression, the U.S. National Transportation Safety Board (NTSB) says.[1]

The Oct. 26, 2010, decompression prompted an emergency landing at Miami International Airport. None of the 160 people in the airplane was injured.

The accident was one of several recent instances in which an airplane fuselage ruptured, causing a rapid decompression. The events prompted the NTSB to convene a public forum in late September to examine issues associated with aircraft fuselage structural integrity — the first of several sessions designed to provide a closer look at situations associated with recent accidents.

In its final report on the Miami accident, the NTSB noted fatigue cracking in the fuselage crown skin, where the rupture occurred, "along the lower longitudinal step of the chemically milled pocket just above the stringer S-4L (left) lap joint." The fatigue cracks began at multiple locations on the

An area of the fuselage that didn't meet Boeing's thickness specifications is blamed for a 757's rapid decompression.

BY LINDA WERFELMAN

THIN SKINNED

© Kazim Alikhan/Airliners.net

Milling Process

The crown skin panel that ruptured on the accident airplane is unique among the skin panels on Boeing 757s in that it is manufactured in a single-step chemical milling process that forms waffle-like pockets.[1]

The U.S. National Transportation Safety Board said in its final report on the accident that, at the time the panel was manufactured, standard procedures called for the skin panels to be "stretch-formed for contour before being masked, hand scribed, peeled and placed on a rack."

The rack then was dipped vertically into a chemical bath several times "and measurements of select pocket thicknesses [were] taken each time it was removed and rinsed," the report said.

"Once the specified amount of material was removed, the panel would have been final-rinsed and inspected. During the final inspection, all pocket thicknesses would be checked. The typical chem-mill rate achieved is about 0.001 in [0.025 mm] per minute," the report said.

— LW

Note

1. The other fuselage skin panels are manufactured in a multi-step process in which additional chemical milling smooths the edges of the pockets.

interior surface of the skin and spread through the skin to the exterior surface.

Although Boeing specified that the skin in that area of the fuselage must be 0.039 in (0.99 mm) thick, investigators measured the thickness at 0.035 in (0.89 mm) to 0.037 in (0.94 mm), the report said (see "Milling Process").

The report added that "calculations from an NTSB study of the fatigue striation density and propagation in the fatigue region indicate that it would take an average of 3,709 total cycles for a crack to grow through skin with 0.035-in thickness and an average of 917 cycles for a crack to grow from a minimally detectable size and penetrate a 0.035-in skin thickness."

The accident airplane was manufactured and delivered to American Airlines in 1990, and, when the accident occurred, it had been flown about 63,010 hours and had accumulated 22,450 cycles. Specific manufacturing records were not available for the panel, but the NTSB said that, "based on the airplane delivery date and estimated manufacturing flow," it probably was manufactured early in 1990.

This 757 is one of several airplanes to experience a fuselage rupture above a forward passenger door, accompanied by a rapid decompression.

The decompression occurred about 16 minutes after departure from Miami, as the 757 climbed through 32,000 ft en route to Boston Logan International Airport. The crew conducted an emergency descent and returned to land at Miami, where a preliminary inspection revealed the rupture in the fuselage crown skin. Most of the ruptured skin — the forward 13-in by 7-in (33-cm by 18-cm) section — was still attached to the airplane, but the aft 5-in (13-cm) by 7-in section had separated from the airplane and was not recovered.

Inspections

At the time of the accident, the area of the airplane where the fatigue cracking and skin rupture occurred was not subject to specific inspections, service bulletins or airworthiness directives, the NTSB said.

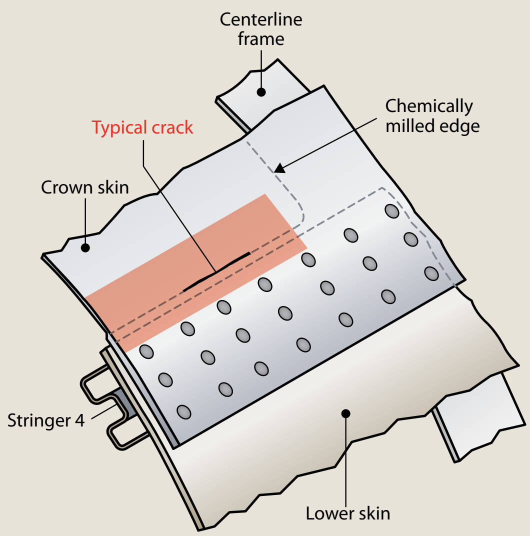
After the accident, however, Boeing and the U.S. Federal Aviation Administration (FAA) took separate actions calling for new inspections:

- On Nov. 22, 2010, Boeing issued Service Bulletin (SB) 757-53-0097, calling for repetitive external inspections, about every 300 flight hours, for cracks in the fuselage skin in the area of the fuselage rupture in the accident airplane.
- On Jan. 10, 2011, with the issuance of Airworthiness Directive (AD) 2011-01-15, the FAA mandated the inspections recommended in the service bulletin.

The NTSB's investigation revealed two incidents of fatigue cracking in the fuselage skin in patterns similar to those in the accident airplane. Both incidents involved 757s — one operated by American Airlines and the second by United Airlines. In each incident, the NTSB said, the airplane had "nonconforming thickness at the base of the chemically milled step at the stringer location specified in the SB."

In all three cases, manufacturing records were not available, so the NTSB was unable to identify a cause of the "less-than-manufacturer-specified" fuselage skin thickness. There were no requirements that the records be retained, the NTSB said.

Area of Cracking in Boeing 757 Fuselage



Note: Cracks were found above the left forward passenger door.

Source: U.S. National Transportation Safety Board

Figure 1

In addition to these instances of fuselage crown cracking, about six weeks before the Miami decompression, United Airlines personnel found a 10.75 in (27.31 cm) crack in the upper crown skin of a 757, "after reports of a whistling noise," the NTSB said. About six weeks after the decompression, American Airlines personnel — in the process of conducting an inspection to comply with the Boeing SB — found indications of cracking in the crown skin of another airplane, the NTSB added.

Gaps and Fatigue Cracks

Another similar decompression occurred several months later. On April 1, 2011, a Southwest Airlines 737-300 experienced a rapid decompression at 34,000 ft, while en route to Sacramento, California, U.S., after takeoff from Phoenix. After an emergency descent, the crew diverted to Yuma, Arizona, where a preliminary inspection revealed a 5-ft by 1-ft (1.5-m by 0.3-m) hole in the fuselage crown aft of the overwing exit at the stringer 4L lap joint. One of the 122 people in the airplane received minor injuries; the others were not hurt.[2]

The NTSB is still investigating, but preliminary reports said that a laboratory examination of the part of the fuselage surrounding the rupture showed fatigue cracks "emanating from at least 42 of the 58 rivet holes connected by the fracture." The fuselage skin was the required thickness.

X-rays showed gaps "between the shank portions of several rivets and the corresponding rivet holes for many rivets associated with S-4L," the NTSB said.

The airplane had 48,740 operating hours and had completed 39,781 cycles at the time of the accident.

After the accident, Southwest inspected several other 737s and found that three of the airplanes had "crack indications in the lap joints," the NTSB said.

As a result of the accident and the subsequent 737 inspections, Boeing issued SB 737 53A1319-00, calling on owners of some 737-300s, 400s and 500s to inspect fasteners at stringers S-4R and S-4L in the area of the crown fuselage failure, to check for cracks in the lower skin of the lap joint. FAA Emergency AD 2011-08-51 mandated the inspections.

In late April, the NTSB said that, of 136 airplanes inspected worldwide, four — all with between 40,000 and 45,000 cycles — had crack indications at a single rivet and one had crack indications at two rivets.

New Regulations

About six months after the Miami accident, on April 16, 2011, U.S. Federal Aviation Regulations Part 21.137(k) took effect, requiring that records associated with the manufacturing of aircraft critical components be retained for at least 10 years.

Because so much time elapsed between the manufacture date of the crown skin panel and the accident, however, even if the regulatory requirement had been in place at the time of the accident, it would not have applied to manufacturing records for the accident airplane, the NTSB said.

Notes

1. NTSB. Accident Report no. DCA11FA004. Oct. 26, 2010.
2. NTSB. Accident report no. DCA11MA039, and related news releases.

BARS

BASIC AVIATION RISK STANDARD

FLIGHT SAFETY FOUNDATION

UPDATE

Greg Marshall, BARS Program Managing Director

It is now more than a year since the Basic Aviation Risk Standard (BARS) program kicked off in September 2010. It has steadily gained momentum, with additional BARS member organizations (BMOs) and aircraft operators (AOs) regularly joining the program.

BARS auditor training has taken place in Australia, Canada, South Africa, the United Kingdom and the United States, with the trained auditors providing services to these accredited audit companies: Aviation Compliance Solutions (Australia), ARGUS PROS (U.S.), Asset Aviation International (Australia), AvLaw (Australia), Litson & Associates (South Africa), Morten Beyer & Agnew (U.S.) and Wake QA (U.K.). The first annual repeat audit was conducted in September.

When aircraft operators register for a BARS audit, they select an accredited audit company to carry out the audit, which is conducted by two auditors over two days. Each auditor has had extensive prior audit experience and has undergone specialist training leading to accreditation as a BARS auditor. Once the audit report has been completed and corrective action plans have been established, the aircraft operator may choose to release the report for viewing by BMOs.

The report is then only viewable by personnel within the BARS program office (BPO), the auditor, the aircraft operator and the BMOs. Corrective actions do not have to be completed before the report is released; in fact, it is desirable for the report to be released as soon as possible for viewing by the BMOs. More information on the process can be obtained by contacting the BPO.

We have introduced the program across five continents. More than 90 aircraft operators from around the globe either have completed or have registered to undergo a BARS audit, and we now have seven BARS-accredited audit companies. And eight of our aviation coordinator (AVCO) training courses have been held in four countries, with courses planned during late 2011 in Phoenix; Brisbane, Australia; and Singapore.

The two-day AVCO course provides participants with an understanding of the BARS program and how it can be used by the resources industry to help identify aviation safety risks. Participants use knowledge gained to review their companies' aviation management policies and procedures and to formulate appropriate strategies to manage risks identified in day-to-day operations.

Personnel from all departments of resource-industry companies developing, monitoring and enhancing aviation safety activities can benefit from the AVCO course.

We have launched the first edition of *BARS Program Update*, a newsletter to be published every four months and circulated to all aircraft operators, audit companies and BMOs, plus other interested parties. In the first edition of the newsletter, I introduce a new member to our team — David Anderson, our new BARS audit manager — show off the ever-expanding list of aircraft operators and audit companies that have gone through BARS, introduce our BMOs and give you a brief introduction to the courses and events in the BARS program.

No Decision at DECISION HEIGHT

Citation pilots were taken off guard by a fast-moving fog bank.

© Peter Tonna/Airliners.net

BY MARK LACAGNINA

Witnesses described the weather conditions at Birmingham (England) Airport the afternoon of Nov. 19, 2010, as extremely unusual. For hours, sunshine and blue skies prevailed at the airport, with southerly winds holding a fog bank at bay to the north of the field. When the winds suddenly shifted to the north, however, the fog moved with startling rapidity over the airport.

During this time, the flight crew of a Cessna Citation 501 was conducting the instrument landing system (ILS) approach to Runway 15. Weather reports and their own observations at the beginning of the approach likely had led the pilots to expect visual conditions all the way to touchdown, according to the report by the U.K. Air Accidents Investigation Branch (AAIB).

However, the fog bank moved in the same direction and enveloped the light jet as it neared the published decision height (DH). The commander, the pilot monitoring, likely became distracted by the sudden and unexpected loss of visual references, and he neglected to make the required callout to land or go around when the aircraft reached DH, the report said.

U.K. Air Accidents Investigation Branch

The aircraft struck the glideslope antenna before hitting the ground.

The copilot, the pilot flying, became confused, and the Citation continued descending until it struck the glideslope antenna and then terrain off the right side of the runway. The commander was seriously injured, the copilot sustained minor injuries, and the aircraft was destroyed by the impact and a fire.

Organ Transfer

The Citation 501, or I/SP, usually was used by the Liverpool-based operator for corporate flights. The other two aircraft in its fleet, both Citation 550 II models, mainly were used for charter operations. Nevertheless, the 501 had been pressed into service for a charter flight, to transport a human transplant organ from Belfast, Northern Ireland, to Cambridge.

The commander, 58, had 7,200 flight hours, including 3,000 hours in type. The copilot, whose age was not specified, had 1,785 flight hours, including 735 hours in type. "The commander was experienced on the aircraft type and had flown G-VUEM [the 501] on a number of previous occasions," the report said. "The copilot had been flying the aircraft type with the operator regularly for several years but had not flown G-VUEM as frequently as their other two aircraft."

The pilots reported for duty at Liverpool Airport at 0845 local time. After positioning the aircraft to Belfast City Airport, they found that the charter flight to Cambridge no longer was necessary. Apparently by chance, however, transport of another transplant organ was required from Belfast Aldergrove Airport to Birmingham, and the crew was reassigned to make that flight.

The Citation departed from Belfast Aldergrove at 1450. Forecasts for Birmingham called for visual meteorological conditions. Nearing the airport, the crew monitored the latest automatic terminal information service broadcast, which said that the surface winds were from 160 degrees at 5 kt, visibility was 10 km (6 mi) or more, and that there were a few clouds at 700 ft.

The applicable minimum runway visibility range (RVR) for the ILS approach was 550 m (1,800 ft). The DH was 200 ft, at a decision altitude of 503 ft.

A radar controller provided vectors to help the crew establish the aircraft on the ILS approach. "On the approach, the commander sighted the airfield from some distance," the report said. "Thus, the circumstances were such that the crew could reasonably have expected to complete the approach in visual conditions."

Late Intercept

As mentioned, the copilot had limited experience in the 501. "There were a number of differences between G-VUEM and the other two aircraft, including the instruments, operation of cockpit displays and equipment, engine management and aircraft performance," the report said.

The copilot, who was in the right seat, had selected the autopilot's approach mode. The flight instruments on his panel did not include a flight director.

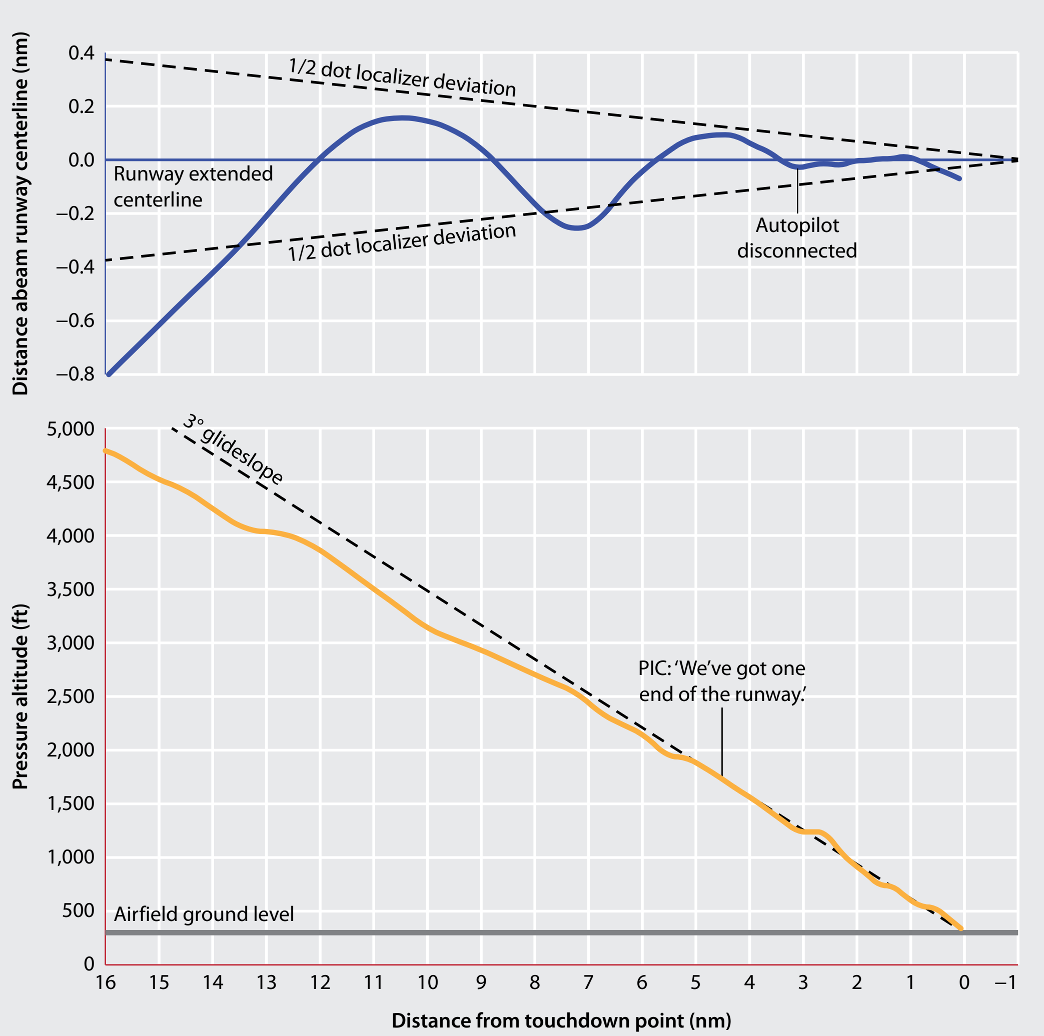
The report said that although the autopilot in the 501 was capable of conducting a coupled approach, "other pilots who had flown this aircraft advised the AAIB that to intercept and track a localizer course successfully with the autopilot engaged, the speed would need to be reduced to around 180 kt."

The pilots had calculated an approach speed of 104 kt, but recorded air traffic control (ATC) radar data showed that the Citation's groundspeed was 254 kt as it neared the 149-degree localizer course on a heading of 135 degrees, the final vector assigned by the radar controller.

Apparently because of the high speed, the aircraft flew through the localizer centerline about 12 nm (22 km) from the runway touchdown zone (Figure 1, p. 24). The autopilot then turned the aircraft to a track of 158 degrees but again failed to capture the localizer. Groundspeed was 242 kt when the Citation flew through the localizer centerline about 9 nm (17 km) from the runway touchdown zone.

The autopilot subsequently captured the glideslope, but the aircraft crossed the localizer

Citation Flight Path



Source: U.K. Air Accidents Investigation Branch

Figure 1

centerline a third time about 6 nm (11 km) from the touchdown zone. The copilot disengaged the autopilot and hand-flew the aircraft, establishing it on the localizer about 3 nm (6 km) from the runway touchdown zone. Groundspeed by then had decreased to 122 kt.

'We've Got One End'

While the Citation was bracketing the localizer course, the radar controller had broadcast an advisory that the fog bank had moved onto the final approach course for Runway 15. The controller also advised that RVR in the touchdown zone was 1,400 m (4,500 ft) and that the RVRs at both the midpoint and the end of the runway were 1,500 m (5,000 ft).

After establishing radio communication with the tower controller, the Citation crew was cleared to land and was advised that touchdown RVR had decreased to 1,100 m (3,500 ft). The aircraft was about 1,000 ft above DH when the commander replied, "We've got one end of the runway."

The report said both pilots recalled that the commander made the standard callouts at 500 ft and at 100 ft above DH. However, neither pilot remembered a callout being made at DH, per standard operating procedure (SOP).

The Citation was at DH and about 1 nm (2 km) from the runway touchdown zone when it deviated slightly to the right of the localizer centerline on a heading of 152 degrees. About 30 seconds later, at 1536, the leading edge of the left wing struck the top of the glideslope antenna, which was 15 m (49 ft) tall and adjacent to the runway touchdown zone. The impact ruptured the aircraft's left fuel tank and separated a position light from the top of the antenna, exposing live electrical cables that likely ignited fuel vapors.

The aircraft then struck soft, waterlogged ground in a wings-level attitude and slid sideways 220 m (722 ft) before coming to a stop.

Trapped in the Cockpit

The copilot evacuated through the main cabin door, on the left side of the fuselage, and sustained minor flash burns as he passed through the fire. The commander's right foot was trapped by the wreckage, and he was unable to exit the cockpit. He discharged a portable fire extinguisher around the cockpit and then donned his oxygen mask.

The tower alerted the airport fire station, which was east of Runway 15. Rescue and fire fighting (RFF) personnel at the station initially saw smoke rising above the fog to the west. Four vehicles were deployed, but the fog had become so dense that the RFF personnel had difficulty locating the accident site.

The driver of an RFF vehicle that was proceeding north on the runway saw an orange glow to the left and turned toward it. "The grass area [off the side of the runway] was soft and made access difficult, but the vehicle reached the site at 1539, and the fire crew applied foam to the left side of the aircraft," the report said.

Two other RFF vehicles reached the accident site shortly thereafter; the fourth had become bogged down in the soft ground. The copilot told the RFF personnel that the commander was still inside the burning aircraft.

"The fire was suppressed quickly," the report said. "A fireman approached the aircraft and could see that the commander was moving, so he smashed the side windows to allow air into the cockpit."

Another fireman entered the aircraft through the emergency door on the right side of the fuselage but was unable to enter the cockpit because of his bulky breathing apparatus. "However, the commander managed to free himself and crawl backward to where he could be assisted from the aircraft," the report said. "He was treated at the scene and then flown by air ambulance to a local hospital."

The RFF personnel also were able to recover the transplant organ from the cabin.

'No Perception of Time'

The report said that in the last three minutes of the Citation's approach, touchdown RVR had decreased from 1,100 m to 300 m (1,000 ft). The fog bank had not yet reached the midpoint and the end of the runway, where the RVRs remained at 1,500 m.

A pilot of an aircraft that preceded the Citation on the ILS approach told investigators that his aircraft had entered but quickly exited the fog bank as it neared DH. A pilot in another aircraft ahead of the Citation said that his aircraft appeared to be "surfing" down the sloping face of the fog bank on final approach.

Recorded ATC radar data showed that the Citation's flight path had not changed when it descended below a height of 300 ft, which indicated that the copilot had made no control inputs after the commander called "100 above" DH.

The copilot told investigators that shortly after hearing that callout, he asked the commander if he should go around. "He recalled hearing the commander say, 'No, go left,'" the report said. "He then caught a glimpse of the antenna ahead, too late to attempt to avoid it."

The commander did not recall having given any instructions to the copilot after the "100 above" callout. The report said that the aircraft likely entered the fog bank at this point, and the captain lost all external visual references.

The commander told investigators he had perceived that only a few seconds had passed between his "100 above" call and the collision with the glideslope antenna.

"The commander may have become absorbed with seeking visual reference in the unexpectedly altered conditions and thereby [was] distracted from the primary task of monitoring the approach," the report said. "He had no perception of the passage of time from the '100 above' call, believing that only a few seconds elapsed before he saw the glideslope antenna ahead of the aircraft. In fact, the elapsed time would have been around 25 seconds."

The report said that the crew's expectation of completing the approach in visual conditions and the unexpected encounter with the fog late in the approach caused a breakdown in crew coordination.

"As an aircraft gets closer to a runway, the localizer and glideslope indications become increasingly sensitive, and small corrections have a relatively large effect," the report said. "The task for the flying pilot becomes more demanding, and the role of the monitoring pilot has greater significance.

"A successful outcome relies on effective crew coordination, based on clear SOPs. The monitoring of the approach broke down in the latter stages, and the crucial [callout at DH] was missed, which led to the aircraft's descent below minimums."

The report said that the aircraft operator reviewed its SOPs after the accident and issued a crew notice requiring, in part, that all instrument approaches be conducted with the autopilot and/or the flight director engaged.

This article is based on AAIB accident report no. EW/C2010/11/02, which is available at <aaib.gov.uk/publications/bulletins/august_2011/cessna_501_citation__g_vuem.cfm>.

About 25,000 traffic-alert and collision avoidance system (TCAS) units aboard aircraft today protect lives worldwide during airline, cargo, business and government flights, including military missions, the U.S. Federal Aviation Administration (FAA) says in a recent advisory circular (AC) and technical report.[1,2] Together, the documents provide a comprehensive guide to the latest operational capabilities, limitations and requirements of TCAS II.

In explaining the evolution of TCAS hardware and its programmed logic — now up to Version 7.1 software (*ASW*, 4/09, p. 34), introduced in 2010 and seeing wider service this year — the FAA also has focused on the critical roles of pilots, air traffic controllers and operators in the effectiveness of TCAS, known internationally as the airborne collision avoidance system (ACAS II).

"TCAS II is a last-resort airborne system designed to prevent midair collisions and significantly reduce near-midair collisions between aircraft," the AC says. "It is intended to serve as a backup to visual collision avoidance, application of right-of-way rules and air traffic separation service.

Appreciating Value

BY WAYNE ROSENKRANS

Updated guidance helps flight crews and air traffic controllers to maximize the safety benefits that TCAS offers.

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"For TCAS to work as designed, immediate and correct crew response to TCAS advisories is essential. Delayed crew response or reluctance of a flight crew to adjust the aircraft's flight path as advised by TCAS due to air traffic control [ATC] clearance provisions, fear of later FAA scrutiny, or other factors could significantly decrease or negate the protection afforded by TCAS. … By not responding to a resolution advisory [RA], the flight crew effectively takes responsibility for achieving safe separation."

Flight crew confidence in the system is essential, the guidance reiterates, and should not be diminished by the fact that "certain incompatibilities between TCAS and air traffic control procedures or airspace design … exist today that will not change with Version 7.1." The AC and report explain how to ensure that flight crews maximize the protective benefits despite the few limitations, reduce the non-safety-critical alerts still generated at times, and continue to utilize voluntary and mandatory event/anomaly–reporting channels, as appropriate.[3]

"TCAS II is designed to provide collision-avoidance protection in the case of any two aircraft that are closing horizontally at any rate up to 1,200 kt and vertically up to 10,000 fpm," the report said. "Surveillance is compatible with both the ATC radar beacon system and Mode S transponders. … TCAS can simultaneously track up to 30 transponder-equipped aircraft within a nominal range of 30 nm [56 km, and] has a requirement to provide reliable surveillance out to a range of 14 nm [26 km] and in traffic densities of up to 0.3 aircraft per square nautical mile [24 aircraft within a 5-nm (9-km) radius, the highest traffic density envisioned over the next 20 years]."

The FAA recommends the installation of Version 7.1 software "as soon as practical … to ensure compatibility with international standards." With respect to pilot training, the agency considers the changes in this upgrade to be relatively transparent to flight crews, requiring a minimal information update such as operational bulletins or similar material. "The only significant change [from Version 7.0] for pilots is the change in one aural annunciation from 'adjust vertical speed, adjust' to 'level off, level off,'" the FAA said, although there are other examples (Table 1). "Version 6.04a and 7.0 units are expected to remain operating for the foreseeable future where authorized."

Version 7.1 also added reversal logic to address "the 'vertical chase with low vertical miss distance' geometry that can arise when either own aircraft or the threat [aircraft] maneuvers contrary to [its] RA in a coordinated encounter, or when an unequipped threat moves so as to thwart [the] own aircraft's RA," the report said.

Comprehensive Training

To be effective, TCAS has to be operated properly by pilots.[4] Approved training typically comprises academic study of the theory and logic, and complementary practice in responding to simulated TCAS traffic advisories (TAs) and RAs. "Many of the operational issues identified during the operation of TCAS can be traced to misunderstandings regarding the operation of TCAS, its capabilities and its limitations," the report said.

Initial and recurrent academic training are expected to explain or review the essential TCAS concepts of tau,[5] sensitivity level[6] and protected volume, and the results and limitations of each TCAS control panel selection. Regarding TCAS limitations in flight operations, for example, they typically include "some RA inhibit altitudes, certain RAs being inhibited by aircraft performance constraints, the inability to comply with an RA due to aircraft performance limitations after an engine failure, and appropriate response to RAs in limiting performance conditions, such as during heavy weight takeoff or while en route at maximum altitude for a particular weight," the report said.

Another academic element is ensuring that pilots know how TCAS may fail because of loss of data from

Examples of TCAS II Annunciation Updates by Software Version

TCAS Advisory	Version 6.04a Annunciation	Version 7.0 Annunciation	Version 7.1 Annunciation
Reduce Climb RA	Reduce Climb, Reduce Climb	Adjust Vertical Speed, Adjust	Level Off, Level Off
Reduce Descent RA	Reduce Descent, Reduce Descent	Adjust Vertical Speed, Adjust	Level Off, Level Off
Maintain Rate RA	Monitor Vertical Speed	Maintain Vertical Speed, Maintain	
Altitude Crossing, Maintain Rate RA (Climb and Descend)	Monitor Vertical Speed	Maintain Vertical Speed, Crossing Maintain	
Weakening of RA	Monitor Vertical Speed	Adjust Vertical Speed, Adjust	Level Off, Level Off

RA = resolution advisory; TCAS II = traffic-alert and collision avoidance system

Source: U.S. Federal Aviation Administration

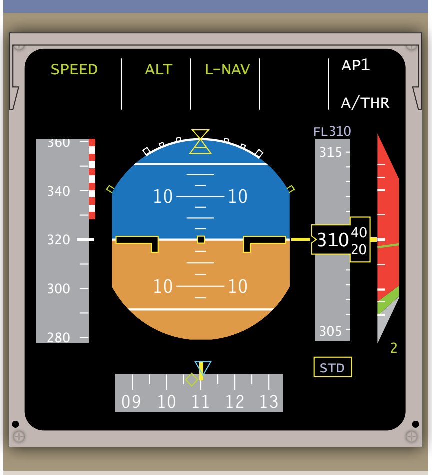
Table 1

other on-board systems, such as the inertial reference system or the attitude and heading reference system. Regarding flight maneuver training for TCAS responses, the FAA expects air carriers to provide practice in responding to corrective RAs, initial preventive RAs, maintain rate RAs, altitude crossing RAs, increase rate RAs, RA reversals, weakening RAs and multi-aircraft encounters.

Predictable Pilots

When responding to an RA, the typical excursion from the ATC-assigned altitude to satisfy the conflict should be 300 ft to 500 ft maximum. "[Vertical speed] responses should be made to avoid red arcs or outlined pitch avoidance areas [Figure 1] and, if applicable, to accurately fly to the green arc or outlined pitch guidance area," the AC said. "Evasive maneuvering must be limited to the minimum required to comply with the RA. Excessive responses to RAs are not desirable or appropriate because of other potential traffic and ATC consequences. … Deviations from rules or clearances should be kept to the minimum necessary to satisfy a TCAS RA."

TCAS Display on PFD Vertical Speed Tape



PFD = primary flight display; TCAS = traffic-alert and collision avoidance system

Note: Some airframe manufacturers now implement TCAS displays on the PFD vertical speed tape, as shown, or with pitch cues, or with both.

Source: U.S. Federal Aviation Administration

Figure 1

Unexpected pilot responses, however, have prompted many of the upgrades since Version 6.04a was finalized in 1993. In recent years, cases of flight crews failing to respond as trained to a TCAS RA — such as by taking no action, delaying action or initiating climb/descent in the wrong direction — have reached a very low level, the report said. This is attributed to the gradually improving TCAS logic and to the quality and compliance of pilot and controller training programs.

"Most cases of 'no response' to an RA can be attributed to pilots having visual contact with the intruder or being on parallel approaches to runways during VFR [visual flight rules] operations and visual separation procedures," the report said. "Wrong-direction responses, though now rarely reported, must always be avoided. … The safety benefits provided by TCAS decrease significantly when pilots do not comply with RAs as the TCAS logic expects. … In no case should a pilot maneuver opposite to a TCAS RA."

The few known cases of no response or delayed response have occurred in situations where the flight crew did not visually acquire the intruder, misidentified the intruder or lost sight of the intruder after visual acquisition. If the intruder is TCAS-equipped (Figure 2, p. 29), either no response or a delayed response by the own airplane causes the crew of the other aircraft to maneuver more than for a correct response, and also may reduce the separation. The Version 7.1 software, for example, was designed "to make the intention of the corrective vertical speed limitation, i.e., a move toward level flight, unambiguously clear," the report said.

Ongoing ATC data analysis of the few cases of improper crew behaviors produces useful explanations and training improvements. "Aircraft [crews have] been observed making vertical or horizontal maneuvers based solely on the information shown on the traffic display, without visual acquisition by the flight crew and sometimes contrary to their existing ATC clearance," the report said. "Such maneuvers may not be consistent with controller plans, can cause a significant degradation in the level of flight safety and may be contrary to a limitation contained in the TCAS airplane flight manual supplement. … Pilots sometimes deviate significantly further from their original clearance than required or desired while complying with an RA. … Data analyses and simulator trials have shown that pilots often are not aware of the RA being weakened."

Pilot responses to a stall warning, wind shear warning or ground proximity warning system take precedence over a TCAS RA, particularly when the aircraft is less than 2,500 ft above ground level, the AC said, and TCAS and associated training are designed accordingly.

The latest guidance also reminds flight crews of ATC's perspective of RAs. Specifically, the controller initially remains unaware that an RA has been issued and may not understand the pilot's RA report to ATC because of its unexpected nature and/or nonstandard phraseology. "Pilots sometimes do not report, or are slow in reporting, TCAS-related clearance deviations to the controller," the report said. "This issue has been effectively addressed by pilot and controller training programs

TCAS Traffic Display Symbols

TCAS = traffic-alert and collision avoidance system

Source: U.S. Federal Aviation Administration

Figure 2

but deserves constant attention and continual monitoring."

As the Version 7.1 software is adopted widely, air traffic controllers will see a higher incidence of unexpected level-offs during climbs and descents caused by flight crews responding to "level off, level off" RAs, according to the report. Related information currently is being incorporated into ATC training programs.

Non-Safety-Critical RAs

To reduce one of the most prevalent types of non-safety-critical RAs — sometimes called unwanted or nuisance RAs — the International Civil Aviation Organization and the FAA ask all pilots to follow the current guidance on reducing the aircraft's vertical rate when approaching their cleared altitude, particularly when there is known traffic cleared to an adjacent altitude. This means limiting vertical speed during climb or descent to 1,500 fpm when within 2,000 ft of an ATC-assigned altitude. This practice should be followed, however, only if safe, practical and compliant with the air carrier's approved operating procedures.

"Version 7.0 [or higher software] is required for operations in reduced vertical separation minimum airspace since it expands the use of [Version 6.04a] logic to higher altitudes to address the occurrence of [RAs related to high vertical rates] in the en route airspace structure," the report noted. "In spite of these improvements, RAs related to high vertical rates still occur."

As updating to Version 7.1 software proceeds, the FAA's TCAS Operational Performance Assessment program has enabled comparison of this software version's performance with that of the two previous versions still in use as permitted by regulations. The analyses of data downlinked to 21 U.S. Mode S interrogation ground sites, associated radar data and Internet pilot reports to the program have been used to develop mitigations for non-safety-critical RAs and to plan for the next generation of TCAS, called NextCAS.

The FAA's Aviation Safety Information Analysis and Sharing (ASIAS) program, working with the U.S. Commercial Aviation Safety Team, a government-industry partnership, also analyzes dozens of data sources to monitor TCAS performance (*ASW*, 8/09, p. 32). Based on the ASIAS research, the FAA has been working to address the few areas of incompatibility between TCAS and ATC procedures or airspace design.

One example of a mitigation of the most prevalent types of non-safety-critical RAs has been a project to test modifications of local ATC equipment. This would alter the conventional TCAS functionality in a specific geographic area from the ground by broadcasting a sensitivity-level command at high-altitude airports or during approaches to some closely spaced parallel runways. Other mitigations in progress aim to resolve RAs that occur despite standard 500-ft vertical separation when aircraft operating under instrument flight rules are near aircraft operating under VFR.

"TCAS RAs are frequently generated during VFR operations and visual separation procedures since the TCAS logic does not consider the horizontal and vertical separations that occur in these situations," the report said. "TCAS RAs may occur during approaches to airfields conducting VFR pattern operations. Also, altitude crossing clearances issued by a controller based on maintaining visual separation may result in RAs being issued, particularly if one … aircraft is level. Finally, nuisance RAs are often generated during visual approaches to closely spaced parallel runways; especially those separated by less than … 0.20

[nm, 0.37 km] or 0.35 nm [0.65 km] at lower altitudes."

Beyond the realm of flight crew behavior, solutions can depend on correct diagnosis of external interference or avionics problems, sometimes traceable to transponders. "Alerts where there is no traffic, or phantoms [false indications of non-existent aircraft], have been generated by improper emissions from different types of ground stations (often during equipment testing) or by faulty installation or functioning of the TCAS equipment," the report said. "The improper altitude reporting by either own or intruder aircraft has been traced to the aircraft's air data or transponder systems. These issues have been greatly reduced, and since they can be easily corrected once identified, prompt reporting of these abnormalities is important."

Operator Responsibilities

The AC recommends that operators be proactive in mitigating TCAS issues related to their specific route environment, aircraft, procedures and TCAS display and mode-control features. For example, correct timing of flight crews' selection of TA and TA/RA modes during normal flight operations positively influences safety risks of frequency congestion.

"To preclude unnecessary transponder interrogations and possible interference with ground radar surveillance systems, do not activate TCAS (TA-only or TA/RA mode) until taking the active runway for departure," the AC said. "A transponder selected to 'XPDR' or 'ON' is adequate for ATC and nearby automatic dependent surveillance–broadcast–equipped aircraft to 'see' the aircraft while taxiing on the airport surface. Following landing and clearing of the runway, de-select TCAS from TA or TA/RA mode. Select 'XPNDR' or 'ON' while taxiing to the ramp area. Upon shutdown, select 'STBY' on the transponder."

The AC also reviewed situations in which operators should consider adopting procedures for when pilots will select TA mode (see "When TA Mode Makes Sense") and for pilot decision making responsibility regarding operation of TCAS controls and RA responses.

The FAA also recommended that aircraft operators evaluate their "unusual TCAS events" and take follow-up action as necessary, and periodically assess related training, checking and maintenance programs. Reporting events voluntarily to aviation databases or when mandated for certain RAs (*ASW*, 5/11, p. 18) and near-midair collisions is vital in improving TCAS. This basic principle extends to hazardous conditions, situations or events and problems with avionics or abnormal behavior that may have been induced by other aircraft, ATC procedures, ATC equipment or other factors.

21st Century Logic

Both guidance documents indirectly explain how operators that continue to use the nearly 20-year-old Version 6.04a software would gain significant benefits by upgrading. In Version 7.0 and Version 7.1 software, for example, modifications to the radio frequency interference–limiting algorithms take into account the distributions of TCAS aircraft in relation to terminal (high-density) areas or

When TA Mode Makes Sense

The U.S. Federal Aviation Administration lists the following examples of situations in which flight crews could enhance safety by selecting the traffic advisory–only (TA) mode of their traffic-alert and collision avoidance system (TCAS) to temporarily suppress resolution advisories (RAs):

- "During takeoff toward known nearby traffic that is in visual contact and which could cause an unwanted RA during initial climb, such as a visually identified helicopter passing near the departure end of the runway. Select the TA/RA mode after the potential for an unwanted RA ceases to exist, such as after climbing above a known visual flight rules corridor;
- "In instrument or visual [meteorological] conditions [VMC] during approaches to closely spaced parallel runways;
- "In [VMC], when flying in close proximity to other aircraft;
- "At certain airports, during particular procedures, or in circumstances identified by the operator as having a significant potential for unwanted or inappropriate RAs;
- "In the event of particular in-flight failures, such as engine failure, as specified by the aircraft flight manual or operator; [and,]
- "During takeoffs or landings outside of the nominal TCAS reference performance envelope for RAs, as designated by the airplane flight manual or operator. TCAS reference performance for RAs is typically attainable during takeoffs and landings at airports within the envelope of the International Standard Atmosphere plus/minus 50 degrees F [minus 46 degrees to 10 degrees C], sea level to 5,300 ft mean sea level."

—WR

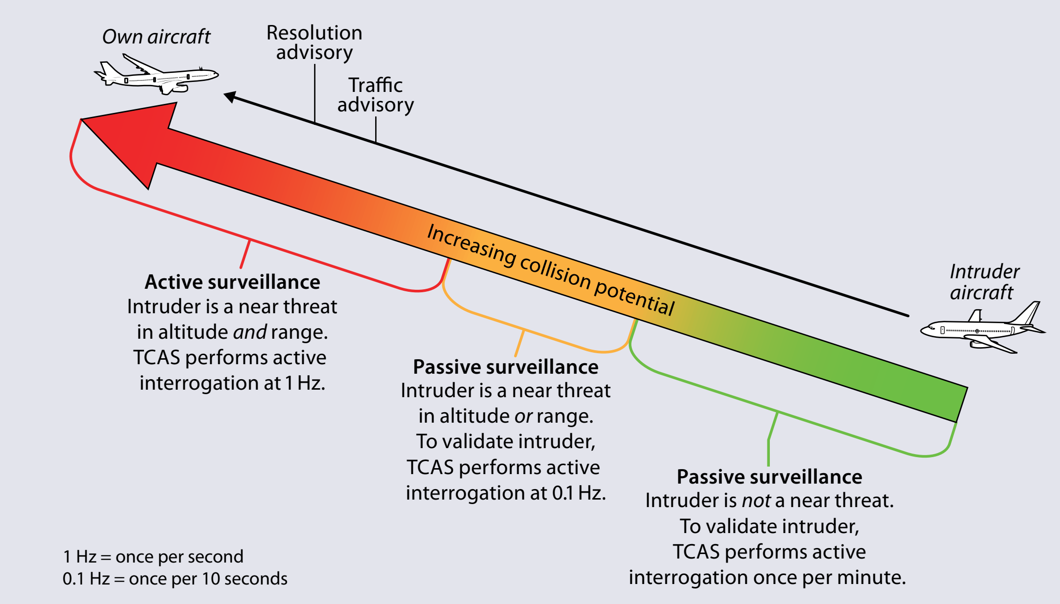
en-route areas, rather than just counting these aircraft. Other enhancements enable longer surveillance ranges for aircraft above Flight Level 180 (approximately 18,000 ft) overflying high density traffic areas. Another improves management of automatic transmit-power reductions by TCAS to "ensure that the TCAS surveillance range is always adequate for collision avoidance," the report said.

"[Versions after 6.04a have] the capability for TCAS to issue RA reversals in coordinated encounters if the encounter geometry changes after the initial RA is issued," the report said. "A new feature was implemented … to reduce the frequency of initial RAs that reverse the existing vertical rate of own aircraft (e.g., displayed a climb RA for a descending aircraft) because pilots did not follow a majority of these RAs, and those that were followed, were considered to be disruptive by controllers."

While envisioning ever more crowded airspace and the associated interference potential, Version 7.0/7.1 software also incorporates hybrid surveillance (Figure 3), an optional way of further reducing the likelihood of data link–radar frequency saturation.

Hybrid surveillance offers, in addition to the normal TCAS active-surveillance mode, a passive-surveillance mode that relies on continuously receiving positions updated from an intruder aircraft's Mode S transponder. These positions originate from an on-board navigation source, typically data from a global positioning system receiver. A limited number of operators so far take advantage of this existing feature of TCAS, however, the FAA said.

Hybrid Surveillance in Traffic-Alert and Collision Avoidance Systems (TCAS)



Note: The intent is to reduce the rate of interrogations by TCAS units to prevent radio frequency congestion and interference with air traffic control radars "without any degradation of the safety and effectiveness of TCAS," the FAA said.

Source: U.S. Federal Aviation Administration (FAA)

Figure 3

Notes

1. FAA. "Air Carrier Operational Approval and Use of TCAS II." AC 120-55C, Feb. 23, 2011.
2. FAA. "Introduction to TCAS II Version 7.1." Feb. 28, 2011.
3. U.S. pilots must consider which of the following reports, if any, are appropriate: ATC clearances and instructions report; captain's report to the operator; pilot/observer questionnaire; logbook entry; aircraft communications addressing and reporting system message; near-midair collision report; report to the Aviation Safety Reporting System; and/or mandatory RA report if the RA fits criteria of U.S. National Transportation Safety Board Part 830, "Notification and Reporting of Aircraft Accidents or Incidents and Overdue Aircraft, and Preservation of Aircraft Wreckage, Mail, Cargo, and Records."
4. "In modeling aircraft response to RAs, the expectation is [that] the pilot will begin the initial 0.25 g acceleration [that is, one-fourth of standard gravitational acceleration] maneuver within 5 seconds to an achieved rate of 1,500 fpm," the report noted. "Pilot response with 0.35 g acceleration to an achieved rate of 2,500 fpm is expected within 2.5 seconds for subsequent RAs."
5. Tau is an approximation, in seconds, of the time to the closest point of approach, known as range tau, or of the time to the own aircraft and intruder being at the same altitude, or co-altitude, known as vertical tau.
6. Sensitivity level controls the dimensions of the protected airspace around each TCAS-equipped aircraft.

The FAA and the airlines are working to transfer LOSA principles from the flight deck to the maintenance shop and to the ramp.

Moving to Maintenance

BY LINDA WERFELMAN

Principles inherent in the line operations safety audit (LOSA) program — typically used on the flight line — can be applied to aviation maintenance and ramp operations to identify conditions that might lead to an incident or accident, a U.S. Federal Aviation Administration (FAA) report says.

"The hazards that threaten the safety of flight deck operations are not unique to that environment," said the report, issued in September by the FAA Office of Aerospace Medicine.[1] "Similar problems are present during maintenance and ramp operations."

LOSA traditionally has been used to gather safety data during routine airline operations. The program had its roots in a Delta Air Lines effort to assess the operational effects of a three-day crew resource management (CRM) training course.

"Analysts soon realized that existing data collection methods did not assemble adequate information regarding flight crew adherence to standard operating procedures and environmental influences on flight crew performance," the report said.

In 1994, Delta and the Human Factors Research Project of the University of Texas at Austin formed a partnership, with a goal of developing "a line audit methodology utilizing jump-seat observations on regularly scheduled flights." The first audits looked primarily at CRM.

LOSA programs expanded to other airlines and gradually evolved to focus on threat and error management.


J.A. Donoghue

LOSA is seen as a way of helping ramp and maintenance workers identify threats and errors in their work environment before they lead to an accident.

"Monitoring routine operations, the cornerstone of the LOSA process, addresses an important aspect of safety auditing, namely, that risks and human error can never be completely eliminated," the report said. "Recognizing correct and incorrect actions to manage these risks and errors before they manifest into larger incidents/accidents makes LOSA a truly proactive — rather than a reactive — strategy, as well as a workable predictive way of risk mitigation."

Typically, the LOSA process works like this: Observers record threats to safety, along with specific information about how the threats were addressed, what errors were generated, how those errors were managed and how the actions that were observed could be associated with incidents and accidents. The resulting data are analyzed to help determine organizational strengths and weaknesses, and countermeasures are developed to address the threats and errors.

$5 Billion in Losses

Only recently have LOSA programs begun to be modified to include maintenance and ramp activities.

The report cited Flight Safety Foundation information published in 2007 that said the industry was losing an estimated $5 billion annually because of ramp damage to aircraft.[2]

"Additional methods of reducing damage and injuries are imperative," the FAA report said, adding that LOSA "holds promise as a means of reducing the incidents and accidents in ramp and maintenance operations because LOSA enables ramp and maintenance workers to identify and develop methods to address threats and errors before they lead to an incident or accident."

Even before the current effort to introduce LOSA into maintenance and ground operations, several air carriers had implemented programs similar to LOSA to reduce maintenance errors and damage to aircraft on the ground, the report said.

For example, the report cited Continental Airlines, which determined that, of 447 problems identified in 2008 by the carrier's flight operations LOSA, 29 percent involved ground safety issues. The industry average is 16 percent, the report said.

Continental responded by beginning several new programs aimed at improving ground safety, including Ramp-LOSA (R-LOSA). In a subsequent review of safety performance from 2006 through 2009, the airline compared data for two stations and found a dramatic improvement at both; nevertheless, improvements at Station No. 1, where R-LOSA was implemented in 2007, surpassed those at Station No. 2, where R-LOSA was not used, the report said. The difference "can potentially be attributed to the effectiveness of R-LOSA," the report said, noting that Station No. 1's initial safety performance also was better than that of Station No. 2.

Ground safety performance was based on the total number of occurrences that were considered ground damage mishaps, the mishap rate per 10,000 departures and the cost of the mishaps. The mishaps also were divided between "attributable" mishaps — those that result from human error and are "charged back" to the department or vendor deemed responsible — and non-attributable mishaps, such as foreign object damage, for which costs cannot be recovered.

Both stations recorded what the report called a "dramatic decrease" in the number of ground damage mishaps between 2006 and 2009. Attributable mishaps decreased by 73 percent for Station No. 1 and 58 percent for Station No. 2, while non-attributable mistakes declined 85 percent for Station No. 1 and 67 percent for Station No. 2.

The ground damage mishap rate also decreased at both stations. At Station No. 1, the rate of attributable mishaps decreased 61 percent, while non-attributable mishaps declined to zero, the report said. At Station No. 2, the attributable mishap rate decreased 43 percent and the rate of non-attributable mishaps decreased 45 percent.

The cost of ground damage decreased at both stations between 2006 and 2009, although the cost of attributable mishaps at Station No. 1 increased slightly in 2008, the report said.

Over the same time period, information gathered through Maintenance-LOSA (M-LOSA) led to the time-saving revision of certain aircraft system deactivation procedures, the report said.

"M-LOSA findings help make deactivation procedures more workable, efficient and safer," the report said.

"As an example, [Boeing] 767 leading edge device deactivation and reactivation procedures used to take three hours to properly lock out and tag out without individual sign-offs. An M-LOSA auditor identified this inefficiency, which was then addressed by Tech Publications by rewriting their deactivation/reactivation procedures. Previously, the lockout and tag-out process involved unnecessary deactivation of some systems following a 37-page procedure. … The new work card is two pages long, with clearly defined steps. Now, with individual sign-offs, this modified process takes between 30 and 45 minutes to complete."

The report said the new procedures also have helped prevent confusion related to interruptions and shift changes.

Line Painting

At Delta, data from the Ramp Operations Safety Audit (ROSA) was credited with persuading the Atlanta Airport Authority to repaint clearance lines at the international concourse, the report said.

Previous requests from Delta officials to repaint the lines had been ignored, "until Delta presented the results of a … ROSA audit," the report said. "The ROSA data illustrated serious problems caused by the missing clearance lines. Following repainting, ground equipment operators have consistently obeyed the rule of parking outside the clearance lines when airplanes are not at the gate. … Consequently, parking violation-induced ground equipment damage and occurrence of FOD [foreign object debris] on the ramp have decreased."

Qantas Safety Audits

Qantas Airways adapted its LOSA methodology for use on the surface, conducting its first ground operational safety audit (GOSA) in 2008. Auditors

J.A. Donoghue

focused on how ramp teams functioned during aircraft turnarounds and provided additional data on "threats, errors and undesirable operational states that threatened the operational safety of ground operations," the report said.

The program allowed the airline's ramp managers to collect data on the strengths and weaknesses of their operation, and helped them evaluate the effectiveness of training and the quality of their procedures, including "processes undertaken by staff that result in work shortcuts, injury or risk to other staff," the report said.

Industry Task Force

A more comprehensive effort — a collaboration between the Air Transport Association Maintenance and Ramp Human Factors Task Force and researchers from the FAA and Saint Louis University — began late in 2008.

The group's efforts generated M-LOSA and R-LOSA forms, training documents and a structure for collecting and storing data, and then tested the paperwork and processes at ramp, line maintenance and base maintenance facilities across the United States.

The goal was to develop "a practical, customizable and scalable methodology," which was delivered to the industry in the form of a tool kit, available online at <https://hfskyway.faa.gov/HFSkyway/LOSAHome.aspx >.

"The development of R-LOSA and M-LOSA will build upon existing knowledge regarding safety across high-consequence industries," the report said. "In particular, the impact of observation of normal behaviors in the aircraft maintenance and ramp operations will help qualify and quantify the efforts made by aircraft mechanics and ramp agents to prevent or reduce incidents and accidents."

Notes

1. Ma, Jiao; Pedigo, Mark; Blackwell, Lauren; Gildea, Kevin; Holcomb, Kali; Hackworth, Carla; Hiles, John J. *The Line Operations Safety Audit Program: Transitioning From Flight Operations to Maintenance and Ramp Operations*. DOT/FAA/AM-11/15. September 2011.

2. Lacagnina, Mark. "Defusing the Ramp." *AeroSafety World* Volume 2 (May 2007): 20–24.

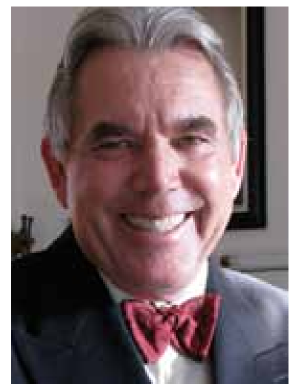
A New BARS Program Team Member

Larry Swantner brings 35 years of aviation experience, insight and flying enjoyment to Flight Safety Foundation, where he will act as manager of program development for the Basic Aviation Risk Standard (BARS) program team to broaden its profile globally.

Much of Swantner's flying experience was in Africa, where he was reminded all too often of the pressing need for improvements in safety and operational standards. As the flight attaché to the U.S. Embassy in Pretoria, South Africa, in the mid to late 1980s, he participated in major accident investigations. One accident was the crash that claimed the life of the president of a southern African nation; another involved the loss of a Boeing 747 and all aboard. More recently, he has conducted surveys of several African countries to determine their commercial aviation capacity and safety oversight capability.

"About two years back, I was presenting a report on the state of African aviation to the Corporate Council on Africa's Business Summit when I became aware of Flight Safety Foundation's work to improve safety oversight of chartered flight operations in support of resource companies," Swantner told *ASW*. He sought to meet FSF President and CEO William R. Voss after the Africa summit, and their interests coalesced at once around the idea that would become the BARS program.

"The work that Bill and his colleagues have done to develop a practical approach to a problem many people only hear about in the context of bad news is admirable," Swantner said. "I'm convinced that the BARS program represents the best systematic approach to raising the level of safety for flight operations in some of the most challenging environments in the world. I hope I can help expand this vital program to enhance safety and oversight. I've seen too many avoidable accidents, been asked by the media to comment too often on why something tragic happened in some remote location. I'd rather not have to make those comments."



Swantner

Swantner's aviation career spans both the military and commercial sectors. He was flight operations manager for Delta Air Lines in New York and the company's representative to the Civil Reserve Air Fleet, which consists of selected aircraft from U.S. air carriers used in meeting military airlift requirements. He supervised forward deployment operations during the fleet's Iraq war mobilization. He also managed a Delta project to convert a Boeing 767 into a medical evacuation configuration.

During operations in the Persian Gulf from 1990 to 1991, he was commander of the U.S. Air Force's largest airlift squadron. He played a diplomatic role in the Air Force, too, accredited to several countries in southern Africa, where he traveled extensively throughout the region, surveying infrastructure and observing the political and military dynamics of the area.

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Evolving guidelines aim to correct deficiencies in methods of training for airplane upset prevention and recovery.

Pilot Project

BY PAUL "BJ" RANSBURY AND JANEEN KOCHAN

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InSight is a forum for expressing personal opinions about issues of importance to aviation safety and for stimulating constructive discussion, pro and con, about the expressed opinions. Send your comments to J.A. Donoghue, director of publications, Flight Safety Foundation, 801 N. Fairfax St., Suite 400, Alexandria VA 22314-1774 USA or donoghue@flightsafety.org.

Although debate continues about how best to incorporate upset prevention and recovery training (UPRT) at the commercial pilot licensing and type rating levels for airline transport pilots (*ASW,* 6/11, p. 24), a robust high-level framework already exists. This framework enables a consistent delivery of instruction, general sequencing of training phases and practical verification of effectiveness by integrating resources such as Web-based curricula, specialized UPRT instructors, aerobatic-capable airplanes and Level D simulators.

The framework also addresses seven deficiencies that we outline in this article to help mitigate the persistent, complex and lethal problem of loss of control in-flight (LOC-I). Loss of control can be a precursor to, or the result of, an airplane upset.

The airline industry's *Airplane Upset Recovery Training Aid, Revision 2* defines *airplane upset* as "an airplane in flight unintentionally exceeding the parameters normally experienced in line operations or training: pitch attitude greater than 25 degrees nose up; pitch attitude greater than 10 degrees nose down; bank angle greater than 45 degrees; [or,] within the above parameters, but flying at airspeeds inappropriate for the conditions."

The geometric pitch and bank components of the definition can be plotted as a blue region representing the normal flight environment (Figure 1). Disregarding airspeed in the definition for the moment, the vast majority of commercial pilots tend to spend more than 99 percent of their flying careers within these tight blue-region confines, which represent less than 5 percent of the all-attitude flight envelope. In rare instances during commercial pilot licensing training, and perhaps during unusual attitude training in the simulator, pilots delve into

Figure 1's yellow region, up to 30 degrees of pitch and 60 degrees of bank, which represents the widely accepted maximum pitch and bank limitations of commercial licensing training. This yellow region represents barely more than 11 percent of the all-attitude flight envelope.

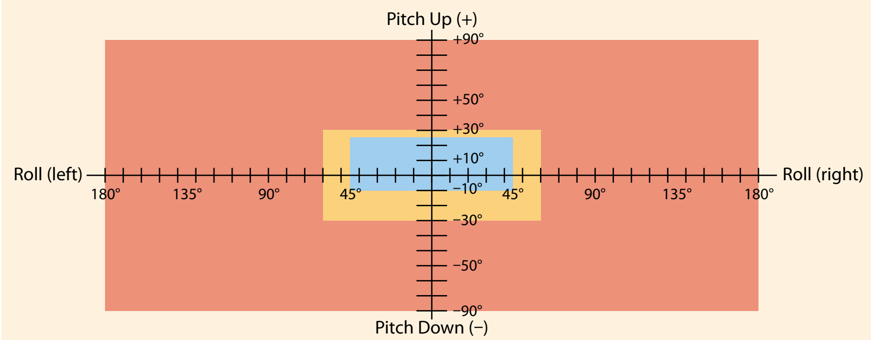
Deficiency no. 1: Unfounded Confidence

One faulty assumption by pilots is that their day-in, day-out expertise in the blue region will give them the skills, discipline and awareness necessary to prevent or recover from an airplane upset event. An upset event that is rapidly hurtling out of the blue region, through the yellow region and into the last region we call the all-attitude *red zone* can present unexpected, unfamiliar and sometimes violent situations that can rapidly degrade a pilot's ability to prevent the escalating LOC-I condition or to effectively recover.

What does the reference to inappropriate airspeeds in the upset definition mean exactly? Similar to plotting data that represent the pitch-bank environment, we can graphically represent on the coefficient of lift curve a plot where pilots are only regularly exposed to certain portions of the speed envelope (Figure 2, p. 38). With effects of aerodynamic loading aside, the typical 1-g experience of pilots (that is, one times standard gravitational acceleration) is shown by the green region of the curve proceeding from the bottom of the chart up to the L/D max angle-of-attack (AOA), the lowest point on the total drag curve.

This region of speed stability is where pilots spend almost their entire flying career. Pilots are only rarely exposed to the yellow region of the curve that proceeds up from L/D max AOA to the stall warning AOA. In speed terms, in a 1-g flight condition, the stall warning AOA is usually 5 kt to 10 kt faster than the published

All-Attitude Flight Envelope



Attitude Regions	Portion of Envelope
Normal flight per upset definition (45° AOB, pitch +25° to –10°)	4.9%
Maximum limits in commercial licensing training (60° AOB, pitch +/–30°)	11.1%
Red zone — all-attitude training (180° AOB, pitch +/– 90°)	100.0%

AOB = angle of bank

Note: The upset definition source is the *Airplane Upset Recovery Training Aid, Revision 2* (November 2008).

Source: Paul "BJ" Ransbury and Janeen Kochan

Figure 1

1-g stall speed. The yellow region is generally only experienced intentionally by commercial pilots when practicing stall prevention training by initiating recovery at the first indication of the stall.

Up to this point in the speed/AOA discussion, pilots have a measured capability to operate in these areas. Unfortunately, most pilots' ability to deal with events further on the curve is noticeably deficient. Nearly 50 percent of fatal LOC-I accidents are due to the aerodynamic stall. That means that pilots, for a variety of reasons, do not always effectively remain below the stall warning AOA/airspeed.

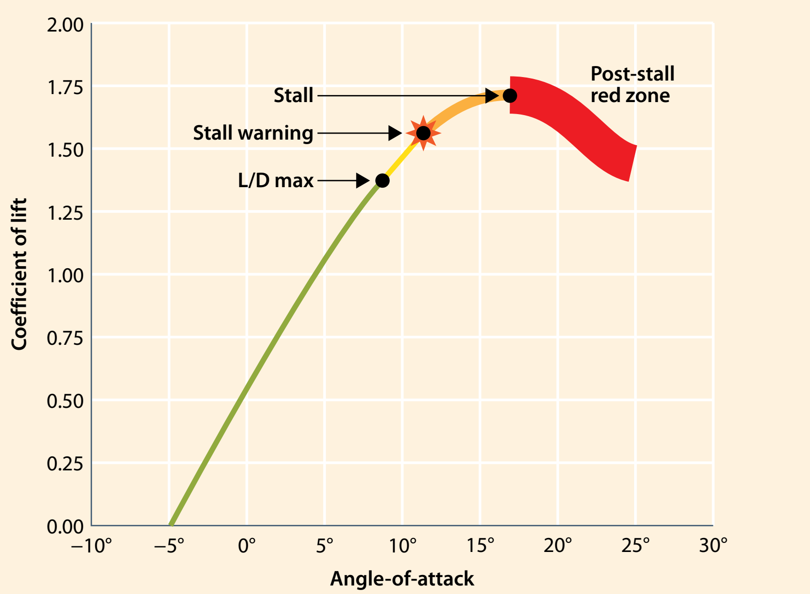
Historically, in stall prevention training at the commercial level, pilots have been repeatedly taught to minimize altitude loss, and this has been a criterion of performance evaluation (*ASW,* 11/10, p. 40). This precept is valid until pilots are faced with an actual stall, when they have maneuvered the airplane beyond the yellow region, through the orange region and into the airspeed/AOA red zone of the coefficient of lift curve.

Once at the stall, a pilot often reverts to what was taught in training: To recover with a minimum loss of altitude. This is the exact opposite of what should be emphasized: To reduce the AOA first and foremost. The aerodynamic stall is an airplane upset by definition, and these pilot errors perpetuate stalls, which can lead to serious airplane upsets.

Deficiency no. 2: Improper Stall Recovery

The obsolete paradigm of minimizing altitude loss has generated situations in which pilots continued to pull back on the control column, further increasing AOA in the stall and immersing themselves in the red zone. Several major challenges are presented here to these

Coefficient of Lift vs. Angle-of-Attack



Note: L/D max, also known as minimum drag speed (V_{md}), separates the speed range of normal flight (green region) from slow flight, often called the back side of the power-drag curve or the region of reverse command.

Source: Paul "BJ" Ransbury and Janeen Kochan

Figure 2

pilots. These challenges may never have been experienced, and pilots have not been consistently trained on how to exit from this deadly region. Other than rare exposures to the peak of the lift curve during initial flight training, this red zone is not often visited.

The risk of a fatal accident increases in proportion to duration and depth of exposure to the red zones. Myriad warning cues — the auditory, visual, tactile control feedback, motion cueing and other combinations of sensory feedback — also flood the pilot's senses, causing extremes of psychological states such as stress and panic and of physiological states such as spatial disorientation. Adding insult to injury, piloting skills suitable for the blue and green regions of Figures 1 and 2, respectively, rapidly decrease in their effectiveness during the escalating upset event. Counter-intuitive, corrective control inputs are often required to reliably recover the airplane to the "normal flight" regions of the commercial licensing flight envelope. Without proper UPRT, it is doubtful the pilot will recover.

If these red zones are not being addressed adequately by traditional training, where do we start as an aviation industry to significantly mitigate LOC-I? Mitigation begins with ensuring that industry-approved UPRT programs establish a sound foundation from which situational awareness, insight, knowledge, and eventually, skills can be reliably developed in the all-attitude, all-envelope environment.

Industry-approved, Web-based training tools can assist as powerful academic resources. At the outset, however, it must be emphasized that LOC-I mitigation is *not* an academics-only challenge. Academic preparation offers limited mitigation as a standalone intervention. Yet, academics combined with practical, hands-on experience under a quality-assured program can have significant and lasting UPRT skill-development benefits.

A pilot's unfamiliarity with the all-attitude, all-envelope environment can be overcome efficiently by imparting a significant portion of the awareness skills early in initial UPRT sessions. These initial sessions are best accomplished in an aerobatic-capable airplane with expert UPRT instructors, preferably before beginning airline flying.

UPRT instructors must cautiously build from the familiar to the unfamiliar to effectively bridge knowledge and experience gaps. Extensive experience shows that early focus on awareness of AOA, load, lift vector, coordination and energy management, combined with real-time feedback on the negative consequences of their mismanagement of those elements, helps trainees to gain trust and confidence in the training platform, the instructor pilot and the building-block design of the course of UPRT training.

Teaching the fundamental concepts and core skills in a progressive, non-threatening manner enhances the trainee's situational awareness at a rate that allows knowledge, skills and abilities to be internalized — enhancing long-term retention. When effectively delivered, this initial UPRT indoctrination comprehensively prepares the pilot for type-specific UPRT differences training ideally provided by the airline in the simulator.

The focus of UPRT must be placed squarely and firmly on upset *prevention* through enhanced pilot awareness. Two general types of this training can be clearly defined. One type stresses *time-favorable* actions through effective aeronautical decision making (ADM), and the other type stresses *time-critical* actions to counter an escalating upset before it develops beyond certain thresholds. UPRT must address both of these prevention concepts. Time-favorable ADM upset prevention, typically on the order of several minutes or even hours, involves environmental analysis, upset risk awareness, resource management and breaking the error chain through sound judgment.

Deficiency no. 3: Pilot Over-Reaction

As the time frame for stall/upset response compresses, typically onto the scale of seconds or fractions of a second, the pilot's challenges become quite different from time-favorable ADM. When startled by a rapid-onset upset event, implementing the correct, time-sensitive control inputs to counter the escalating condition is often the most difficult aspect of prevention in UPRT. For the psychological and physiological reasons noted, pilots faced with rapid-onset airplane upset events tend to over-react to situations without dedicated training. Pilots in real upsets have been observed making the situation worse, sometimes unrecoverable, or causing airplane structural failure in rare instances. Over-reaction must be addressed, and this is another critical LOC-I mitigation from UPRT.

Once an airplane's flight condition unintentionally exceeds a certain level of severity, the pilot must recognize the necessity of intervention. As the situation transitions from the prevention phase to the recovery phase defined by the above airplane upset parameters — or the prevention phase seemingly has been skipped entirely — the pilot must take immediate corrective action.

Deficiency no. 4: Primary/Exclusive Recovery Focus

Many training providers treat the upset *recovery* phase as the primary, or exclusive, focus of their version of UPRT. To be clear, a comprehensively addressed recovery phase has tremendous value in enhancing the trainee's ability to contain real-world startle factor; to properly use the primary controls of all-attitude, all-envelope flight; and to enhance situational awareness of the event. Nevertheless, the core element of UPRT must be upset *prevention* with the understanding that this can be significantly augmented by integrating thorough and comprehensive recovery training.

The building-block sequence necessary in imparting UPRT recovery-phase skills comprises the development of primary control strategies, alternate control strategies, secondary flight control integration, airplane type/class–specific considerations and UPRT-specific crew resource management (CRM).

Deficiency no. 5: Absence of Startle Factor

Some UPRT programs fail to adequately address the startle factor. Imparting UPRT skill sets to trainees without startle training does not reliably enable them to recover during the mentally and physically demanding challenge of an actual airplane upset. However, training providers must be extra cautious in how unannounced events are integrated into UPRT. Inappropriately subjecting trainees to dramatic in-flight or simulated events — those beyond their skill level to resolve correctly — can have long-term negative consequences in UPRT skill development.

Deficiency no. 6: Simulator Limitations

Presently, the required magnitude, quality and relevance of startle factor training for UPRT cannot be fully accomplished exclusively through ground-based simulation. Appropriate UPRT training in all-attitude, aerobatic-capable airplanes readily immerses the trainee in dynamic surprise/startle experiences that are recognized in scientific research as unique and necessary.

Deficiency no. 7: Problematic CRM

Ensuring that CRM optimizes a flight crew's upset response has been particularly challenging to the global community of UPRT specialists — for example, the concerns if only one flight crewmember has completed UPRT.

The presence of an untrained crewmember in this same crew arguably could have dire consequences in an upset event due to flight control interference. In LOC-I scenarios, the flight crew must immediately communicate and confirm the situation; manage the automation and transfer control (if necessary) to the pilot with the most situational awareness; work together through standardized interactions to mutually enhance awareness of the dynamic flight condition; and apply correct, timely control manipulation.

Paul "BJ" Ransbury, president and chief flight instructor (CFI) of APS Emergency Maneuver Training, and three-time recipient of the master CFI–aerobatic designation from the aviation education industry's Master Instructor Program, is a founder and vice president–global integration of the Upset Prevention and Recovery Training Association <uprta.org>, a former Airbus A320 airline pilot and a former F/A-18 fighter pilot and tactics instructor. He also is co-leader of the upset analysis and development team of the Royal Aeronautical Society's International Committee for Aviation Training in Extended Envelopes (ICATEE). Janeen Kochan, Ph.D., is a human factors scientist, designated pilot examiner and instructor pilot at Aviation Research, Training and Services; a former airline captain; and an author of research reports on pilot training for the mitigation of startle/surprise effects. She is also a member of ICATEE. Their original paper is available at <apstraining.com/uprt-deficits>.

Taking Steps

BY LINDA WERFELMAN

Even as the FAA is trying to revise pilot rest requirements, a government report says industry opposition presents a challenge.

Considerable opposition within the aviation industry to proposed changes in pilot flight, duty and rest requirements will hinder efforts by the U.S. Federal Aviation Administration (FAA) to finalize the changes, according to a report by a U.S. Department of Transportation (DOT) oversight office.[1]

The FAA published a notice of proposed rulemaking (NPRM) in September 2010, calling for flight, duty and rest requirements to be updated in accordance with scientific research — actions that were characterized by the DOT Office of Inspector General (OIG) report as "important and much-needed steps."

The FAA had planned to issue the final rule on flight, duty and rest requirements in August, but the action has been delayed until late November to allow more time for executive review, an FAA spokeswoman said.

The OIG report said the FAA faces a significant challenge in proceeding with the implementation of the regulations.

"It will be difficult for FAA to address this issue or finalize new rest rules given the significant opposition the NPRM faces from the aviation industry," said the report, published in mid-September.

The proposed rule would require U.S. Federal Aviation Regulations Part 121 air carrier pilots to have at least nine hours of rest before reporting for duty; in most cases, the current requirement is for at least eight hours of rest. The proposed rule also would establish maximum allowable duty and flight times that would be determined according to the number of pilots in the crew, the start time, the number of flight segments and the existence of rest facilities in the aircraft; in most cases, allowable flight and duty times would be shorter than those permitted under current regulations, but in some situations, the allowable times would be longer.

The airline industry — especially cargo and charter operators — have opposed the proposed changes, which the Air Transport Association says go "well beyond what current scientific research and operational data can support." The association also estimates the cost of compliance at about $20 billion over 10 years, compared with the FAA's estimate of $1.3 billion.

The OIG report noted that there had been similar opposition to the FAA's previous proposals to revise flight and duty regulations and that the FAA had ended that effort —15 years after it was begun — in November 2009, and then began developing the new NPRM that was published the following year.

The current regulations, last modified in 1985, are "outdated, difficult to interpret and not scientifically based," the OIG report said,

Number of Pilot Commuters

Airlines	Number of Pilots Interviewed	Current Commuters	Past Commuters	Percent of Current and Past Commuters
Airline 1	7	1	4	71%
Airline 2	5	0	1	20%
Airline 3	10	7	2	90%
Airline 4	5	2	1	60%
Airline 5	6	5	1	100%
Total	**33**	**15**	**9**	**73%**

Source: U.S. Department of Transportation, Office of Inspector General

Table 1

noting that, for example, they do not take into account the complications of multi-leg flights or of flights that cross multiple time zones.

The report noted that, after the fatal crash of a Colgan Air Bombardier Q400 in 2009,[2] the FAA identified pilot fatigue as a top priority for the industry and took several steps to address the problem, including issuance of advisory circulars that discussed best practices for dealing with fatigue and concepts of a fatigue risk management system, as well as publication of the 2010 NPRM.

Research determined that pilots might not be reporting all instances of fatigue.

Fatigue was a likely factor in the Colgan crash, according to the U.S. National Transportation Safety Board (NTSB) final report on the accident, although investigators were unable to determine precisely how fatigue might have contributed to the pilots' "performance deficiencies," the accident report said.

The OIG report said that the FAA and U.S. air carriers have systems designed to ensure compliance with existing FAA flight, duty and rest requirements. The six air carriers visited by OIG researchers during the course of their study used several different automated scheduling systems, all programmed to ensure compliance with FAA flight, duty and rest requirements, as well as with terms of the collective bargaining agreements negotiated with the pilots' labor unions.

Citing a previous report, the OIG noted that, on occasions when human error by an airline scheduling employee results in non-compliance, FAA inspectors "do not fully examine and analyze the self-disclosure data from the carriers." The collection and analysis of such data could help identify instances and trends associated with fatigue, the report said.

For this report, the OIG reviewed 214 automated pilot schedules and actual shifts during a one-month period at all six carriers represented in the study and found no violations of FAA flight, duty and rest regulations. In 31 instances, however, pilots exceeded their permitted flight time because of weather problems or other circumstances beyond the airline's control. The report also noted 25 instances in which pilot rest periods were less than nine hours but more than eight hours; in each instance, the pilot received "compensatory rest," as required by regulations.

Identifying Fatigue

In addition, the OIG report said that the office's research determined that pilots might not be reporting all instances of fatigue. The report noted that, of 33 air carrier pilots interviewed by OIG researchers, 26 pilots (79 percent) said that, at some time, they had been fatigued while on duty; nevertheless, only eight pilots notified their carriers of their condition. Among the reasons cited for not reporting fatigue was a fear of "punitive action from their employers," the report said.

The limited data may be hindering the FAA in its ability to identify any link between pilot commuting and pilot fatigue, the report said.

The OIG recommended that the FAA improve its collection and analysis of data related to pilot fatigue, calling for implementation of "an internal mechanism that encourages pilots and other flight crewmembers to voluntarily report instances of fatigue without facing disciplinary action." A second recommendation said that the FAA should require inspectors to "analyze voluntary disclosure data specifically for violations of flight, duty and rest requirements."

The FAA already has completed actions that "address the intent of these recommendations," the report said.

The FAA said that it published guidance in 2010 to aid airlines in developing fatigue risk management plans, and noted that one element of a fatigue risk management plan is the establishment of a just culture, including a policy that encourages crewmembers to "report fatigue occurrences without fear of retribution," the report said. The FAA said that it consistently reviews information gathered through two programs for voluntary disclosure of safety issues to identify the causes of the reported problems and to help develop corrective actions.

Pilot Commuting Practices

The NPRM includes no provisions for dealing with the fatigue issues associated with pilots who commute hundreds — or thousands — of miles to work, and the OIG report noted that neither the FAA nor individual airlines have addressed the issue Instead, the FAA drafted an advisory circular emphasizing the dual role of operators and their pilots in ensuring that pilots are well rested when they begin work.

The commuting issue was raised after the Colgan crash, when NTSB accident investigators learned that both pilots lived hundreds of miles from their assigned work location and that both often slept in an airport crew lounge (*ASW*, 3/10, p. 20).

The NTSB accident report noted that Colgan "did not proactively address the pilot fatigue hazards associated with operations at an airport where pilots typically have to commute … in order to begin their work shifts."

At the time, the NTSB recommended that the FAA address fatigue issues involved in commuting. The FAA has not moved to require air carriers to identify commuting pilots or to address issues involving commuting and fatigue, the OIG report said.

The OIG report noted that commuting issues surfaced again when the U.S. Congress included in 2010 legislation a call for a study of air carriers' commuting policies and their effects on pilot fatigue.

That study, released in July by the National Academy of Sciences, found that, although airline pilots' commuting practices "could potentially contribute to their fatigue," not enough data exist to determine the extent of the related safety risks.[3]

"Some commutes have the potential to contribute to fatigue in pilots, and fatigue can pose a safety risk, but at this point, we simply don't know very much about actual pilots' commuting practices," said Clint Oster, a professor in the Indiana University School of Public and Environmental Affairs and head of the panel that researched the issue. "Airlines and FAA should gather more information on pilots' commutes and also work with pilots to lower the likelihood that fatigue from commuting will be a safety risk."

The OIG report noted that the Air Line Pilots Association, International (ALPA) has estimated that 60 percent of its members commute to their jobs from other cities. Of 33 air carrier pilots interviewed by OIG researchers, 24 pilots (73 percent) said that they had commuted at some time in their careers (Table 1, p. 41).

Of four recommendations by the OIG to the FAA, two dealt with commuting pilots. The OIG said that the FAA should "ensure the collection and analysis of data regarding domicile and commuting length for all Part 121 flight crews.

"Specifically, information regarding the number of pilots and other flight crewmembers who commute, their methods of transportation and the distances they commute should be collected."

After the data are collected, they should be analyzed to determine "if further changes to flight duty and domicile regulations are needed or if airlines need to take further mitigating actions in their fatigue management systems," the OIG said.

In response, the FAA — noting that the National Academy of Sciences study had found no link between pilot commuting and aviation safety — said that it would "scan for available data on pilot commuting" rather than actively pursue data collection and analysis.

The OIG insisted, however, that FAA collection and analysis of commuting data are needed because of the current scarcity of data, as well as "the potential for commuting to contribute to fatigue, clear scientific evidence that fatigue can decrease performance and recent fatal regional air carrier accidents in which pilot performance or fatigue was cited as a cause or contributing factor."

The OIG's subsequent response said that, although issuance of the NPRM and publication of the National Academy study were positive steps, a comprehensive review of domicile and commuting data would "better position the agency and airlines to determine whether additional mitigation or oversight measures are needed."

The OIG asked the FAA to reconsider its position on both recommendations.

Notes

1. DOT OIG. Report No. AV-2011-176, "FAA and Industry Are Taking Action to Address Pilot Fatigue, but More Information on Pilot Commuting Is Needed." Sept. 12, 2011.

2. NTSB. Accident Report NTSB/AAR-10/02, "Loss of Control on Approach; Colgan Air Inc., Operating as Continental Connection Flight 3407; Bombardier DHC-8-400, N200WQ; Clarence Center, New York, February 12, 2009." All 49 people in the airplane and one person on the ground were killed when the airplane struck a house during approach to Buffalo Niagara (New York, U.S.) International Airport on Feb. 12, 2009. The airplane was destroyed. The NTSB said the probable cause was the captain's "inappropriate response to the activation of the stick shaker, which led to an aerodynamic stall from which the airplane did not recover."

3. National Academy of Sciences. "Steps Needed to Reduce Likelihood That Pilot Commuting Practices Could Pose Safety Risk, But Too Little Data Now to Support Regulation." July 6, 2011.

MAST rocking

The NTSB says intensified efforts are needed to find the cause of incidents of severe vibration in R44s.

BY LINDA WERFELMAN

The U.S. National Transportation Safety Board (NTSB), citing a 2009 accident involving severe vibration known as "mast rocking" in a Robinson R44, says the manufacturer should be required to identify the cause of the phenomenon and develop steps to avoid it.

Robinson Helicopter told NTSB accident investigators that, even before the agency issued its recommendations, it has begun flight tests to evaluate the problem, sometimes called "chugging."

The pilot of the accident helicopter — operated by the state of Alaska and being flown in visual meteorological conditions on May 12, 2009, by the Alaska State Troopers–Fish and Wildlife Protection on a game-management patrol — said that about 90 seconds after departure from a site 57 nm (106 km) northwest of Iliamna, Alaska, he felt an unusual vibration, mostly in the pedals, followed by a slight yaw.

"The pilot said the vibrations became oscillations, in both yaw and pitch, to the point he felt the helicopter was going to come apart," the NTSB said in a safety recommendation letter to the U.S. Federal Aviation Administration (FAA). "He said an emergency landing was his only option."

The pilot said he "fought to maintain control" of the helicopter during the emergency landing, and the helicopter touched down with a forward airspeed of 5 to 10 kt. The main rotor blades contacted the tail boom during the hard landing, causing substantial

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damage to the helicopter, the NTSB said. The pilot and his two passengers were not injured.

The pilot's post-accident calculations indicated that the helicopter's weight had been below the gross weight limit but the center of gravity (CG) had been about 1.1 in (2.8 cm) forward of the forward limit.

The NTSB said the probable cause of the accident was "the main rotor transmission mount design, which resulted in an in-flight vibration/oscillation and damage to the helicopter during the subsequent emergency descent and hard landing." Contributing factors were "the lack of information from the manufacturer regarding this known flight oscillation, and loading the helicopter beyond the forward center of gravity limit by the pilot."

In both the safety recommendation letter to the FAA and in its report on the accident,[1] the NTSB quoted a Robinson Helicopter accident investigator as saying that the company already had begun flight tests to learn more about mast rocking.

"The tests determined that an oscillation may develop at high gross weight, [at] about 90 to 100 kt, and that the oscillation was more of a 'bucking' movement due to the fore-and-aft movement of the rotor mast," the NTSB said.

"According to the manufacturer, the tests determined that chugging could occur within the normal CG range, most typically at or near a gross weight with a CG near the forward limit."

The NTSB said that the manufacturer believed that the oscillation is "not destructive to the helicopter," that it can be attributed to "the degree of firmness of the transmission mounts" and that it can be mitigated when the pilot increases power to make possible a safe landing.

The Robinson Helicopter investigator said that he was aware of one mast-rocking event in which the helicopter was damaged. In that case, the helicopter was landed before the main rotor mast oscillations stopped; as a result, the top of the cabin was dented by "the fore-and-aft movement of the main rotor shaft fairings," the NTSB said.

The NTSB also quoted the manufacturer's investigator as saying that he was unaware of information provided by the manufacturer — in the form of alerts, bulletins, pilot training and a pilot operating handbook — that discusses mast rocking.

The manufacturer's tests had followed a Dec. 16, 2006, accident in which the pilot of an "almost new" R44 conducted an emergency landing near Ballymena, Ireland, because of severe vibration. The pilot and his three passengers were not injured, and the only damage to the helicopter was the distortion of an aluminum rib in the mast fairing assembly.[2]

The U.K. Air Accidents Investigation Branch (AAIB) said that the vibration was caused by "new, softer, main rotor gearbox mounts allowing excessive fore-and-aft rocking of the gearbox."

During the investigation, the pilot told the AAIB that as he flew a downwind leg in preparation for landing, and the helicopter descended through 700 ft above ground level at 75 to 80 kt, it "suddenly started to oscillate in pitch" and he felt "high vibrating control forces through the cyclic control." The oscillations and vibration increased "to the point where the pilot was concerned about the helicopter's structural integrity," the AAIB report said.

He conducted a run-on landing, with the vibration continuing during engine shutdown.

The AAIB accident report quoted Robinson Helicopter as saying that the company became aware of the vibration problem during test flights in 1993 when the CG was forward of the main rotor gearbox. In test flights, the vibration ceased when the pilot increased power. Robinson began installing stiffer gearbox mounts, which appeared to prevent the vibration.

After the 2006 incident in Ireland, Robinson determined that the gearbox mounts were softer than those manufactured in previous years, the AAIB said, adding, "The manufacturer believes that this softening of the mounts resulted in a recurrence of the vibration problem."

The AAIB said, in a report published in October 2007, that the manufacturer had again begun installing stiffer mounts and that the manufacturer had told the AAIB in August 2007 that "they were no longer encountering the vibration

The NTSB says Robinson Helicopter should maintain a database of mast-rocking events involving R44s.

problem during production flight test and … had not received any further reports of vibration incidents from in-service aircraft."

As a result, the manufacturer had no plans to issue a service letter, the AAIB added, "although this situation would be reconsidered if new reports of vibration were received."

The NTSB safety recommendation letter cited two events involving mast rocking, including one that occurred after the manufacturer's statement to the AAIB:

- On March 15, 2007, an R44 pilot conducted an emergency autorotative landing in Miami after experiencing a "huge vibration." Neither of the two people in the helicopter was injured, but the helicopter was substantially damaged. The NTSB said the probable cause of the accident was "the pilot's failure to maintain sufficient rotor rpm during an autorotative landing, which resulted in a hard landing and separation of the tail boom."[3]

- On Sept. 30, 2007, the pilot of another R44 conducted an emergency landing in a cornfield near Jackson Center, Ohio, U.S., after he experienced a severe vibration during approach to the landing zone. The pilot — the only person in the helicopter — was not injured, but the helicopter was substantially damaged when the tail rotor struck tall corn and the tail rotor gearbox separated. The NTSB cited as the probable cause "the reported vibration in the helicopter during an approach for landing."[4]

The NTSB safety recommendation letter cited a December 2006 report by an FAA flight test engineer who had participated in Robinson's flight tests and who noted that mast rocking had been induced "in various flight regimes and stopped under certain conditions using an R44 with aft and forward main rotor transmission mounts designed to react with upward and downward movement of the transmission."

The FAA test pilot's report noted that some combinations of transmission mounts and vibration isolators precluded mast rocking. Nevertheless, the manufacturer and the FAA test pilot agreed that each helicopter behaved differently during testing, so "no standard configuration was established," the NTSB said.

The NTSB added, "The lack of a specific solution for the mast-rocking vibration in all affected R44 helicopters suggests that the manufacturer has not identified the underlying cause of the vibration."

The agency recommended that the FAA "require Robinson Helicopter to resolve the root cause of the mast-rocking vibration in the main rotor assembly to ensure that all applicable R44 helicopters are free of excessive vibrations in all flight regimes."

Other recommendations called on the FAA to require the manufacturer to maintain a database of reported mast-rocking events in R44s, to add information to the R44 flight manual to inform pilots of the potential for mast rocking and to require that the R44 pilot training program be revised to include instruction in the recognition and mitigation of mast rocking vibrations in the main rotor assembly.

A final recommendation said the FAA should "issue a service letter to all approved service centers describing the mast-rocking vibration that can occur in the main rotor assembly" of R44s and "instructing service centers to report all incidents of mast rocking to the manufacturer."

Robinson R44

The Robinson R44 is a four-seat light helicopter developed in the late 1980s and first flown in 1990. It incorporates some elements of the two-seat R22 — including a tri-hinge underslung rotor head designed to limit blade-flexing and rotor vibration — but has a larger cabin.

The R44 has one Textron Lycoming O-540 six-cylinder reciprocating engine. Its empty weight is 1,442 lb (654 kg) and maximum takeoff and landing weight is 2,400 lb (1,089 kg). Standard fuel capacity is 31 U.S. gal (116 L).

Cruising speed at maximum takeoff weight and 75 percent power is 113 kt. Maximum rate of climb at sea level is 1,000 fpm. Service ceiling is 14,000 ft, hovering ceiling in ground effect is 6,100 ft, and hovering ceiling out of ground effect is 4,500 ft. Maximum range, with no fuel reserve, is about 347 nm (643 km).

Source: *Jane's All the World's Aircraft*

Notes

1. NTSB. Accident report no. ANC09GA040. May 12, 2009.

2. AAIB. Accident report no. EW/G2006/12/08. *AAIB Bulletin 10/2007*.

3. NTSB. Accident report no. MIA07LA059. March 15, 2007.

4. NTSB. Accident report no. CHI07LA309. Sept. 30, 2007.


J.A. Donoghue

Economic factors contribute to pilot commuting time and stress.

The Pilot Diaspora

BY SIMON BENNETT

Concerned about developing a fuller understanding of pilot fatigue, stress and other factors, in 2010 the British Air Line Pilots' Association (BALPA) funded our project to investigate the pilot lifestyle. BALPA intended to use the study to inform the European Aviation Safety Agency's deliberations on a new Europe-wide flight time limitation (FTL) scheme. BALPA knew that an FTL developed without reference to an *accurate* model of pilots' physical and psychological capacities and general behavior patterns might increase operational risk.

While there has been some research into the pilot lifestyle over the years, the BALPA-funded study was notable for its scale. Three research instruments were used: a sleep log (SLOG), an on-line questionnaire and interviews (*ASW*, 9/11, p. 58). Pilots kept SLOGs, ranging in length from 2,000 to 9,000 words, for three weeks. By the end of the research period (summer 2010–spring 2011) over 130 SLOGs and 433 questionnaires had been analyzed.[1]

Of the many findings suggested by the research, we will discuss here several that have received relatively little attention in discussions of pilot schedules, duty time and fitness.

Roster Instability

Most pilots in our survey understood that rosters could be changed at short notice. To anticipate the worst-case scenario, most went to bed when they could. Few, however, were able to "sleep to order," resulting in long periods of wakefulness and sleep debt. It was concluded that roster instability creates a latent risk.

Crewing and rostering officers are either assuming that pilots can sleep to order, or are ignoring evidence that pilots can't. By overturning pilots' plans for rest and recreation, roster changes upset the work-life balance.

More than 73 percent of respondents said they had felt unduly stressed at work. Nearly 80 percent of respondents said the same about home life. More than 40 percent of respondents said that relationships with partners and/or offspring had affected their working life. Nearly 20 percent said they had sought advice or help for a domestic relationship issue.

Researcher J.A. Young noted, "Even for the most expert or skilled performers, it is likely that cognitive processes, at one time or another, will be affected by life stress in a way that impairs performance."[2]

A Pilot Diaspora

Escalating training costs and downward pressure on salaries affected pilots' finances and domiciles. As one remarked, "Total training costs £118,000 ($185,000; ab initio and two conversion courses). One conversion course of £23,000 [$36,000], paid back by airline over five years. Current debt left after repaying for just under 10 years: £62,000 [$97,000]. Monthly payments to the bank of £1,050 [$1,650]. About five years to go."

Pilots on low incomes could not afford to live close to major airports. Aviation is a volatile industry. Obliged to "follow the work," pilots could find themselves commuting long distances. Over 30 percent of respondents took between 60 and 120 minutes to commute. Nearly 23 percent of respondents lived between 51 and 100 mi (82 and 161 km) from base, meaning a car journey of at least one hour. Nearly 7 percent of respondents lived between 101 and 150 miles [163 and 241 km] from base. About 30 percent of respondents used temporary accommodation. Over 83 percent said that their airline would not subsidize hotel accommodation for fatigued crew returning to base.

The FRMS "Trap"

A fatigue risk management system (FRMS) enables operators to develop an FTL that balances the rest and recreational needs of flight crew with the company's operational requirements. Operators use qualitative data, like fatigue reports, and quantitative data, like Actiwatch[3] printouts, to run their FRMS. Data are the lifeblood of the system. Without data, rosters cannot be validated.

A nonvalidated roster creates a risk because, without management knowledge, the roster may induce pilot fatigue. Pilots won't file fatigue reports if they believe they will be ignored or if they fear victimization. An FRMS cannot function properly without a just culture and pilot buy-in. There was some evidence of pilots reporting sick when they were, in fact, fatigued. "Masking" undermines an FRMS because it inhibits feedback.

Relationship and Trust

The data suggest deterioration in relations, both between pilots and management and, at one airline in particular, between pilots and cabin crew. Several pilots talked about a "bonus culture" among managers. One wrote, "There is a downward trend in terms and conditions. Who is going to borrow £120,000 [$188,000] to become a pilot when they can only expect £15,000 [$23,500] per year on a temporary contract? Directors are bonus-driven, and don't care if the airline exists in five years' time." More than 73 percent of pilots said their relationship with cabin crew had changed. Nearly 16 percent of respondents described their relationship with cabin crew when on duty as "poor."

Locus of Control

Flight operations are characterized by multiple centers of control. Pilots shoulder great responsibility, for the safety of their passengers, aircraft and crew and, to some degree, for the economic performance of the airline. Pilots' authority is largely situated on the flight deck.

Most pilots have no control over their rosters. In roster planning, the locus of control rests firmly with back office staff, most of whom have no first-hand knowledge of the lived reality of flight operations. Such "remote control" is problematic for two reasons.

First, it ignores a useful source of information on roster planning — the pilots. Second, some pilots perceive remote control as an affront.

Preferential rostering — involving pilots in roster planning — provides a way of shifting the locus of control more towards flight crew. It addresses the physiological capacities of individual pilots. Some pilots are "day people" while others are "night people." Of course, individuation costs money. It is cheaper for rostering departments to stereotype pilots than to acknowledge differences.

Because preferential rostering involves pilots in the management of fatigue — and, to some degree, management of the company — it breaks down the "us versus them" mentality that has become so much a feature of commercial aviation in recent years.

The survey strongly suggests that the factors we have described, as well as others, affect pilot well-being and performance. Currently, pilot morale is low. Only 19.2 percent of pilots said they would recommend a career in aviation to their offspring.

Simon Bennett, director of the University of Leicester's Civil Safety and Security Unit, has a doctorate in the sociology of scientific knowledge. He has been a consultant to the airline industry for more than a decade.

Notes

1. The full report can be purchased from the University of Leicester, <www2.le.ac.uk/departments/lifelong-learning/research/publications-1/vaughan-papers>.

2. Young, J.A. *The Effects of Life-Stress on Pilot Performance*. Moffett Field, California, U.S.: National Aeronautics and Space Administration Ames Research Center, 2008.

3. The Actiwatch is a wristwatch-like device that can measure activity, sleep and waking data.

BY RICK DARBY

IOSA Pays Off

Certification shows a risk management benefit in the latest IATA report.

The International Air Transport Association (IATA) Operational Safety Audit Program (IOSA), a certification requirement for all IATA member air carriers, continues to be a significant accident-rate differentiator. In 2010, IOSA-certified operators "had an accident rate 53 percent better than non-IOSA carriers," according to IATA's *Safety Report 2010*[1] (Figure 1).

The gap between IATA's 230 member carriers — representing 93 percent of scheduled international air traffic — and the industry as a whole in terms of hull-loss accidents widened in 2010, compared with 2009 (Figure 2, p. 50).[2] "The [industry] accident rate was 0.61 Western-built jet hull losses per million sectors flown in 2010," the report says. "IATA member airlines greatly surpassed the industry's performance in terms of safety, with an accident rate of 0.25 Western-built hull losses per million sectors flown. This was the lowest rate ever recorded by IATA carriers."

IOSA-certified carriers in 2010 "accomplished approximately 61 percent of all international and domestic passenger and cargo flights worldwide," the organization says. In that year, among the 94 total accidents, 28 percent involved IATA members. In runway excursions, the most common type of accident, 21 percent involved IATA carriers, down from 26 percent in 2009 and 27 percent in 2008.

The total number of accidents — IATA and non-IATA, jet and turboprop — increased from 90 in 2009 to 94 in 2010. The number of fatal accidents increased year-over-year from 18 to 23. Fatalities totaled 786 in 2010, compared with 685 in 2009. The Western-built jet hull-loss rate decreased from 0.7 per million sectors flown in 2009 to 0.6 in 2010.

Runway excursions were responsible for 23 percent of the accident total in 2010 (Figure 3, p. 50). Ten percent of those involved fatalities. Runway excursions as a percent of the annual total have decreased from 27 percent in 2008. "IATA members reduced seven runway excursion accidents by 43 percent in two years, four in 2010 versus seven in 2008," the report says.

"Aircraft technical faults and maintenance issues" was the second most frequent category

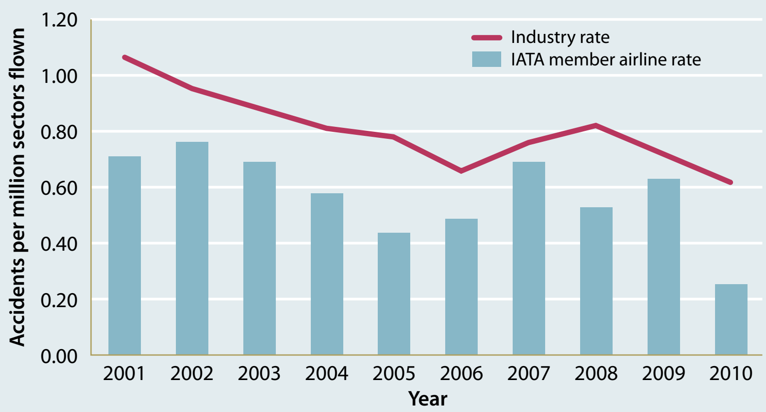
Worldwide Aircraft Accident Rate, 2001–2010

Note: Data include all Eastern- and Western-built jets and turboprops.

Source: International Air Transport Association

Figure 1

Aircraft Hull-Loss Rate, Western-Built Jets, IATA Members vs. Industry, 2001–2010

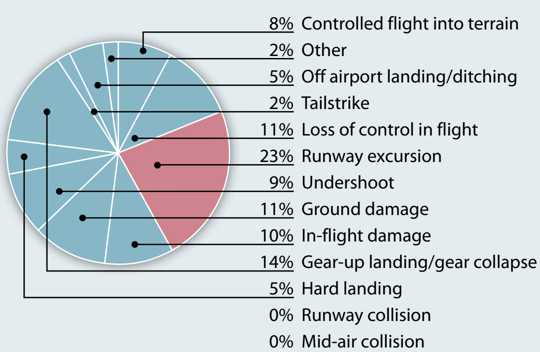


IATA = International Air Transport Association

Source: International Air Transport Association

Figure 2

Worldwide Aircraft Accidents, by Accident Category, 2010



Source: International Air Transport Association

Figure 3

of accident contributing factors in 2010. The report says, "While a technical fault is rarely the only or most significant cause of an accident, it can be one of the first events in a sequence leading up to an accident. … A large percentage of maintenance-related accidents involve landing gear malfunctions."

The category "maintenance issues as primary cause" included 11 accidents in 2010, compared with 10 in 2009 and 14 in 2008. The "total number of accidents with technical faults" was 36 in 2010, 26 in 2009 and 40 in 2008.

IATA has developed a classification system of "contributing factors" derived from a threat and error management (TEM) framework. Accidents are analyzed in terms of those categories, each divided and subdivided down to a granular level. The "top level" contributing factors include latent conditions, threats, flight crew errors and undesired aircraft states.

For 2010 runway excursions, the most frequent contributing factors under the heading of threats were "deficiencies in regulatory oversight" in latent conditions; "airport facilities," particularly contaminated runways and poor braking action; "meteorology," specifically wind conditions and thunderstorms; "aircraft malfunction"; "errors related to manual handling/flight controls" among flight crew errors; and the most common of all, under undesired aircraft states, "long, floated, bounced, firm, off-centerline or crabbed landing," followed by "unstable approach" and "loss of control while on the ground."

The IATA analysts looked for "correlations of interest" in which contributing factors tended to combine in accidents.

Among the correlations for runway excursions were these:

- "Weather (wind/wind shear/gusting wind or thunderstorms) was a factor in 71 percent of runway excursions where a long, floated, bounced, firm, off-centerline or crabbed landing occurred."
- "In 57 percent of runway excursions where weak regulatory oversight was noted [under the contributing factor category of latent conditions], poor airport facilities were also a factor. Within these cases of poor airport facilities, contaminated runways/taxiways and/or poor braking action was a factor in 75 percent of accidents."

A further analytical category was "accident scenarios of interest." One runway excursion scenario, for example, was: "The flight is operating in adverse weather conditions into an airport with contaminated runways and/or poor braking action. The flight crew lands long, lands off the centerline or bounces the landing, after which the aircraft exits the runway and is substantially damaged or destroyed. This scenario is common for 20 percent of all runway excursion accidents."

At 11 percent of the total accidents, loss of control in flight represented a smaller proportion of the whole, but 100 percent were fatal accidents. The most prevalent contributing factors were deficiencies in "flight operations: training systems" under latent conditions; "meteorology" and "aircraft malfunction" under threats; "manual handling/flight controls" under flight crew errors; and "vertical, lateral or speed deviations" under undesired aircraft states.

Two correlations were noted:

- "Sixty-seven percent of accidents involving crew training deficiencies also cited unintentional noncompliance with SOPs [standard operating procedures]."
- "In 67 percent of accidents with vertical, lateral or speed deviations, manual handling errors were also noted."

Controlled flight into terrain (CFIT) accidents had one of the lowest rates among the various categories, 0.19 per million sectors, compared with 0.54 for runway excursions and 0.27 for loss of control in flight. But CFIT accidents, too, had severe consequences — 86 percent involved loss of life.

Significant contributing factors to CFIT included "flight operations: training systems" under latent conditions; "poor visibility/instrument meteorological conditions" under threats; "flight crew errors related to SOP adherence/SOP cross-verification; intentional noncompliance" under flight crew errors; "vertical, lateral or speed deviations" under undesired aircraft states; and "fatigue" as an additional classification.

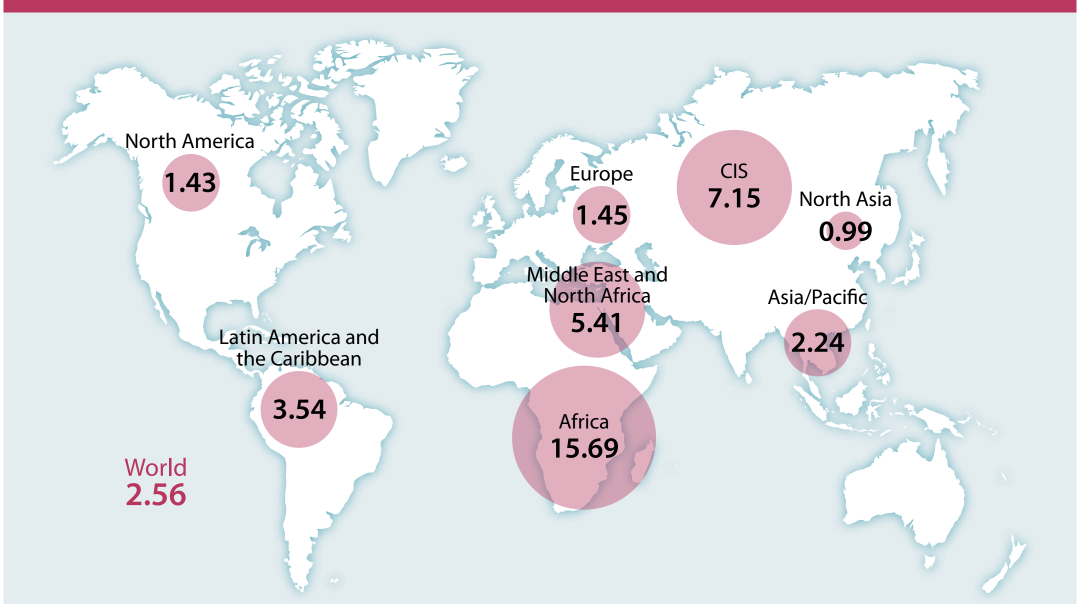
As correlations, "manual handling was cited in 67 percent of CFIT accidents where lack of ground-based navigations aids was a factor. Both cases where fatigue was a factor also cited deficiencies in airline training. Regulatory oversight was a factor in 67 percent of accidents where training deficiencies were also noted."[3]

The accident rates by region for jets and turboprops, Eastern- and Western-built, varied considerably among IATA-defined regions (Figure 4).[4]

"From a regional perspective, the Western-built jet hull loss rates remained the same or decreased in all IATA regions except North Asia and Latin America and the Caribbean," the report says.

Africa's 15.69 accidents per million sectors was the highest rate, but a lower percentage of those accidents were fatal than in some other

Accident Rates, by IATA Operator Region, 2010



IATA = International Air Transport Association

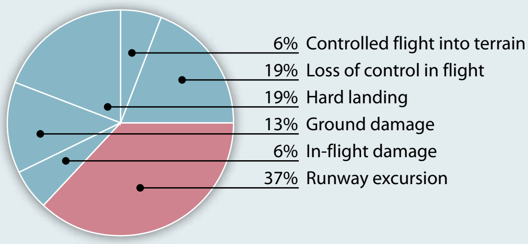
Note: Accidents are per million sectors for operators based in the IATA regions shown. Data include Eastern- and Western-built jets and turboprops.

Source: International Air Transport Association

Figure 4

regions — Asia/Pacific, Latin America and the Caribbean, and the Commonwealth of Independent States (CIS), for instance.

IATA Africa Region Accidents, by Category, 2010

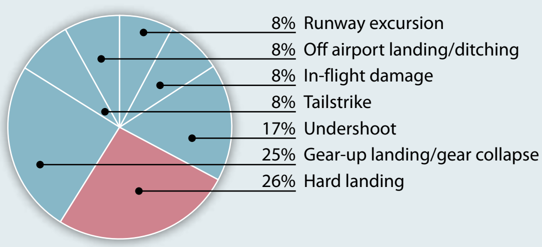


IATA = International Air Transport Association

Source: International Air Transport Association

Figure 5

IATA Europe Region Accidents, by Category, 2010

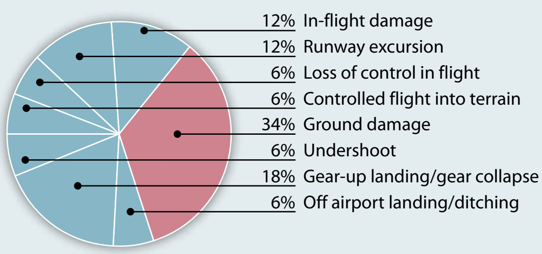


IATA = International Air Transport Association

Source: International Air Transport Association

Figure 6

IATA North America Region Accidents, by Category, 2010



IATA = International Air Transport Association

Note: One accident was not placed into any of the categories.

Source: International Air Transport Association

Figure 7

Runway excursions were the most frequent accident category in Africa (Figure 5), Asia/Pacific and the CIS, at 37 percent of the total, 34 percent and 45 percent, respectively. Hard landing, at 26 percent, ranked highest in Europe (Figure 6). Loss of control in flight was the most common category in Latin America and the Caribbean, representing 33 percent of accidents. In the North America region, the leading category was ground damage (Figure 7).

Europe, as well as Latin America and the Caribbean, had no CFIT accidents. But 23 percent of accidents in the Middle East and North Africa region were CFIT. One of the three total accidents in the North Asia region was CFIT.

For all Western-built jet aircraft in cargo service, the operational accident rate was 5.15 per 1,000 aircraft, compared with 2.22 for passenger-service aircraft.[5] Western-built turboprops in cargo service had 4.31 operational accidents per 1,000 aircraft, versus 3.94 for passenger-service aircraft. Loss of control in flight and runway excursion were tied for the largest category among cargo aircraft accidents, at 22 percent each.

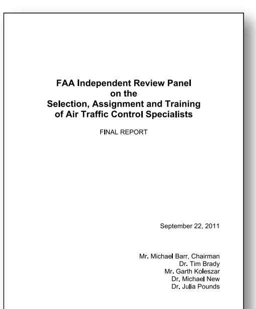
Notes

1. IATA. *Safety Report 2010*. 47th edition. April 2011. Available for purchase via the Internet at <bit.ly/p7WaYX>.
2. Flight Safety Foundation views hull-loss numbers and rates as more of an economic than a safety metric. The IATA report includes a mixture of hull-loss data, accident numbers and accident rates.
3. There were 20 runway excursions, seven CFIT accidents and 10 loss of control accidents. Because of the small numbers, percentages for contributing factors, correlations and accident scenarios suggest threats and errors worth considering but should not be taken as definitive evidence of relative risks.
4. The region assigned to an accident is based on the operator's country, not the location of the accident.
5. An operational accident is one "believed to represent the risks of normal commercial aviation, generally accidents which occur during normal revenue operations or positioning flights." This definition excludes sabotage as well as crew training, demonstration and test flights.

Controlling Interest

An independent panel recommends changes in how the FAA nurtures new air traffic controllers.

BY RICK DARBY


FAA Independent Review Panel
on the
Selection, Assignment and Training
of Air Traffic Control Specialists

FINAL REPORT

September 22, 2011

Mr. Michael Barr, Chairman
Dr. Tim Brady
Mr. Garth Koleszar
Dr. Michael New
Dr. Julia Pounds

REPORTS

Traffic Report

FAA Independent Review Panel on the Selection, Assignment and Training of Air Traffic Control Specialists: Final Report

Barr, Michael; Brady, Tim; Koleszar, Garth; New, Michael; Pounds, Julia. U.S. Federal Aviation Administration (FAA). Sept. 22, 2011. 62 pp. Available via the Internet at <1.usa.gov/naZInb>.

In the spring of 2011, FAA Administrator Randy Babbitt commissioned an independent panel to study the FAA's hiring, assignment and training of air traffic control specialists (ATCS) and recommend improvements. This report, which includes 49 recommendations, is the outcome.

"The panel reviewed hiring sources, screening, selection and faculty assignments; instructor selection; training content and delivery; organizational structure; and professional standards," the report says.

What follows are some of the report's findings and recommendations.

Collegiate training initiatives and selection. The panel studied the Air Traffic Collegiate Training Initiative (AT-CTI) program, finding that "there are 36 AT-CTI programs around the country, each with varying capabilities. … Yet the FAA does not break down each school's capability and further discriminate how in-depth the curriculum is at the different schools; all AT-CTI schools are in the same category. Failing to understand the capabilities of each approved school deprives the FAA of accurately assessing the full benefit from each of the programs."

The panel recommended that the FAA track the success of ATCS candidates recruited from various sources. "The use of this data would reduce the total training cost to the FAA," the report says. "The data most likely resides in a variety of sources, but it has not been consolidated, collated and studied."

The FAA should categorize AT-CTI schools based on the strength of a program's curriculum, the panel said. It proposed four levels for the training institutions, ranging from those that teach only the basics to those that teach the basics and all options — tower, terminal radar, en route and non-radar — with supporting laboratories for each option.

"Combining the methodology of evaluating AT-CTI schools and assigning a level to each program with the idea of tracking all selectees by hiring source (and, if AT-CTI, by level) from initial selection through full qualification will allow the FAA to determine the most efficient and most cost-effective groups to be trained as air traffic controllers," the report says. "This, in turn, should reduce attrition rates of those selected for training."

The panel could find no studies on the validity of the Air Traffic Selection and Training (AT-SAT) test battery given to applicants. "To improve the predictability of the AT-SAT battery, it is important for the FAA to attempt to correlate controller training success and failure with specific scores on AT-SAT," the report says.

The FAA's current methodology for candidate selection and placement is flawed, the panel said. Currently, it is conducted by a centralized selection panel. "Having been supplied with very little information, the selection panel is operating in the blind and is making selections that will obligate the FAA for years to come," the report says. It recommends a two-step process: first, selection for training; second, assignment to a facility based on performance in training.

FAA Academy training and the facility assignment process. "It is widely acknowledged within the operational units that field-based training programs are struggling because a record number of inadequately prepared [FAA] Academy graduates are being assigned to their facilities," the report says.

'Opportunities to improve the preparation of new controllers became apparent.'

During the review, "opportunities to improve the preparation of new controllers became apparent." They include the following:

- "Improve the retention of basic ATCS knowledge by presenting the air traffic basic course material as early in the educational process as possible via online training";
- "Decrease the amount of initial training conducted in the field by reinforcing previously learned material through a cumulative testing strategy and providing advanced courses for terminal and en route ATCS candidates prior to [their] reporting to [ATC facilities]";
- "Improve the quality of Academy-based training by capturing additional performance samples during training; replacing the 'pass/fail' grading strategy with multilevel performance measures; and providing detailed Academy training records to the … facility manager" they are assigned to; and,
- "Incorporate performance criteria in the assignment decision by basing track and facility assignments on objective measures and using 'just-in-time' processes … to fill vacancies as soon as the resources are available."

The report says that the FAA should "delay the track [specialty] assignment until after the candidate's aptitude is assessed during initial training at the FAA Academy and use OJTIs [on-the-job training instructors] in this process. Given that different skills are required for each ATCS specialty, the panel recommends that the track assignment decision be delayed until after the candidate has the opportunity to demonstrate his or her aptitude for a particular specialty."

Field training. After a student successfully completes the Academy curriculum, he or she reports to a facility for field training — a combination of classroom, simulation and on-the-job training.

The panel requested data from 32 FAA facilities about the OJTIs working there. Their tenure since certification averaged 10.5 years, and "at least one facility averaged over 15 years and several individual OJTIs exceeded 25 years since certification."

The FAA provides no recurrent or refresher training to these OJTIs, the report says. "Establish an annual refresher course for OJTIs," the panel recommended. "This course must include classroom exercises applying any new training techniques while refreshing competency on established key training elements."

Increased use of simulators is important in reducing training times and costs, the report says, adding that the FAA has made progress in this area, installing high-fidelity simulators at Chicago O'Hare, Miami, Ontario (California) and Phoenix.

However, "anecdotal reports suggest that the deployed tower simulators may be underutilized because of factors such as distance, travel time, available training time remaining and faculty staff scheduling." The report includes a recommendation to "continue to move forward with the implementation of simulation technology in field training. The FAA should consider the implementation of simulation of differing degrees of fidelity. A laptop-based simulation program can provide gains in training efficiencies at smaller facilities, reducing the on-the-job training time needed. While it may not provide the same gains as a high fidelity system, it offers an alternative [for] an outlying, low-complexity facility."

Professional standards. "Recent publicized events involving controller professionalism have brought attention to the question of ATCS professional standards. … The panel looked at the training of ATCSs at all levels for the application of the concepts of professionalism."

The report says, "The current training provided at the Academy does not adequately establish a true concept in professionalism. … Nearly all well-known professions (e.g., medical and legal) require an ethics- and professionalism-based course for completion of a particular study. There is no current requirement for a course similar to these for air traffic controllers."

The panel urged that the FAA "develop an introductory professionalism curriculum. This curriculum could be added to the air traffic basics course as required curriculum for all AT-CTI programs. It would provide initial exposure to the code of the professional air traffic controller."

It also recommended that a class on professional standards should be part of Academy training.

Organizational structure and responsibilities. "The panel considered how the FAA organizational structure supports delivery of air traffic technical training including … the stakeholders in successful delivery, their relationships, roles and responsibilities, communication, and coordination."

The report suggests that various units within the FAA's ATC hierarchy are stakeholders whose operations do not mesh smoothly. "Needed communications between stakeholders are either not formally documented or not accomplished," it says.

A reorganization did not help matters, the report says: "The anecdotal evidence suggests that the realignment of the Air Traffic Service (ATS) into the Air Traffic Organization (ATO) included changes that have impacted training delivery. For example, prior to the ATO structure of three service areas (western, central and eastern), the ATS training functions were organized and co-located with other FAA units in nine regions, each coordinated through a regional office structure with a traditional vertical hierarchy that reported to headquarters offices. …

"The decision to place the functions in the service centers but outside the direct vertical report to the service units has evidently had unintended consequences on the offices which support ATO delivery of technical training. … This organizational environment reportedly forces service center staff to ferret out information that should be readily available. Such a dysfunctional dynamic between groups sets up the organization to be ineffective, with unproductive use of resources and ill-informed decisions."

The report recommends that the FAA "clarify and document the specific roles and responsibilities of personnel *within each office* that contributes, receives or uses information related to provisioning of air traffic technical training, inclusive of the ATO service units, service areas, service centers and facilities, as well as any other FAA offices.

"Clarify and document the specific roles and responsibilities *between offices* that contribute, receive or use information related to provisioning of air traffic technical training."

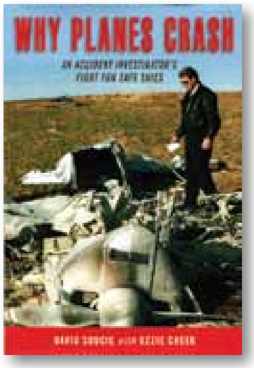
'Continue to move forward with the implementation of simulation technology in field training.'

BOOKS

Journey of Discovery

Why Planes Crash: An Accident Investigator's Fight for Safe Skies

Soucie, David, with Ozzie Cheek. New York: Skyhorse Publishing, 2011. 240 pp. Photographs, appendix, bibliography.



As the title implies, this is an autobiographical account rather than an analytical study. As such, it sometimes seems dramatized. But it also puts a human face on the technical and forbidding world of accident investigation, as well as offering the author's view about what he sees as institutional politics and dysfunction at the U.S. Federal Aviation Administration (FAA).

As a young maintenance director for an air ambulance service, David Soucie made a decision not to install wire-strike prevention kits on the emergency air medical service's Bell 206 helicopters. He felt constrained by the budget he had been given and his company's financial situation. Moreover, the company had never had a wire strike.

And then it did. One of its pilots was killed.

"This tragedy changed the course of my life and set me on a long journey of discovery," Soucie says. "I became a passionate student of the complexities and interdependencies of hazard, probability and risk. Over the following years, I was driven to learn more about how to recognize hidden accident indicators or precursors that could make business decision makers and regulators aware of a possible accident, to understand what those indicators tell them about imminent threats to safety and to find ways to prevent an accident."

For most of his career, Soucie says, he was an investigator and manager at the FAA.

Why Planes Crash is a mixture of anecdotes, incidents from Soucie's personal life, his self-criticisms, a large cast of characters, accounts of perceived back stabbing by associates, wisecracks, a near-death experience involving an other-worldly vision, and his allegations about the FAA's philosophy of risk management:

"After [the U.S. airline industry's] deregulation, the way in which the FAA approached safety improvements changed dramatically. The change was that the FAA had to provide proof that any proposed regulation would prevent future loss of life and that the benefit of the safety initiative outweighed the cost for both the government and the aviation industry. This was the same situation I faced … when I refused to put wire-strike kits on helicopters. The proof of their value came *after* a disaster. The FAA can prove the safety value of a proposed change only by waiting for a disaster to occur, which proves its value."

Soucie also criticizes FAA internal operations, with statements such as, "I was learning that the FAA is like the sea, where fish swallow other fish simply as a way of life."

The co-author is described on the book jacket as a "writer, producer and published short story author." Indeed, there is more than a whiff of script doctoring in the dialogue. On the day he is invited to join the FAA, for instance, Soucie confesses to his wife Jill that he forgot to get her the diamond anniversary ring he had promised her.

"'I know that,' she said. Only then did she turn to me and smile. 'David, I've had a front-row seat. I've watched you struggle with your conscience since [the pilot's] death, and I couldn't change it. I know you feel responsible and need to make it right.' As usual, Jill seemed to know me better than I knew myself. 'I'm just happy you've finally found a way.'"

There is no reason to doubt that the incident happened, but only a character in a made-for-TV movie *talks* like that.

Why Planes Crash did not strike this reader as offering new insight into the causes and amelioration of accidents, but a general audience will learn from it important risk management concepts and the entertaining story of one safety professional's experiences.

Runway Work Area Grazed on Takeoff

Flight crew disregarded reduced available runway distance.

BY MARK LACAGNINA

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

JETS

'Impaired Performance' Cited

Boeing 737-800. Minor damage. No injuries.

The flight crew's "failure to take into account the length of the runway available for takeoff" caused a serious incident in which the 737 struck temporary lights and safety-barrier markings adjacent to a construction work area on a runway at Paris Charles de Gaulle Airport on Aug. 16, 2008, said a report issued in August by the French Bureau d'Enquêtes et d'Analyses (BEA).

The report said that factors contributing to the incident were inadequate procedures established by the operator for the use of the on-board performance tool to calculate takeoff performance parameters and the "impaired level of crew performance, specifically related to the pilots' fatigue."

The 737 was three hours late when it arrived in Paris at 2125 coordinated universal time (2325 local time). While taxiing to the gate, the captain requested that police board the airplane because of a conflict that had arisen between a flight attendant and a passenger who had smoked in a lavatory.

"During the stopover, the copilot programmed the FMS [flight management system]," the report said. "The captain handled the police presence and asked the ground-handling-company agent to complete the weight-and-balance sheet."

Both the flight crew and the operator, an Egyptian charter airline, told BEA investigators that the copilot used the on-board performance tool, an electronic flight bag software program provided by Boeing, to calculate takeoff performance data, including airplane configuration, thrust setting and V-speeds. The captain then used the program to cross-check the copilot's calculations.

The pilots planned to take off on Runway 27L from the intersection of Taxiway Y11, which was the closest to their gate. The available takeoff distance on Runway 27L was reduced by about one-third by a construction area at the departure end of the runway. Taxiway Y11 was 600 m (1,969 ft) from the approach end, leaving 2,360 m (7,743 ft) of runway available for takeoff.

Investigators found that the flight crew did not include the restrictions to the available runway takeoff distance in their performance calculations, which also resulted in their use of a reduced thrust setting for takeoff.

"The pilots indicated … that they had experienced difficulties in understanding the restrictions in force, whether listening to the ATIS [automatic terminal information service] or reading the Jeppesen charts and the NOTAM [notice to airmen]" information about the restrictions, the report said.

The pilots may have lacked the mental alertness required for the takeoff performance calculations, the report said. "Time pressure, increased by the incident with a passenger that the captain had to handle during the turnaround, as well as the physiological strain caused by the flight schedule, had affected the pilots' capacity to handle a delicate phase of the flight together."

The report noted that the airline had not established specific procedures for using the on-board performance tool, relying on pilots to employ the procedures learned while training for their type ratings. "The operator did not make available to crews any operational backup for the use of this new tool, to lighten their workload," the report said.

The 737 barely cleared a temporary blast fence adjacent to the construction area.

The airplane left the gate at 2245, and while taxiing, the crew was asked by the ground traffic controller whether they preferred to begin the takeoff from the intersection of Taxiway Y11 or from Taxiway Y12, which was closer to the approach threshold and from which 2,640 m (8,661 ft) of runway were available. The crew replied that they preferred to use Y11. The controller approved the request and told the crew that 2,360 m of runway were available for takeoff from that intersection.

The crew was cleared for takeoff as they approached the Y11 intersection. As the airplane reached rotation speed at 2257, both pilots heard a loud noise when the nose landing gear struck an object. The report said that after striking the lights and markers on rotation, the 737 barely cleared a temporary blast fence adjacent to the construction area.

None of the 192 people aboard was hurt, and damage to the airplane was minor. "The crew realized that they had struck objects on the ground," the report said. "They carried out a systems and parameters review, then decided to continue the flight to the destination." The flight continued to Egypt without further incident.

After landing, the airplane was found to have slight damage to an engine fairing and to the horizontal stabilizer, a detached support for a main landing gear electrical harness and a deep cut in a nose landing gear tire.

The crew did not report the incident to controllers at the Paris airport. There apparently were no other departures on Runway 27L before debris was reported about two hours later by a flight crew that was cleared to cross the runway.

Long Landing Leads to Overrun

Gulfstream IV. Minor damage. No injuries.

As the G-IV neared Teterboro (New Jersey, U.S.) Airport the afternoon of Oct. 1, 2010, the flight crew received the ATIS information, which included 2 mi (3,200 m) visibility in rain and mist, an 800-ft broken ceiling and winds from 360 degrees at 6 kt, gusting to 16 kt. Because of the wind conditions, the captain decided to add 10 kt to the landing reference speed (V_{REF}), which resulted in a target approach speed of 146 kt, according to the report by the U.S. National Transportation Safety Board (NTSB).

The crew conducted the localizer approach to Runway 06, which was 6,013 ft (1,833 m) long and had a grooved asphalt surface. Airspeed was on target as the airplane descended through 1,000 ft, and the captain disengaged the autopilot.

"As the airplane descended through 700 ft, the copilot obtained a wind check from the tower controller, which indicated the wind was from 010 degrees at 15 kt, gusting to 25 kt," the report said.

Airspeed decreased to 136 kt in turbulence as the approach continued. The captain disengaged the autothrottle and increased thrust to regain the target approach speed.

"The copilot made airspeed callouts throughout the approach, which included 'V_{REF} plus 15' as the airplane descended through 200 ft and 'V_{REF} plus 15' again as the airplane was 40 ft above the runway," the report said.

Neither pilot called for a go-around. "The airplane descended into ground effect at 150 to 160 kt, floated and bounced before finally touching down with approximately 2,250 ft [686 m] of runway remaining," the report said.

The captain applied wheel braking and activated the thrust reversers; the ground spoilers and anti-skid system engaged automatically. However, the G-IV overran the runway at 40–50 kt and came to a stop 100 ft (30 m) within the engineered material arresting system.

The seven passengers, the flight attendant and the pilots escaped injury. An inspector for the U.S. Federal Aviation Administration observed damage to the airplane's landing light and foreign object damage to both engines.

Loose Coupling Causes Fire

Boeing 747-400. Substantial damage. 21 minor injuries.

The 747 was being taxied for takeoff from Mumbai (India) Airport the morning of Sept. 4, 2009, when a pilot in another company aircraft saw fuel gushing from the 747's left wing and radioed the company dispatcher. The dispatcher tried unsuccessfully to contact the 747 flight crew on the company radio frequency.

The fuel leak also was observed by an engineer, who removed his jacket and waved it to attract the crew's attention. The 747's cabin crewmember-in-charge saw him but, not understanding why he was signaling, ignored him, said the report by the Indian Directorate General of Civil Aviation.

Another witness, the operator of an airport ground vehicle, radioed the airport control tower. A controller informed the flight crew about the fuel leak and then told them to shut down the engines because a fire had erupted.

"The crew carried out the emergency shutdown [procedure] for all the engines and discharged the fire bottle for the no. 2 and no. 1 engines," the report said. The external fire was extinguished rapidly by airport fire services personnel.

"The cabin crewmember-in-charge ordered an evacuation from the right-hand side," the report said. "All [213] passengers and [16] crew evacuated the aircraft safely through slide chutes." Twenty-one passengers sustained minor injuries during the evacuation.

The fire damaged the 747's no. 1 engine and pylon, as well as the bottom of the left wing and its leading and trailing edges.

Investigators traced the leak to a fuel line coupling assembly that had not been tightened properly either during replacement of the fuel line during a D check in June 2005 or during the removal and reinstallation of the coupling during a C check in September 2008.

Rotation of the coupling and detachment of its safety wiring during subsequent flights eventually led to a fracture from which fuel leaked onto the hot no. 1 engine while the aircraft was being taxied at Mumbai, the report said.

Wing Contamination Triggers Stall

Bombardier Challenger 604. Destroyed. One fatality, two serious injuries.

Contamination of the wing leading edge by snow caused an asymmetric loss of lift on takeoff, resulting in a crash at Almaty (Kazakhstan) Airport the night of Dec. 26, 2007, said an English translation of the final report released in June by the Interstate Aviation Committee.

The aircraft was on a charter flight from Hannover, Germany, to Macao, China, and was landed at Almaty at 0046 local time to refuel. The report said that the Challenger was within weight-and-balance limits after being refueled.

Weather conditions at the airport included 2,800 m (1 3/4 mi) visibility in light snow and mist, an outside air temperature (OAT) of minus 13 degrees C (9 degrees F) and a dew point of minus 14 degrees C (7 degrees F).

At 0217, the flight crew told the airport ground controller that they would be ready to start the engines after the application of deicing and anti-icing fluids on the aircraft was completed. The report said that the application of the fluids was performed properly and was completed at 0243.

After starting both engines, the crew completed an abbreviated "After Engine Start" checklist that did not include items on the airplane flight manual (AFM) checklist, such as checks of the wing and engine cowl anti-icing systems, which use engine bleed air for heating.

At 0247, the crew requested and received clearance to taxi. When they reported that they were ready for takeoff at 0252, the airport traffic controller told them to wait at the holding point because another aircraft was on a 14-km (8-nm) final approach. The crew subsequently was cleared to line up and wait on the runway, and then was cleared for takeoff at 0301.

An abbreviated 'After Engine Start' checklist did not include … checks of the wing and engine cowl anti-icing systems.

The right wing stalled just after liftoff, and the Challenger rolled right more than 60 degrees. The right wing tip touched the runway, and the aircraft struck the ground and a reinforced airport fence. The copilot was killed, and the passenger, flight attendant and pilot-in-command (PIC) sustained serious injuries. The aircraft was destroyed by the impact and fire.

The right wing stalled just after liftoff, and the Challenger rolled right more than 60 degrees.

Investigators determined that the wing anti-icing system was not activated before takeoff. The cockpit voice recording indicated that while conducting the "Line Up" checklist, the PIC told the copilot, the pilot flying, that he would activate the wing anti-icing system during the climb.

The PIC told investigators that he did not perceive a risk of icing, in part because the anti-icing fluid would provide protection for 30 minutes after its application. "Therefore, the PIC decided to use the engine thrust wholly for the takeoff roll and engage the wing anti-ice right after the takeoff," the report said, noting that the AFM requires activation of the wing anti-icing system before takeoff when the OAT is at or below 5 degrees C (41 degrees F) and visible moisture is present.

The report discussed two other accidents involving Challengers and two accidents involving Bombardier CRJs that entered uncommanded rolls on takeoff. "All the investigations revealed that the contamination of the wing leading edge (with snow, frost, etc.) was one of the main factors contributing to the accident," the report said.

In 2008, Transport Canada issued several airworthiness directives requiring, in part, application of anti-icing fluid and activation of the wing anti-icing system before takeoff under certain conditions, as well as specific training for pilots on takeoff procedures and winter operations.

Erroneous Overspeed Warnings

Boeing 767-300. No damage. No injuries.

The 767 was en route with 206 passengers and 10 crewmembers from Chicago to Warsaw, Poland, the night of June 29, 2009. While cruising in instrument meteorological conditions (IMC) and light to moderate turbulence at Flight Level 330 (approximately 33,000 ft) over Ontario, Canada, the airspeed indicated on the captain's primary flight display (PFD) suddenly increased from 276 kt to 320 kt, the maximum operating speed.

At the same time, the altitude indicated on the captain's PFD increased by 450 ft, said the report by the Transportation Safety Board of Canada (TSB). The autopilot responded by pitching the aircraft nose-down about two degrees. An overspeed warning was generated, and the captain manually reduced thrust to flight idle, causing the autothrottle to disengage.

The autopilot then pitched the aircraft nose-up about 8 degrees. The captain disengaged the autopilot and, with the thrust still at flight idle, increased the pitch attitude to 12 degrees. Indicated airspeed initially decreased to 297 kt but then rapidly increased to 324 kt, triggering a second overspeed warning.

The 767 climbed to 35,400 ft and then began to descend. "The aircraft was descending through 34,500 ft with the captain's airspeed indicator decreasing through 321 kt and the overspeed warning on when the stick shaker [stall warning] activated," the report said.

The overspeed warning continued for about 45 seconds, while the stick shaker remained active for nearly two minutes. "When the aircraft had descended through approximately 30,000 ft with the captain's airspeed indicating 278 kt, the captain increased thrust, and, within nine seconds, the stick shaker stopped," the report said.

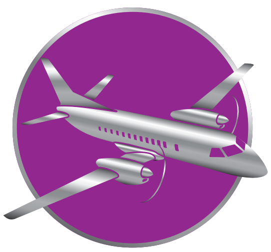
The airspeed indicated on the captain's PFD decreased rapidly to 230 kt, and there were no more airspeed-indication fluctuations. The crew diverted the flight to Toronto, dumped fuel and landed the 767 without further incident.

"Throughout this event, the first officer's airspeed indicator displayed information that was not indicative of an overspeed event," the report said, noting that the crew believed the erroneous airspeed and altitude indications on the captain's PFD were correct.

An inspection of the 767 revealed no structural damage and no faults in the air data system. The aircraft subsequently was returned to service.

About a month later, however, another flight crew in the incident aircraft received an overspeed warning and observed discrepancies between the airspeed and altitude indications on the captain's PFD and those on both the first officer's PFD and the standby instruments. When the captain changed his air data computer (ADC) setting from normal to alternate while conducting the "Airspeed Unreliable" checklist, the overspeed warning stopped and the indications on his PFD returned to normal.

Tests performed by the airline after the second incident revealed that the erroneous airspeed and altitude indications had been caused by a fault in the ADC phase-locked-loop circuitry.



TURBOPROPS

Deceptive 'Hole' in the Weather

Beech King Air B100. Destroyed. Four fatalities.

Before departure, the pilot received three weather briefings from flight service station specialists who said that severe weather conditions associated with a squall line could be expected along the planned route of flight from Uvalde, Texas, U.S., to Leesburg, Florida, the morning of Oct. 26, 2009.

"The pilot expressed concern about these conditions and altered his route of flight further south so he could maneuver around and through 'holes' in the weather," or clear areas depicted by the King Air's weather radar system, the NTSB report said.

Recorded air traffic control (ATC) radar data showed that the pilot initially flew a southerly course west of the area of severe weather but, about 30 minutes into the flight, requested a heading of 150 degrees, toward a hole in the weather in the direction of Corpus Christi, Texas, a navigation waypoint on his original flight plan.

The controller said that he also saw a clear area to the southeast and told the pilot to fly a 120-degree heading and proceed direct to Corpus Christi when able.

While on that heading, "the airplane flew into a line of very heavy to intense thunderstorms during cruise flight at 25,000 ft before the airplane began to lose altitude and reverse course," the report said. "The controller queried the pilot about his altitude loss, and the pilot mentioned that they had 'gotten into some pretty good turbulence.' This was the last communication from the pilot before the airplane disappeared from radar."

The pilot had lost control of the King Air, which broke up during a rapid descent and struck terrain near Benavides, Texas.

The controller told investigators that when the pilot requested the heading change, his radar display "showed a large hole in the line of weather that he believed the airplane could pass through safely," the report said, noting that recorded weather data and a statement by another controller working the sector at the time contradicted this observation.

NTSB concluded that the probable causes of the accident were "the pilot's failure to avoid severe weather and the air traffic controller's failure to provide adverse-weather-avoidance assistance."

Overheated Brakes Cause Fire

Bombardier Q400. Substantial damage. No injuries.

After arriving on stand at Amsterdam (Netherlands) Schiphol Airport on Oct. 10, 2010, the aircraft's left main wheel caught fire. The 54 passengers, who were about to disembark through the rear exit, were directed by cabin crewmembers to the front exit, where they vacated without harm directly into the terminal.

"The fire went out after approximately two minutes, although the wheel continued to emit smoke until cooled by the AFRS [aerodrome fire and rescue service]," said the report by the U.K. Air Accidents Investigation Branch (AAIB).

An investigation by the operator of the Q400 determined that the brake assembly was not fully released during the 14-minute taxi from the runway to the stand. "The heat generated by the brake caused the grease in the wheel hub to melt, leak out and ignite when it came into contact with the hot brake units," the report said.

Bird Strike Causes Flameout

Beech King Air B100. Substantial damage. No injuries.

Shortly after rotating the King Air for takeoff from Montmagny (Quebec, Canada) Airport the evening of Sept. 22, 2010, the flight crew saw a large flock of gulls, estimated between 100 and 200, on the departure end of the runway. As the aircraft approached, the gulls took flight, creating what the crew described as a "whiteout," the TSB report said.

Several gulls were ingested by the left engine, which lost power about 40 ft above the runway, causing the aircraft to yaw and roll left. The copilot helped the pilot level the wings, but the King Air descended and touched down on the runway.

The pilot rejected the takeoff, and the aircraft came to a stop in a ditch about 500 ft (152 m) from the end of the 3,010-ft (917-m) runway. There was no fire, and the four passengers and the pilots evacuated without injury.

Because of its proximity to migration paths over the St. Lawrence River and to a farm that attracts birds, the airport uses shotguns to "selectively kill" congregating birds and flare guns and a propane cannon to try to scare them away, the report said. The cannon was out of service when the accident occurred.

No large congregations of birds had been seen either by the King Air crew while taxiing or by the pilot of a Cessna 206 that departed five minutes earlier. Investigators were unable to determine when the gulls landed on the end of the runway. The report also noted that the crew's vision might have been impaired while taking off to the west, into the setting sun.

PISTON AIRPLANES

Lost in the Clouds

Gippsland GA-8 Airvan. Destroyed. One minor injury.

Marginal visual meteorological conditions (VMC) prevailed when the Airvan departed from Flinders Island, Tasmania, Australia, for a visual flight rules charter flight with six passengers to Bridport the evening of Oct. 15, 2010. While climbing to the intended cruise altitude, 1,500 ft above ground level, the single-engine utility aircraft entered IMC.

"The pilot did not hold a command instrument rating, and the aircraft was not equipped for flight in IMC," said the report by the Australian Transport Safety Bureau (ATSB). "He attempted to turn the aircraft to return to [the departure airport] but became lost, steering instead toward high ground in the Strzelecki National Park in the southeast of Flinders Island."

The Airvan was very close to the ground when it exited the clouds. "The pilot turned left [to avoid rising terrain], entering a small valley in which he could neither turn the aircraft nor outclimb the terrain," the report said. "He elected to slow the aircraft to its stalling speed for a forced landing."

One passenger sustained minor injuries when the aircraft struck treetops and then the ground. "During the night, all the occupants of the aircraft were rescued by helicopter and taken to the hospital [on] Flinders Island," the report said.

Disoriented in Fog

Piper Aerostar 601P. Destroyed. Two fatalities.

Visibility was 1/2 mi (800 m) in fog and vertical visibility was 100 ft when the Aerostar departed from Aurora, Illinois, U.S., the evening of Jan. 23, 2010. After taking off from Runway 09, the pilot was told to turn left to a heading of 270 degrees.

"The airplane's turning ground track and the challenging visibility conditions were conducive to the onset of pilot spatial disorientation," the NTSB report said.

Although the pilot told ATC that he was at 1,300 ft, climbing to 3,000 ft, a witness saw the Aerostar fly overhead at treetop height. The airplane then struck trees and the ground about 2.3 nm (4.3 km) north-northeast of the airport. Portions of the right wing struck a garage on a house, and small pieces of the wreckage penetrated the kitchen windows. None of the four people in the house was injured.

The pilot had 25 hours of multiengine flight time and 73 hours of instrument time when he purchased the Aerostar three months before the accident. The flight instructor who had trained the pilot for his commercial license and instrument rating told investigators that he had tried to "talk the pilot out of buying the Aerostar because he thought it was too much airplane for him to handle," the report said.

The pilot received 52 hours of training in the Aerostar from another instructor. The training was completed within seven days. "The instructor stated that he told the pilot that the airplane was 'unforgiving' and that it did not have a lot of lateral stability," the report said.

Wake Causes Control Loss

Piper Chieftain. Destroyed. Two fatalities.

While completing the final segment of a cargo flight, the flight crew was sequenced third for landing at Vancouver (British Columbia, Canada) Airport in VMC the night of July 9, 2009. The Chieftain was on a left base leg for Runway 26R when the airport traffic controller pointed out an Airbus A321 on final approach.

The TSB report said that after the crew reported the traffic in sight, the controller told them to follow the A321 "but not too far behind, as another Airbus flight was 8 nm [15 km] from the preceding Airbus." The controller also cautioned the crew about wake turbulence.

The Chieftain was turned onto the final approach course 1.5 nm (2.8 km) behind and 700 ft below the A321's flight path. Shortly thereafter, ATC lost radar contact with the aircraft.

The wreckage was found in an industrial area 3 nm (6 km) from the runway. "There was a post-impact explosion and fire," the report said. "The two crewmembers on board were fatally injured. There was property damage but no injuries on the ground."

The report said that the accident was caused, in part, by the Chieftain's encounter with wake turbulence, resulting in an upset and loss of control.

Based on the findings of this and other wake-turbulence accident investigations, TSB concluded that "the current wake turbulence separation standards may be inadequate" and that "visual separation may not be an adequate defense to ensure that appropriate spacing for wake turbulence can be established or maintained, particularly in darkness."

HELICOPTERS

Downwind Approach Goes Awry

Eurocopter AS 355-F2. Destroyed. Four minor injuries.

Surface winds were from the southwest at 25 kt, gusting to 35 kt, as the pilot conducted a low-speed circling approach to a landing site on a 2,054-ft hilltop in the Mourne Mountains of Northern Ireland the morning of Oct. 28, 2010.

During final approach on an easterly heading, the pilot sensed a sudden loss of airspeed and lift before the helicopter began to sink rapidly. He increased power by raising the collective control lever, but the helicopter descended to the ground and struck a stone wall before coming to a stop short of the landing site. The helicopter was destroyed, and the pilot, observer and two passengers sustained minor injuries.

"The investigation determined that an error of judgment or perception led the pilot to attempt a downwind approach," the AAIB report said.

Rotor Vibration Precedes Power Loss

Robinson R44. Substantial damage. No injuries.

A pilot who had just flown the R44 told the accident pilot that he had encountered slight main-rotor vibration, but no maintenance report was filed. The accident pilot then flew two sightseeing flights from Cairns, Queensland, Australia, the morning of Jan. 3, 2011.

Although pronounced vibrations were experienced during the second flight, the pilot elected to conduct another flight with three passengers, the ATSB report said. He told investigators that during an upwind turn, the R44 began to "shake quite badly," and that the rotor vibration increased as he turned back toward Cairns.

While descending through 400 ft, the engine failed without warning, and the pilot ditched the helicopter at the mouth of a river. The right float inflated only partially, and the helicopter rolled over in the water. All four occupants were able to exit the helicopter and were rescued by fishermen.

The report said that further damage incurred during salvage operations four days later "precluded any in-depth investigation of the main rotor assembly."

Preliminary Reports, August 2011

Date	Location	Aircraft Type	Loss Type	Injuries
Aug. 2	Santa Catarina, Brazil	Cessna 208 Caravan	total	8 fatal
The Caravan, operated by the Brazilian air force, was in a steep dive when it struck the ground in an area of strong winds and rain.				
Aug. 2	Ankara, Turkey	ATR 72	minor	4 minor/none
The aircraft was being prepared for departure when strong winds blew a ground power unit into the forward fuselage, destroying the radome.				
Aug. 3	Kasba Lake, Northwest Territories, Canada	Convair 580	total	30 minor/none
The Convair's nose landing gear collapsed while landing on a gravel runway.				
Aug. 3	Bitung, North Sulawesi, Indonesia	Bell 412	total	10 fatal
The helicopter was en route to a gold mine when it struck high terrain in an area of strong winds and low clouds.				
Aug. 5	Hackett River, Nunavut, Canada	Bell 407	total	5 minor/none
An uncontained engine failure occurred shortly after the pilot landed the helicopter in response to a chip-warning light. The 407 was destroyed by fire.				
Aug. 5	Calledizzo di Peio, Italy	Eurocopter AS 350	total	1 fatal, 4 minor/none
The helicopter was in a hover while disembarking avalanche-prevention workers when the tail rotor struck a rock. The AS 350 then crashed, killing the pilot.				
Aug. 8	Mumeng, Papua New Guinea	Eurocopter BO 105	total	3 fatal
The pilot was unable to land at a gold mine because of low clouds. The helicopter crashed in mountainous terrain while returning to Lae.				
Aug. 8	Blagoveshchensk, Russia	Antonov 24	total	36 minor/none
Thunderstorm conditions prevailed when the An-24 struck trees during an instrument landing system (ILS) approach and crashed off the right side of the runway.				
Aug. 9	Omsukchan, Russia	Antonov 12	total	11 fatal
The An-12 crashed in a remote area about eight minutes after the flight crew reported a fuel leak and an engine fire.				
Aug. 16	Afghanistan	Lockheed C-130	total	NA
The C-130 was landed without further incident after an RQ-7 unmanned aerial vehicle struck the left wing.				
Aug. 17	Beijing, China	Agusta Westland 139	total	4 fatal, 1 minor/none
The police helicopter was returning from a search-and-rescue exercise and was seen circling low over the calm surface of a reservoir when it struck the water.				
Aug. 17	Boca de Uchire, Venezuela	Bell 412	total	9 fatal, 1 serious
One passenger was rescued after the helicopter crashed in the Caribbean Sea.				
Aug. 18	Loma de Redo, Mexico	Eurocopter AS 355	total	2 fatal, 1 minor/none
The helicopter crashed while rescuing people in cars thrown into a river when a bridge collapsed.				
Aug. 19	near Macae, Brazil	Agusta Westland 139	total	4 fatal
The helicopter crashed in the ocean after the flight crew reported the loss of both hydraulic systems on departure from an oil platform.				
Aug. 20	Resolute Bay, Nunavut, Canada	Boeing 737	total	12 fatal, 3 serious
The ceiling and visibility were low when the 737 struck a hill about 1 nm (2 km) off the side of the runway following an ILS approach.				
Aug. 24	Lawas, Sarawak, Malaysia	de Havilland Twin Otter	major	18 minor/none
The nose landing gear collapsed when the Twin Otter veered off the runway while landing in strong winds.				
Aug. 26	Mosby, Missouri, U.S.	Eurocopter AS 350	total	4 fatal
The pilot, nurse, paramedic and patient were killed when the air ambulance crashed on approach.				
Aug. 28	South Malekula, Vanuatu	Hughes 500	total	1 fatal, 2 serious
The pilot was killed when the helicopter crashed in mountainous terrain.				
Aug. 29	Kochi, India	Airbus A320	major	1 serious, 141 minor/none
One passenger was seriously injured during an evacuation after the A320 veered off the runway while landing in heavy rain and strong, gusting winds.				

NA = not available

This information is subject to change as the investigations of the accidents and incidents are completed.

Source: Ascend