AeroSafety WORLD

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UNMET CHALLENGES

THE JOURNAL OF FLIGHT SAFETY FOUNDATION

OCTOBER 2010

STEPPING Forward

I thought I would take this opportunity to catch everyone up on what happened at the recent International Civil Aviation Organization (ICAO) Assembly. ICAO has one of these big meetings every three years — an opportunity to turn resolutions into international law, and to define the organization's work program for the next three years. Ninety percent of this meeting was about security and the environment, but there also were a couple of important safety issues to talk about.

ICAO has grasped the importance of data gathering, sharing and protection. It is investing in a major effort that will integrate information from ICAO, Europe, the United States, the International Air Transport Association (IATA) and others to create a truly global and relevant database of safety occurrences. More players will be joining the process, and we have started discussions to see how Flight Safety Foundation can help. Part of this database will be fed by the ICAO audit program that will transition from a program of periodic audits to a program of continuous monitoring of state safety activity (*ASW*, 4/10, p.19). The idea is that when something goes seriously wrong — or right — with a nation's safety oversight system, it shouldn't take three to six years for ICAO to notice it through the previous audit cycle and communicate its findings.

Continuous monitoring and data sharing will force regulators to raise their game a bit. There was plenty of debate about how this information is shared, and with whom. Countries all support the idea of data sharing in principle, but they pull back when they realize the data might make them look bad. Stay tuned for more on that.

Data protection is even a tougher problem than data sharing. If you have been keeping track, there have been a number of landmark cases in which judges have summarily dismissed data protections and released information we had all hoped would be protected. To point out just a few, consider the ruling to release the cockpit voice recorder material from the Air France Airbus A340 accident in Toronto, or the ruling that released confidential internal reports following an Air Canada tail strike, or the release to the media of a confidential British Airways report regarding an engine failure.

ICAO recognizes this problem and is stepping forward. The Assembly called for ICAO to rewrite the guidance and standards for the protection of safety data. This is going to be a very big deal. ICAO is now forming a multi-disciplinary task force that will bring in experts from both sides of the argument. There will be legal experts from the aviation safety world and the justice departments. The good news is that ICAO has asked the Foundation to play a prominent role in this task force. We have been working on this issue for the better part of a decade, and at this point, our contribution is recognized and welcomed.

It will be up to this task force to find some sort of reasonable approach toward data protection that can then be adopted nation by nation. Don't expect miracles, but some momentum may finally develop, and some protections may finally fall into place. In the meantime, we will hope for the best and work really hard.

William R. Voss
President and CEO
Flight Safety Foundation

AeroSafetyWORLD

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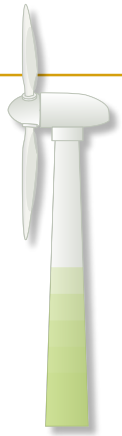

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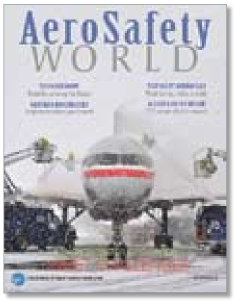

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Audit finds good compliance with deicing rules.
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RETURN TO PILOT Experience

When the U.S. Congress recently passed a law requiring pilots to possess an airline transport pilot (ATP) certificate before flying as second-in-command (SIC) for an airline operating under Federal Aviation Regulations Part 121, it gave the industry the ability to improve on what initially was a meat-ax approach to setting pilot qualification standards (*ASW*, 9/10, p.12). While the ATP specification would require a candidate pilot to have at least 1,500 hours of flight time, the law also allows the U.S. Federal Aviation Administration (FAA) to substitute academic training for part of that total.

An aviation rulemaking committee (ARC) of regulators and user groups was convened to study this opportunity. That report, we understand, would allow academics, combined with specific types of actual flight experience and qualifications, to bring down the total required flight time to 500 hours to qualify for a new class of license, ATP–SIC, adding the requirement that the SIC possess a type rating in the aircraft being used. The training and the flight experience required would be detailed and extensive, including new requirements for experience in multi-engine, multi-pilot, turbine-powered aircraft.

This decision was reached through the study of records from the industry's training and hiring of pilots for the nation's regional airlines, where most pilots enter the world of Part 121 flying. We are not talking about little mom and pop operations with a few airplanes; we're talking about a sophisticated industry where individual carriers fly hundreds of jet-powered aircraft over wide-ranging route networks.

These professional organizations of business necessity have thorough procedures for selecting and completing the training of pilots, and they keep detailed records on what previous training these pilots had so that they can correlate how the nature of the training affected the outcome.

Using this information and other available facts, the ARC produced a program firmly anchored in empirical data that would substantially strengthen the quality of pilots entering Part 121 service.

We understand there were numerous dissenting opinions within the ARC, including some that argued for raising the barrier to the right seat even higher than the original law, using as justification essentially the same idea that drove the legislation in the first place: Four of the last five fatal airline accidents have involved regional carriers, which in many cases hire less-experienced pilots.

Other dissenters noted that no safety studies have correlated SIC experience with recent regional airline accidents, and that in the most recent 14 regional accidents, five were flown by the captain and, in the remainder, the SICs flying had either an ATP, more than 2,000 hours or both. It must also be mentioned that military pilots are launched into the air with far fewer hours of flight experience, buttressed by an extensive and proven academic foundation.

It is exasperating to see the pilot qualification process turned on its ear based on emotional and, in the case of pilot unions, financial arguments that ignore science and data-based air safety investigations.

However, if the product of the ARC can be sustained, the result of this process will be a truly enhanced and clearly detailed path from the start of flying to the right seat of a Part 121 airliner. It also will preserve the role of the important system of aeronautical universities and advanced training schools that underpin the higher levels of aviation professionalism, that, if left to the unaltered legislation, would be severely threatened.

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

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

OCT. 19–21 ➤ NBAA 2010: Advancing Business Through Aviation. National Business Aviation Association. Atlanta. Donna Raphael, <draphael@nbaa.org>, <www.nbaa.org/events/amc/2010>, +1 202.478.7760.

OCT. 22–23 ➤ TALPA Aviation Law Conference. Türkiye Airline Pilots' Association (TALPA). Istanbul, Turkey. Hacer Oz Ozcan, <hacerozcan@talpa.org>, <www.talpa.org/site/?p=1730>, +90 212.662.1201, ext. 15.

OCT. 25–28 ➤ International Aircraft Fire and Cabin Safety Research Conference. U.S. Federal Aviation Administration; U.K. Civil Aviation Authority; Transport Canada; National Agency of Civil Aviation of Brazil; Australia Civil Aviation Safety Authority; Singapore Civil Aviation Authority. Atlantic City, New Jersey, U.S. April Horner, <april.ctr.horner@faa.gov>; <www.fire.tc.faa.gov>; +1 609.485.4471.

OCT. 25–29 ➤ Aviation Safety Program Management. Embry-Riddle Aeronautical University. Daytona Beach, Florida, U.S. Sarah Ochs, <case@erau.edu>, <www.erau.edu/academic/ep-case.html>, +1 386.226.6928.

NOV. 1–5 ➤ Safety Management System Principles. MITRE Aviation Institute. McLean, Virginia, U.S. <mpthomps@mitre.org>, <www.mitremai.org/MITREMAI/sms_course/sms_principles.cfm>, +1 703.983.5573.

NOV. 1–5 ➤ Aircraft Accident Investigation and Management. Embry-Riddle Aeronautical University. Daytona Beach, Florida, U.S. Sarah Ochs, <case@erau.edu>, <www.erau.edu/academic/ep-case.html>, +1 386.226.6928.

NOV. 1–10 ➤ Safety Management System Theory and Application. MITRE Aviation Institute. McLean, Virginia, U.S. <mpthomps@mitre.org>, <www.mitremai.org/MITREMAI/sms_course/sms_application.cfm>, +1 703.983.5573.

NOV. 1–12 ➤ Accident Investigation for Aviation Management. Cranfield University. Bedfordshire, England. Graham Braithwaite, <g.r.braithwaite@cranfield.ac.uk>, <www.cranfield.ac.uk/soe/shortcourses/atm/page3523.html>, +44 (0)1234 754252.

NOV. 2–4 ➤ ERAU Wildlife Management Workshop. Embry-Riddle Aeronautical University. Dallas/Fort Worth International Airport. Al Astbury, <astbufc5@erau.edu>, <worldwide.erau.edu/professional/seminars-workshops/wildlife-hazard-management/index.html>, +1 386.226.7694.

NOV. 2–4 ➤ Advanced SMS Training. Prism Training Solutions. Denver. Kendra Christin, <www.aviationresearch.com>, +1 513.852.1010.

NOV. 2–5 ➤ 63rd annual International Air Safety Seminar. Flight Safety Foundation. Milan, Italy. Namratha Apparao, <apparao@flightsafety.org>, <flightsafety.org/aviation-safety-seminars/international-air-safety-seminar>, +1 703.739.6700, ext. 101.

NOV. 7–12 ➤ Global Safety Seminar 2010. Civil Air Navigation Services Organisation. Singapore. Anouk Achterhuis, <events@canso.org>, <www.canso.org/cms/showpage.aspx?id=1367>, +31 (0)23 568 5390.

NOV. 8–9 ➤ Human Factors for Aviation Managers and Technicians Workshop. Grey Owl Aviation Consultants. Las Vegas. Richard Komarniski, <richard@greyowl.com>, <www.greyowl.com>, +1 204.848.7353.

NOV. 8–10 ➤ 48th Annual Symposium. SAFE Association. San Diego. Jeani Benton, <safe@peak.org>, <safeassociation.com/symposium.htm>, +1 541.895.3012.

NOV. 9–10 ➤ Regulatory Affairs Training Course: Building and Maintaining Positive FAA Relationships. JDA Aviation Technology Solutions. Bethesda, Maryland, U.S. Michael Kushner, <mkushner@jdasolutions.aero>, <www.jdasolutions.aero/services/regulatory-training.php>, +1 301.941.1460, ext. 130.

NOV. 9–10 ➤ Air Traffic and Meteorology. Académie de l'Air et de l'Espace (French Academy of Air and Space). Toulouse, France. <anae@anae.fr>, <www.academie-air-espace.com/event/newdetail.php?varCat=14&varId=132>, +33 5 34 25 03 80.

NOV. 10 ➤ Safety Management Systems Workshop. Grey Owl Aviation Consultants. Las Vegas. Richard Komarniski, <richard@greyowl.com>, <www.greyowl.com>, +1 204.848.7353.

NOV. 10–11 ➤ Business Aviation Safety Seminar–Asia 2010. Flight Safety Foundation, International Business Aviation Council, National Business Aircraft Association, Asian Business Aviation Association and Singapore Aviation Academy. Singapore. Namratha Apparao, <apparao@flightsafety.org>, <flightsafety.org/aviation-safety-seminars/business-aviation-safety-seminar-asia-2010>, +1 703.739.6700, ext. 101.

NOV. 11 ➤ AViCON 2010. Aviation Disaster Conference: Investigating the Causes, Resolving the Claims. RTI Group. London. <www.rtiavicon.com>, +1 866.327.1165 (U.S.); +44 207 481 2150 (U.K.).

NOV. 15–19 ➤ Aviation Lead Auditor Training. ARGUS PROS. Denver. <John.Darbo@argus.aero>, <www.pros-aviationservices.com/alat_training.htm>, +1 513.852.1057.

NOV. 20–22 ➤ Safety Management System Course in Spanish. Total Resource Managment. Toluca, Mexico. Victor Manuel del Castillo, <info@smsenespanol.aero>, <www.factoreshumanos.com>, +52 722.273.0488.

NOV. 21–25 ➤ Crew Resource Management Instructor Training Course. Integrated Team Solutions. London. <sales@aviationteamwork.com>, <www.aviationteamwork.com/instructor/details_atticus.asp?courseID=7>, +44 (0)7000 240 240.

NOV. 23 ➤ Cabin Safety Inspector Theory (Initial Training). U.K. Civil Aviation Authority International. London Gatwick. Sandra Rigby, <training@caainternational.com>, <www.caainternational.com/site/cms/coursefinder.asp?chapter=134>, +44 (0)1293 573389.

NOV. 24–26 ➤ Safety Oversight Seminar. International Centre of Excellence for Space and Aviation. Harare, Zimbabwe. <boikiem.tripod.com/icesa/id5.html>.

NOV. 29–DEC. 1 ➤ CANSO Caribbean and Latin American Conference. Civil Air Navigation Services Organisation. Willemstad, Curaçao. Anouk Achterhuis, <anouk.achterhuis@canso.org>, <www.canso.org/caribbeanlatinamerica>, +31 (0) 23 568 5390.

DEC. 2–3 ➤ CANSO Caribbean and Latin America ATM Safety Seminar and Benchmarking Seminar. Civil Air Navigation Services Organisation. Willemstad, Curaçao. Anouk Achterhuis, <anouk.achterhuis@canso.org>, <www.canso.org/caribbeanlatinamerica>, +31 (0) 23 568 5390.

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

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

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

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

Member**Guide**

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Safety News

Plague of Locusts

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Pilots in Australia are being cautioned about the flight risks presented by swarms of locusts.

The insects fly at altitudes as high as 3,000 ft, in swarms of as many as 50 million; individual swarms can cover hundreds of kilometers, the Australian Civil Aviation Safety Authority (CASA) says. They can attract large numbers of birds, increasing the risk of bird strikes.

The density of the insects can reduce visibility when they strike windshields and can make it difficult for pilots to see features on the ground, CASA said. Locusts also can be ingested into engine intakes and pitot tubes, causing damage and making instrument readings unreliable, the agency said.

'Terrific Progress' on Runway Incursions

Wikimedia

The number of serious runway incursions at U.S. airports in fiscal year 2010 decreased 50 percent from the previous year, transportation officials said.

Six serious runway incursions, including three involving commercial aircraft, were recorded in the fiscal year that ended Sept. 30, the U.S. Federal Aviation Administration (FAA) said. There were 12 serious runway incursions in fiscal 2009, down from 24 in fiscal 2008 — a reflection of what the FAA described as a "steady, significant improvement in runway safety over the last decade." By comparison, in fiscal 2000, there were 67 serious runway incursions.

"We continue to make terrific progress in the area of runway safety," said Transportation Secretary Ray LaHood.

"The goal we are working toward is zero runway incursions," added FAA Administrator Randy Babbitt. "I'm confident that the right combination of education and technology will help get us there."

The declining numbers of runway incursions have coincided with an FAA effort to enhance runway safety by improving airport signage and markings, as well as pilot training.

New Rules on Investigations

The European Parliament has voted in favor of a new regulation to "strengthen the independence and effectiveness" of aviation accident investigations throughout the European Union — an action that the European Commission (EC) says will bolster accident-prevention efforts.

The new regulation also will increase cooperation between European accident investigation authorities, provide for a better follow-up to safety recommendations and strengthen the rights of accident victims.

"Efficient and independent investigations of civil aircraft accidents are crucial for aviation safety," said Siim Kallas, EC vice president in charge of transportation. "New rules will allow us to improve investigations, but most importantly, better prevent accidents from happening."

Wikimedia

The new regulation will establish the European Network of Civil Aviation Safety Investigation Authorities, which the EC described as a "natural continuation of the existing informal cooperation between air accident investigation bodies of member states. The network will coordinate cooperation between national authorities, advise EU institutions on air safety matters and implement an annual work program covering activities such as the training of investigators or developing a system for sharing investigation resources."

The regulation also "reconfirms the principle that the sole objective of accident investigation is to prevent future accidents without attributing blame or liability," the EC said.

"The regulation implements international standards on the protection of sensitive air safety information. In addition, while the regulation will not affect the prerogatives of the national courts and competent judicial authorities of member states, it will ensure that accident investigators have immediate access to evidence material and information which may be relevant for the improvement of aviation safety. Finally, it will require that member states guarantee coordination between accident investigations and judicial proceedings."

Lithium Batteries

Air carriers operating in the United States are being asked to implement new procedures for safely transporting lithium batteries (*ASW*, 3/10, p. 44).

Although the batteries are classified as Class 9 hazardous materials, most are currently exempt from regulations that require the pilot-in-command to be notified if Class 9 materials are in his or her aircraft.

Tests conducted by the U.S. Federal Aviation Administration (FAA) showed that lithium batteries possess "particular propagation characteristics" that become apparent if the batteries are overheated.

"Overheating has the potential to create thermal runaway — a chain reaction leading to self-heating and release of a battery's stored energy," the FAA said in Safety Alert for Operators (SAFO) 10017. "In a fire situation, the air temperature in a cargo compartment fire may be above the auto-ignition temperature of lithium. For this reason, batteries that are not involved in an initial fire may ignite and propagate, thus creating a risk of a catastrophic event."

The FAA recommended that all air carriers ask their customers to provide information on shipping documents to identify bulk shipments of lithium batteries that currently are exempt from such requirements; to stow bulk shipments of lithium batteries, whenever possible, in Class C cargo compartments "or in locations where alternative fire suppression is available"; to "evaluate the training, stowage and communication protocols in your operation with respect to the transportation of lithium batteries in the event of an unrelated fire"; and to emphasize careful handling of all Class 9 hazardous materials, including lithium batteries.

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Global Information Exchange

A new Global Safety Information Exchange is being established to help reduce accident risks and improve aviation safety worldwide.

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Partners in the creation of the exchange are the International Civil Aviation Organization (ICAO), the European Union, the International Air Transport Association and the U.S. Department of Transportation. Representatives of the four organizations signed a memorandum of understanding in late September declaring their intention to establish the exchange.

"The more effective and widespread sharing of safety information by regulators and industry can help to better identify existing and emerging risks in air transport operations, making it possible to take action before safety issues result in accidents," said ICAO Secretary General Raymond Benjamin.

The four organizations currently collect and analyze safety information, primarily through accident reports and safety audits, but the information typically is not available to outside organizations.

ICAO said it will coordinate the collection, analysis and exchange of aviation safety information under the new information exchange, and will disseminate the information in the global aviation community. The information will be exchanged "in the most efficient and secure manner possible, taking into consideration existing confidentiality legislation and agreements," ICAO said.

Helicopter Safety Surveillance

Australian helicopter operators will receive increased attention from regulatory authorities as part of an effort to improve the industry's safety record, John McCormick, director of aviation safety at the Civil Aviation Safety Authority (CASA), says.

McCormick cited data showing that, although helicopters account for 12 percent of all aircraft in Australia, they are involved in 25 percent of accidents.

CASA said recent data indicate that an increased number of applicants for positions as chief helicopter pilot are "failing prior to the actual check flight, with problems including an inability to interpret weather forecasts, poor flight planning and an inability to determine maximum takeoff weight."

"All these accidents can be prevented by improving training and concentrating on more than just the manipulative skill of the pilot," McCormick said, adding that CASA also will emphasize flight training "to achieve higher standards for the next generation of rotary pilots."

Fire and Smoke Protection

The aviation industry must develop new guidelines to improve aircraft fire protection, fire detection and fire fighting abilities, the International Federation of Air Line Pilots' Associations (IFALPA) says.

contri/Flickr

In a recent position paper, IFALPA called for adoption of a number of recommendations developed in the aftermath of the Sept. 2, 1998, crash of a Swissair McDonnell Douglas MD-11 off the coast of Nova Scotia, Canada. The crash killed all 229 people in the airplane, which was destroyed. The Transportation Safety Board of Canada (TSB) found that the crash resulted from a loss of control caused by a hidden on-board fire.

The organization said that it "believes that the results from the industry initiative on smoke and fire following the … accident should become industry best practice and be implemented worldwide. … A follow-up initiative is necessary to develop further industry guidelines to improve safety."

The follow-up initiative should address aircraft design, fire detection and fire fighting, protection of crew and passengers, the effects of new materials and survivability, IFALPA said.

An industry initiative after the crash recommended changes in procedures and checklists for in-flight fire, but some operators have not implemented those recommendations.

"There can be no doubt that the threat posed by in-flight smoke and fire is a serious one," IFALPA said. "This fact alone makes the case for not only the immediate implementation of recommendations made more than seven years ago but also [for] a further review of the threat and effective countermeasures."

In Other News …

The U.S. Federal Aviation Administration (FAA) has proposed a $4.9 million **civil penalty** against Evergreen International Airlines; the FAA says that, on 232 revenue flights, the airline used pilots who were not trained in an FAA-approved training program. Evergreen had 30 days from its receipt of the civil penalty notice to respond. … Eurocopter and Kannad were honored during a conference of aviation industry managers for their development of the Integra helicopter **emergency beacon**, which uses an internal global positioning system receiver and an integrated antenna to transmit distress data that can be detected by search-and-rescue systems.

Wo st 01/Wikipedia

Information Sharing

The U.S. Federal Aviation Administration (FAA) plans a data-sharing program enabling airlines to merge voluntary safety information that has been self-reported by pilots and air traffic controllers.

The FAA says the integrated data-sharing system will provide "a more complete picture of the national airspace system by collecting, assessing and reviewing safety events from the perspective of both pilots and air traffic controllers."

United Airlines and its pilots already have agreed to participate in a demonstration program, and the FAA said it expects similar agreements with other airlines in the future.

The program will merge information collected from pilots through United's aviation safety action program (ASAP) and from air traffic controllers through the FAA's air traffic safety action program. Both are voluntary reporting programs designed to encourage employees to report information that might aid in identifying risks that could lead to accidents. Those hazards are then addressed through corrective actions — not punishment or discipline.

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Compiled and edited by Linda Werfelman.

High Marks Overall

BY WAYNE ROSENKRANS

The fine safety record of U.S. cold weather operations still warrants integrated risk reduction, auditors say.

Despite years of safe winter operations, including those in last season's remarkably harsh conditions, U.S. airlines and the federal government must avoid complacency and refine risk reduction, concludes a report by the U.S. Government Accountability Office (GAO). Working from August 2009 to July 2010 to determine how risks of airplane icing and other winter hazards could be mitigated further, GAO auditors weighed the accident and incident history of large commercial airplanes[1] related to icing and contaminated runways in the United States; results of Federal Aviation Administration (FAA) inspection programs and enforcement of operator compliance with icing-related safety requirements (see "Airline Deicing Compliance," p. 15); results of FAA-industry initiatives on cold weather safety; and informed opinions about remaining challenges.

Inspection and enforcement policies were studied in conjunction with government databases, and subject specialists and aviation associations lent their expertise to a consensus view that icing remains a concern.

Non-government specialists told the auditors that meteorologists sometimes provide

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overly cautious forecasts that cover too broad a geographical area, and that excessive false alarms can result in airline pilots discounting subsequent forecasts of icing. "[Air Line Pilots Association, International] representatives also said that pilots do not know when they are entering severe conditions, as they are only given generalized statements about icing conditions," the report said. "Despite a variety of technologies … to mitigate icing risks … icing can be a significant hazard for aviation operations of all types, including commercial flights."

One difference between current winter operational priorities and those of the late 1990s has been recent approval for implementing the Next Generation Air Transportation System (NextGen), which includes comprehensive enhancements to weather services. "Currently, NextGen weather researchers are focused on creating technology and procedures that enable forecasters to provide pilots with more precise and accurate predictions of icing conditions, which they believe will address the problem of pilots ignoring traditionally unreliable icing forecasts and better communicate the existence of dangerous weather conditions to pilots," the report said.

The FAA's 1997 *Inflight Aircraft Icing Plan* focused on in-flight icing, intentionally excluding ground-level icing issues. "Yet contaminated runways … pose hazards to planes during takeoff and landing, and removing ice or preventing ice from forming on aircraft occurs not only during flight but also on the ground prior to takeoff," the report said. "Since it issued the plan, FAA's icing steering committee has identified many additional actions to reduce risks from icing, such as researching and developing approaches to mitigate the risk of [turbine engine] power loss from ice crystal ingestion. At [the GAO's] request, FAA provided … a lengthy compilation of the tasks it is undertaking with respect to icing; however, its *Inflight Aircraft Icing Plan* has not been publicly updated since the initial release in 1997." Periodic informal reports to the industry have been made, however.

The auditors concluded that a formal update would be preferable to provide all stakeholders "consolidated and readily accessible" details. "Furthermore … FAA is missing an opportunity to take a more holistic and coordinated approach to the broader range of issues related to winter weather, including ground icing and deicing, and contaminated runways," the report said.

Since 1997, the FAA generally has accomplished plan objectives by creating or amending regulations and airworthiness directives, and by refining guidance to airlines, flight crews and other stakeholders, auditors found. Examples cited were the August 2007 final rule on revised airworthiness standards for transport category airplanes in icing conditions; proposed amendments in January 2009 to icing-related training requirements for air carrier flight crews and dispatchers; the August 2009 final rule requiring "a means to ensure timely activation of the ice-protection system on transport category airplanes"; and proposed amendments in June 2010 related to supercooled large droplet icing, ice crystal and mixed phase icing conditions that fall outside icing conditions covered by current standards for specified transport airplanes and engines.

The GAO recommended creation of a new holistic plan to reduce cold weather–related operational risks and suggested that this formal plan contain more detailed goals, time frames and measurable milestones than previous plans. "A comprehensive plan could help identify gaps or other areas for improvement and assist FAA in developing an integrated approach to winter operations," the report said. "FAA should also periodically report to affected parties on its progress in implementing the plan, as well as any updates to the plan."

Hardly Any Accidents

The National Transportation Safety Board (NTSB) database showed that in the category of large commercial airplanes over a recent 10-year period, one nonfatal accident occurred after the airplane encountered in-flight icing conditions. GAO auditors found a total of five nonfatal accidents among large commercial airplanes involving snow or ice on runways. "Data on hundreds of incidents that occurred during this period reveal that icing, contaminated runways and other winter weather conditions pose substantial risk to aviation safety," the report said. "FAA's database of incidents includes 120 incidents related to icing, contaminated runways, taxiways or ramps, or other winter weather conditions involving large commercial airplanes that occurred from 1998 through 2007.

"These data covered a broad set of events, such as the collision of two airplanes at an ice-covered gate, and an airplane that hit the right main gear against the runway and scraped the left wing down the runway for about 63 ft [19 m] while attempting to land with ice accumulation on the airplane. During this same time period, the National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System (ASRS) received [more than] 600 icing and winter weather–related incident reports involving large commercial airplanes. These incidents reveal a variety of safety issues such as runways contaminated by snow or ice, ground deicing problems and in-flight icing encounters [Figure 1]. These incidents thus also suggest that risks from icing and other winter weather operating conditions may be greater than indicated by NTSB's accident database and by FAA's incident database."

FAA officials agreed that although ASRS reports can be subjective, the reports warrant ongoing review and also demonstrate the value of aggregating safety data from every known source. Operators of small commercial airplanes had more icing-related accidents and fatalities in the period than did operators of large commercial airplanes.

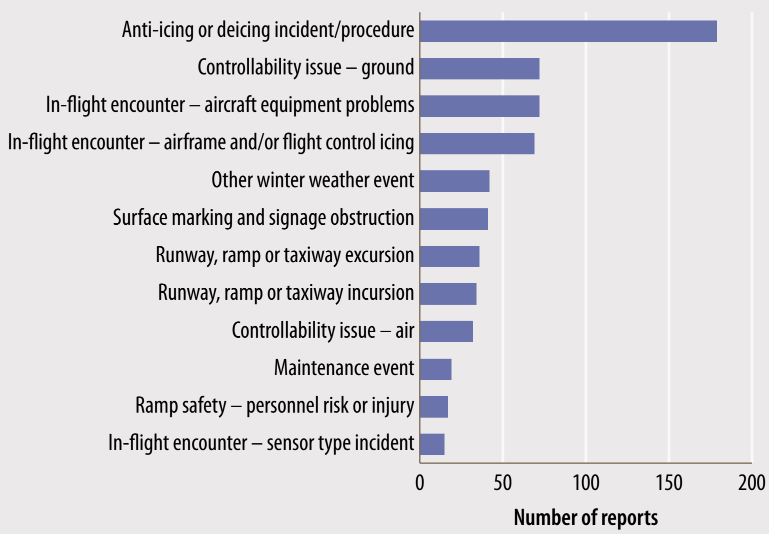
Basic/Applied Research

The FAA continues to conduct research on endurance times for deicing and anti-icing fluids, and provides separate annual guidance on best practices for other aspects of winter ground operations. "Regulations and guidance developed as a result of the ground icing program include a rule that no longer permits frost to be polished smooth on critical surfaces prior to takeoff and requires pilots to ensure that the wings of their aircraft are free of all frost prior to takeoff," the report said.

FAA funding from 1999 to 2009 supported NASA research on severe icing conditions and National Center for Atmospheric Research (NCAR) research on weather and aircraft icing. GAO analysis also found FAA funding simultaneously enabled airports to construct deicing facilities and to acquire aircraft deicing equipment. Meanwhile, stricter environmental regulations affecting winter operations were proposed.

"When airlines and airports conduct deicing operations on aircraft and airfield pavement, the large amounts of chemicals used for deicing operations may drain off airport facilities to nearby rivers, lakes, streams and bays, and can have major impacts on water quality," the report said. "In August 2009, the Environmental Protection Agency (EPA) issued a proposed rule on the use of deicing fluids at airports. According to EPA, the proposed rule would

Icing and Winter Weather–Related Event Reports for Large Commercial Airplanes by Category of Event, 1998 to 2007



Note: The GAO analyzed events due to winter weather conditions from reports in the U.S. National Aeronautics and Space Administration Aviation Safety Reporting System.

Source: U.S. Government Accountability Office (GAO)

Figure 1

Airline Deicing Compliance

Personnel from the Air Transportation Oversight System (ATOS) of the U.S. Federal Aviation Administration (FAA) check airline ground deicing programs for compliance with safety regulations. The oversight includes assessing the design of each program twice every five years and assessing its safety outcomes twice each year.

"Performance assessments confirm that an air carrier's operating systems produce intended results, including mitigation or control of hazards and associated risks," said a July 2010 report by the U.S. Government Accountability Office (GAO). "For inspections of … ground [deicing] crews in fiscal years 2005 through 2009, FAA inspectors indicated that carriers were meeting the requirement in 16,867 out of 20,513 cases (82 percent), were not meeting the requirement in 3,569 cases (17 percent), and that the question was not applicable in 77 cases (0.4 percent). For inspections of … flight crew [involvement in ground deicing] in fiscal years 2005 through 2009, FAA inspectors indicated that carriers were meeting the requirement in 13,734 out of 16,266 cases (84 percent), were not meeting the requirement in 2,122 cases (13 percent), and that the question was not applicable in 410 cases (3 percent). Of the 423 assessments … from December 2007 through the end of fiscal year 2009, 290 (69 percent) did not require any corrective action by the carrier, while 133 (31 percent) required some form of corrective action."

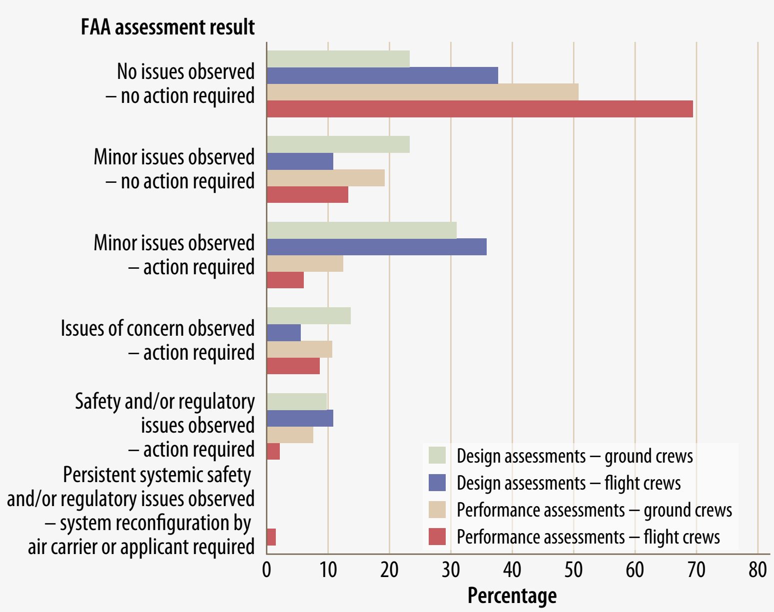
Until April 2008, the FAA maintained oversight of some of these programs under different standards called National Work Program Guidelines (NPG). "In fiscal years 2005 through 2009, FAA initiated enforcement actions against large commercial carriers in 274 cases following one or more violations of icing-related regulations," the report said. "FAA had closed 254 of these actions by March 2010; of these, 226 were administrative actions, such as letters to carriers specifying required corrective actions; 22 were monetary fines … ; three were closed with no action taken; two were [60-day and 90-day] suspensions of operating certificates … ; and one was a revocation of an operating certificate.

"In fiscal years 2005 through 2009, FAA completed 942 of 1,026 required inspections (92 percent) of small commercial carriers' ground deicing programs. … FAA completed 2,029 out of 2,099 planned inspections (97 percent) of small commercial carriers' ground deicing programs under NPG, and it completed an additional 431 inspections that were not planned.

"In fiscal years 2005 through 2009, FAA initiated enforcement actions against small commercial carriers in 274 cases following one or more violations of icing-related regulations. FAA had closed 209 of these actions by March 2010; of these, 112 were administrative actions … ; 29 were monetary fines … ; 28 were closed with no action taken; 28 were suspensions of operating certificates … ranging from seven to 270 days; and 12 were revocations of operating certificates."

A number of operators, airplane manufacturers, maintenance organizations and other entities also were directed to implement new technology, correct technical deficiencies and/or implement new winter operations procedures and manuals. "Since 1997, FAA has issued over 100 airworthiness directives to address icing safety issues involving more than 50 specific types of aircraft, including directives that require revising the FAA-approved airplane flight manual limitations to provide the flight crew with recognition cues and procedures for exiting severe icing conditions, or inserting a copy of the airworthiness directive in the manual," the report said.

— WR



FAA = U.S. Federal Aviation Administration

Note: Results refer to inspections of ground deicing programs of large commercial air carriers from December 2007 through Sept. 30, 2009.

Source: U.S. Government Accountability Office analysis of FAA inspection data require 218 airports to collect spent deicing fluid and treat the associated wastewater, and six major airports would likely need to install centralized deicing pads to comply with the rule. Additionally, some airports would be required to reduce the amount of ammonia discharged from urea-based airfield pavement deicers or use more environmentally friendly airfield deicers that do not contain urea. EPA plans to issue a final rule in December 2010."

'Pilots are likely to encounter icing conditions beyond their aircraft's capabilities at least once in their career.'

Research performed by NASA scientists has advanced the aviation industry's knowledge, awareness and strategies for managing encounters with severe atmospheric threats — notably enabling meteorologists to precisely locate and forecast supercooled large droplet icing conditions. "Furthermore, NASA has an icing program, focused generally on research related to the effects of in-flight icing on airframes and engines for many types of flight vehicles," the report said. "NASA has developed icing simulation capabilities that allow researchers, manufacturers and certification authorities to better understand the growth and effects of ice on aircraft surfaces. NASA also produced a set of training materials for pilots operating in winter weather conditions."

FAA-funded efforts to predict the location and severity of in-flight icing conditions also have engaged the National Oceanic and Atmospheric Administration and the National Weather Service. "The National Weather Service operates icing prediction systems, and NCAR conducts research to determine more efficient methods to complete this task," the report said.

The atmospheric research center also introduced two in-flight icing weather products accessible to the aviation community at no cost via the Internet:[2] the NCAR Current Icing Product, which uses mathematical models combining satellite, radar, surface, pilot-observation and other sources of data to display detailed, three-dimensional, hourly graphics about icing that existed up to 12 hours before a flight; and the NCAR Forecast Icing Potential, which "calculates the likelihood of icing and supercooled large droplet conditions," the report said, and has been designed for operational interpretation by meteorologists and dispatchers only, according to the Web site.

Reviewers of the GAO auditors' work noted that the Aircraft Icing Research Alliance, an international team of organizations, simultaneously has conducted icing-related research. U.S. private-sector initiatives — such as those responsible for wing deicers, anti-icing systems and heated wings developed by aircraft manufacturers — also have reduced winter operational risks in the study period, the report concluded.

"The National Science Foundation (NSF) … said that a number of universities, under funding from NSF, conduct research into the physics of icing and also had provided in situ measurements (using a storm-penetration aircraft) of icing and other conditions associated with large convective storms," the report said. This foundation also emphasized that upgrades to today's icing forecast products will be needed as scientific knowledge evolves (*ASW,* 7/09, p. 13).

Better Training

The issue of what constitutes adequate pilot training and experience for safe airline winter operations resurfaced recently as part of government-industry discussion of minimum qualifications and aviation professionalism. "Aviation experts told us that pilots are likely to encounter icing conditions beyond their aircraft's capabilities at least once in their career," the report said. "For example, it is important that regional airline operators provide region-specific training to their pilots as regional airline consolidations may cause pilots to fly a geographically wider variety of routes with more variation in weather conditions."

NASA specialists told GAO auditors that FAA written tests for pilot certification cover "very little operational information compared with what a pilot needs to know when faced with icing." Educational materials that NASA specialists have designed to bridge this knowledge gap have not been endorsed by FAA, however, and have not been added to commercial pilot training requirements, the report said.

Unmet Challenges

The assessment listed the principal winter-operations challenges for the United States beyond the 2010–2011 season as "improving the timeliness of FAA's winter weather rulemaking efforts; ensuring the availability of adequate resources for icing-related research and development; ensuring that pilot training is thorough, relevant and realistic; ensuring the collection and distribution of timely and accurate weather information; addressing the environmental impacts of deicing fluids; and developing a more integrated [national] approach to effectively manage winter operations."

The report described the U.S. rulemaking process as inherently time-consuming because of lengthy procedures and processes required by federal law, typically requiring years to propose, finalize and enforce as new or amended FAA safety regulations.

"External pressures — such as highly publicized accidents, recommendations by NTSB and congressional mandates — as well as internal pressures, such as changes in management's emphasis — [noted since 2001 have] continued to add to and shift the [FAA's] priorities," the report said. "For some rules, difficult policy issues [in 2001] continued to remain unresolved late in the process."

For example, the latest round of rulemaking efforts on the issue of airworthiness standards related to supercooled large droplets dates from 1997. The notice of proposed rulemaking was issued in July 2010 with a projected final rule date of January 2012, the report said.

"Much of the time on this rulemaking effort has been devoted to research and analysis aimed at quantifying the atmospheric conditions that lead to supercooled large droplet icing, as well as developing tools that would allow industry to comply with the … rule," the report said. Internal projects to accelerate all FAA rulemaking have been under way since 2009, however, FAA officials told the auditors.

NASA representatives advised the auditors that key areas for increased research and development funding by FAA now include pilot training, experimental and computational simulation of supercooled large droplet effects, engine icing and ice effects on future aircraft wing designs.

"Because the outcomes of [NASA] research and development are often a required precursor to the development of rules and standards, as well as technological innovation, a decline in research and development resources can delay actions that would promote safe operation in icing conditions," the report said. "For example, FAA's chief scientist for icing told [GAO auditors that] the decline in NASA's icing research budget has adversely affected NASA's research to understand how icing affects various makes and models of aircraft in real time — research that would ultimately help pilots determine how to respond to specific icing encounters." The NSF concurred that the issue has become a major concern.

FAA officials pointed out that developing an integrated approach to icing threats historically has been among their most difficult challenges. "FAA said that, in conjunction with the aviation industry, it needs to begin focusing on winter operations holistically because there are many vital elements to safe operations in winter weather conditions, including airport surface conditions, aircraft ground deicing, aircraft in-flight icing and icing certification, dissemination of airport condition information, air traffic handling of aircraft in icing conditions, and air traffic arrival and departure sequencing. … FAA stressed that it is important [to] not view the components in isolation."

This article is based on GAO report no. GAO-10-678, "Aviation Safety: Improved Planning Could Help FAA Address Challenges Related to Winter Weather Operations," released July 29, 2010, and available at <www.gao.gov/new.items/d10678.pdf>.

Notes

1. "Large commercial airplanes" in the GAO report referred to air carrier operations under U.S. Federal Aviation Regulations Part 121, and "small commercial airplanes" referred to commuter and on-demand operations under Part 135.

2. The website is <aviationweather.gov/adds/icing/>.

Thundersnow

Difficult to forecast and rare, but a real threat to landing or low-altitude aircraft.

BY ED BROTAK

It was a cold April morning in the mountains of western North Carolina in the United States. It was raining lightly, with temperatures above 40 degrees F (4 degrees C). The rain started to pick up. The temperature dropped dramatically in minutes, down to 32 degrees F (0 degrees C). The rain changed to snow. Then a flash lit the sky — lightning! This was a thunder snowstorm.

Blinding snow filled the sky, dropping the visibility at the Asheville Airport to 1/4 mile (400 m) at times. It snowed heavily for an hour, with numerous lightning flashes. Four inches (10.2 cm) of snow accumulated. Even though the ground was warm, snow covered everything. Just as quickly as it had started, the storm ended. Temperatures warmed back up above freezing, and the snow melted nearly as fast as it had fallen.

DainisDerics/istockphoto

Thundersnow is defined as a snowstorm accompanied by lightning and thunder — a type of convective precipitation with below-freezing temperatures. We normally think of convective showers and thunderstorms occurring in the warmer months, but convection is not a direct function of high temperature. It is controlled by the change of temperature with altitude — the lapse rate. Convection is a type of lifting in the atmosphere that occurs when a parcel of air becomes warmer than the environment. The parcel is buoyant and begins to rise. The difference in temperature between the parcel and the surrounding atmosphere — not any particular range of temperatures — is the key in the development of convective activity.

A parcel of air can be below freezing and still rise if it is warmer than a very cold surrounding environment. The lapse rate determines this environmental temperature at different elevations. A steep lapse rate, defined by a rapid temperature drop with altitude, favors convection. Within clouds, saturated parcels rise and cool at the moist adiabatic lapse rate — approximately 3 degrees F (2 degrees C) per 1,000 ft. If the environmental lapse rate is greater than that, convection can occur. Steep lapse rates are more common in the warmer months when strong solar radiation heats the surface, which then warms the air directly over it. However, steep lapse rates can occur at any time, even with below-freezing temperatures.

Convection brings with it hazards to aviation, even without electrical activity. The occurrence of lightning adds yet another problem, but often this is not as serious as the issues accompanying the precipitation itself. In these cases, lightning and thunder also act as warning signs of convective activity.

For aviation interests, convective snow or thundersnow can produce problematic, if not outright dangerous, conditions. The reductions in visibility are an obvious concern. Occasionally, visibility drops in a matter of minutes to near zero in whiteout conditions. Although the storms themselves usually aren't particularly strong as thunderstorms go, there still is some turbulence. Hail occasionally accompanies these storms, but most commonly it is the small, graupel[1] type. High winds can also occur, but these are not the "downburst" type winds associated with severe thunderstorms. Rather, they are strong straight-line winds aloft brought down to the surface in the

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Kyle House/Flickr

thunderstorm downdraft. They produce high gusts, adding to the existing wind pattern. If there is lightning, this is another threat. There are numerous reports of aircraft in flight being hit by lightning during thundersnow events, including two documented incidents in Alaska. On Feb. 22, 1997, near Kodiak, a Lockheed C-130 was hit twice, and on Feb. 1, 2009, near Sitka, an Alaska Airlines Boeing 737 was hit. In both events, minor damage was reported.

Runway conditions can also deteriorate in a hurry. Snowfall rates are often excessive. Four in (10 cm) per hour is not unusual, and rates as high as 6 to 9 in (15 to 23 cm) per hour have been recorded. With such extreme snowfall rates, runways become snow-covered within minutes, and snow removal efforts are unable to keep up with the accumulation. Even if ground temperatures are above freezing, the snow sticks and piles up, the accumulation rate exceeding the melting rate. This also applies to snow accumulating on the exposed surfaces of aircraft on the ground. If the situation favoring convective snows continues for a number of hours, total snowfall amounts can be prodigious. Several feet of snow are possible in a day. The sheer bulk of the snow can make removal difficult or even impossible.

The crux of the problem for aviation is the "magnification effect" of snow versus rain.

Convective lifting is usually intense. Therefore, precipitation rates are excessive. The combination of adiabatic cooling due to lifting and evaporative cooling from the precipitation drives down temperatures. In some cases, the induced temperature fall can drop temperatures below freezing. Rain can change to snow, and a fairly benign rain situation can become a critical snow event.

For aircraft in flight, these storms look fairly innocuous and pilots may not try to avoid them, but the only major concern is attempting an approach and landing in such conditions, or if a thundersnow develops during an approach. There would be some turbulence, but it would not be nearly as bad as during warm-season storms.

The actual surface temperature may not indicate what could happen in the near future. Keep in mind that snowflakes are formed within the clouds thousands of feet above the surface. If the layer of air near the surface has temperatures above freezing and is sufficiently deep, the snow melts and falls to the ground as rain. If the near-ground layer of air is shallow, then snow can reach the ground even with surface temperatures above 32 degrees F. Snow has been reported with surface temperatures, at least at the start, above 40 degrees F and sometimes, rarely, above 50 degrees F (10 degrees C), but temperatures plunge once the snow begins to fall. Convective snow situations often feature steep lapse rates which favor such switch-overs.

The crux of the problem for aviation is what I'll call the "magnification effect" of snow versus rain. You've probably heard the adage "one inch of rain would equal ten inches of snow." This is a general rule, dependent on the actual temperature, but it makes the point. For example, suppose the precipitation rate is 0.5 in (1.3 cm) of liquid water equivalent an hour. If it all falls as rain, that's 0.5 in of rain in an hour, a good rain but not excessive. Convert that same precipitation rate to snow, and you have 5 in (13 cm) of snow per hour and major problems. Reductions in visibility probably follow a similar ratio since snowflakes have a much larger surface area than raindrops. A visibility of 4 mi (6 km) in rain could easily drop to ¼ mi (400 m) in heavy snow even though the actual precipitation rate does not change.

There are a number of weather situations in which thunder snowstorms can develop. Cold air moving across a warmer body of water can set up a lapse rate sufficiently steep to generate convection, and the added moisture from below can generate more precipitation. Such a setup often occurs around the Great Lakes of the United States and Canada in winter. The famous "lake effect" snows often have a convective

Don Sutherland/Flickr

nature, especially early in the winter when the lake waters are their warmest and cold polar or arctic air masses move in from the northwest. This usually occurs following the passage of a low pressure area and its associated cold front. With the low to the northeast of the region, the cyclonic flow produces a westerly wind across the lakes. As the cold air moves across the warm lake waters, the air near the surface is warmed and moistened.

Convective snows are common on the lee side of lakes. Extreme snowfall rates and incredible snowfall totals can evolve. Fortunately, the more extreme situations tend to be confined to the immediate lee of the lakes. For example, on Oct. 13, 2006, at 0153 local time, the Buffalo, New York, airport was reporting ¼ mi visibility with a thunderstorm and heavy snow, a ceiling of 200 ft and frequent lightning. Twelve in (30 cm) of snow had fallen in the previous six hours, with 4 in (10 cm) falling in the previous hour alone.

Ocean areas with warm currents and their adjacent coastal regions could see similar situations in the winter. Extremely cold arctic air masses can move from their inland source regions out over the open waters. The lower layer of air can warm quickly from below while temperatures aloft remain very low, setting up steep lapse rates and possible convective activity. Thundersnow has occurred along the northwest coast of North America from Alaska southward to Washington, in the British Isles and northwestern Europe, and in Japan. All of these regions feature warm ocean currents and relatively warm waters.

Another area in which convective snows can develop is near the center of major winter storms. Warm, unstable air from the south can be pulled into the cyclonic circulation. As this air is lifted, it cools. If lifted high enough, the layer of air may cool to below freezing but still have an unstable lapse rate. By this point, the unstable layer often has been rotated cyclonically to the northwest side of the low center. Convectively enhanced snow bands can add to the more stratiform precipitation shield of the storm. The major snowstorm that affected the East Coast of the United States on Feb. 6, 2010, featured convective snow bands. For example, at 0326 local time, Georgetown, Delaware reported heavy snow with thunder and a visibility of ¼ mi. The wind was from the east-northeast at 27 kt with gusts to 37 kt.

Sometimes, vigorous upper-level troughs induce snow-producing thunderstorms. The troughs are pools of cold air aloft that induce lifting on their east side. Often convection is produced, and, with cold surface temperatures, snow can form. The situation described in the opening paragraph was an example of this dynamic. In this situation, an actual upper-level closed low was centered just south of the southern Appalachians in the eastern U.S. A trough rotating around the low instigated the thunder snowstorm.

Thundersnow is more common in mountainous terrain. The higher elevations result in colder temperatures, and orographic lifting — winds pushed up by rising terrain — aids in thunderstorm development.

Because of their rarity, thundersnow or convective snow in general is difficult to predict. Meteorologists can look at the situations described above and make generic forecasts that thundersnow might occur, but specific forecasts (times and snowfall amounts) are impossible. As with most convective situations, an examination of local soundings gives the best clues as to the potential for thundersnow. But, as has been mentioned, these are not strong storms. These are low-topped thunderstorms developing in a marginally unstable environment.

Sometimes standard stability indices indicate instability in these cases. This is more likely for the "warm water" events. For example, a convective snow situation developed in the U.S. Pacific Northwest on Jan. 27, 2008. The indices all indicated at least some convective activity. In cases like this, the unstable layer extended from the surface to above 18,000 ft.

However, in cyclonic cases like the U.S. East Coast storms, the unstable layer is not near or at the surface, and typical stability indices are usually worthless for prediction. In the thundersnow event in Georgetown, the indices indicated extreme stability in the atmosphere and no chance of convection. The unstable layer, where the convection was generated, was located well above the surface. In these cases, a close examination of the sounding usually is required to identify regions of instability in the atmosphere that would otherwise go undetected. Even then, it's difficult to predict with certainty that convective snow or thundersnow will occur.

Edward Brotak, Ph.D., retired in 2007 after 25 years as a professor and program director in the Department of Atmospheric Sciences at the University of North Carolina Asheville.

Note

1. Heavily rimed snow particles, often called snow pellets; often indistinguishable from very small soft hail except for the size convention that hail must have a diameter greater than 5 mm. Sometimes distinguished by shape into conical, hexagonal, and lump (irregular) graupel.

BY LINDA WERFELMAN

Ins and Outs of ADS–B

An avionics industry group warns of disruptions in the installation process.

A decision by the U.S. Federal Aviation Administration (FAA) is likely to complicate and delay implementation of the planned overhaul of the nation's airspace known as the Next Generation Air Transportation System (NextGen), the Aircraft Electronics Association (AEA) says.

The AEA, which represents the U.S. avionics industry, says an Aug. 30, 2010, FAA memo outlining the policy for approval of "ADS–B Out" systems — automatic dependent surveillance–broadcast avionics systems that transmit data, including aircraft identity, position and speed, from an aircraft to ground stations and to other aircraft that are equipped with ADS–B

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equipment — creates "severe turbulence" in the procedures for installing ADS–B equipment.[1]

"Without your immediate intervention, this communication will stall early equipage, delay early implementation and, at the extreme, cause the failure of ADS–B altogether," the AEA said in an Oct. 4 letter to FAA Administrator Randy Babbitt.

An FAA spokeswoman said later in October that representatives of the agency had met with the AEA on the matter and were "working to resolve the issues."

In its August memo, the FAA said that ADS–B Out equipment must "only be installed when approved using the type certificate (TC), amended TC (ATC) or supplemental type certificate (STC) process. … Installation of ADS–B systems may not be approved as a major alteration with 'approved data'; thus, field approvals are not appropriate."

The FAA said its instructions stemmed from its belief that TC, ATC or STC design approval would be "more appropriate to ensure consistent performance," and that, as the agency and the avionics industry become more experienced in this area, field approvals would be permitted.

However, in its letter to Babbitt, the AEA cautioned that the memo might have the "unintended consequence" of hindering implementation of NextGen.

"The AEA supports the vetting of new products through the STC process, as required by [Advisory Circular] AC 20-165," the AEA said. "However, your memorandum goes beyond the reasonable approach of the AC and expresses a severe lack of trust of your employees, your designees and your TSOs [technical standard orders] and is simply not the best answer."

The approval process will push up the cost of installing an individual ADS–B system by at

Report: FAA Faces Risks in Implementing ADS–B

The reluctance of aircraft owners to buy and install new avionics is among the greatest risks to the U.S. Federal Aviation Administration's (FAA's) implementation of its automatic dependent surveillance–broadcast (ADS–B) program, the U.S. Transportation Department's Office of Inspector General (OIG) says.

In a report released in mid-October, the OIG said that the FAA is progressing with its implementation of ADS–B, a satellite-based air traffic surveillance technology that is a key element of the Next Generation Air Transportation System (NextGen) — the planned overhaul of the U.S. national airspace system.

Nevertheless, the report identified risks in five areas that the OIG said would affect the cost, schedule and expected benefits of ADS–B. The reluctance to purchase new equipment is one of the two greatest risks, as is the agency's ability to "define requirements for the more advanced capabilities," the report said.

"Users have raised justifiable concerns about evolving requirements and uncertain equipage costs and benefits," the report said. "For example, based on FAA's analysis, the costs for users to equip with ADS–B avionics could range from $2.5 billion to $6.2 billion."

The report noted that the surveillance information that initially will be provided through ADS–B will replicate the information already provided by radar and therefore provide few new benefits to aircraft operators. In addition, the FAA has not yet specified how it will modify the existing systems that will display ADS–B information to air traffic controllers, the report said.

"Until FAA effectively addresses these uncertainties associated with equipage and requirements for ADS–B's advanced capabilities, progress with ADS–B will be limited, and the potential for cost increases, delays and performance shortfalls will continue," the report said.

The report said that the OIG also had identified problems in other areas: "new requirements and controller/pilot procedures, frequency congestion with ADS–B broadcasts, integration with air traffic management systems and potential security vulnerabilities."

The OIG issued nine recommendations that it said were intended to reduce risks associated with ADS–B implementation, including speeding up efforts to establish requirements for the implementation of ADS–B In — in which properly equipped aircraft receive information transmitted from ground stations and other aircraft.

Other recommendations, intended to aid in oversight of the ADS–B contract, include a call to update the program's cost-benefit analysis.

The FAA agreed with seven of the recommendations and parts of the other two, and proposed what the OIG considered acceptable actions for all nine.

This article is based on U.S. Department of Transportation Office of the Inspector General audit AV-2011-002, FAA Faces Significant Risks in Implementing the Automatic Dependent Surveillance–Broadcast Program and Realizing Benefits. *Oct. 12, 2010.*

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least 200 percent and, in some cases, as much as 700 percent, the AEA said.

"The unintended consequence of this action is that, because of the high cost and slow certification times, the agency has effectively killed all new and novel technology advances in ADS–B and created a barrier that will provide a negative incentive to new entrants into the ADS–B marketplace," the AEA said.

The organization added that, although the industry is pleased that the FAA intends to eventually ease installation requirements, "how do we encourage an early applicant to commit to an installation with a 700 percent premium that would likely take months to complete, instead of choosing to delay equipage until some later date, knowing it will reduce the owner's initial investment from $35,000 for a required STC installation to … $4,500 for a follow-on installation?"

Development of low-cost ADS–B installations for general aviation will not begin until the STC requirement has been eliminated, the AEA said.

The AEA complaint to Babbitt followed the FAA's go-ahead for nationwide ADS–B ground station deployment and air traffic control surveillance.

The AEA said the FAA's policy — which specifically addressed the installation of equipment governed by TSO C166b — resulted in the unintended interruption of installations of Mode S transponders, which are manufactured according to standards set forth in TSO C166 — not TSO C166b.

"We already have received reports from our members that FAA regional certification offices are implementing this policy on ADS–B-equipped Mode S transponders," the AEA said.

The AEA's complaint came days after the FAA said that it had given "the green light for full-scale, nationwide deployment" of ADS–B — an action that the FAA said will allow air traffic controllers to use ADS–B technology for aircraft separation.[2] In areas that have ADS–B coverage, the controllers' screens will display aircraft being tracked by radar and those whose positions are broadcast by on-board ADS–B equipment.

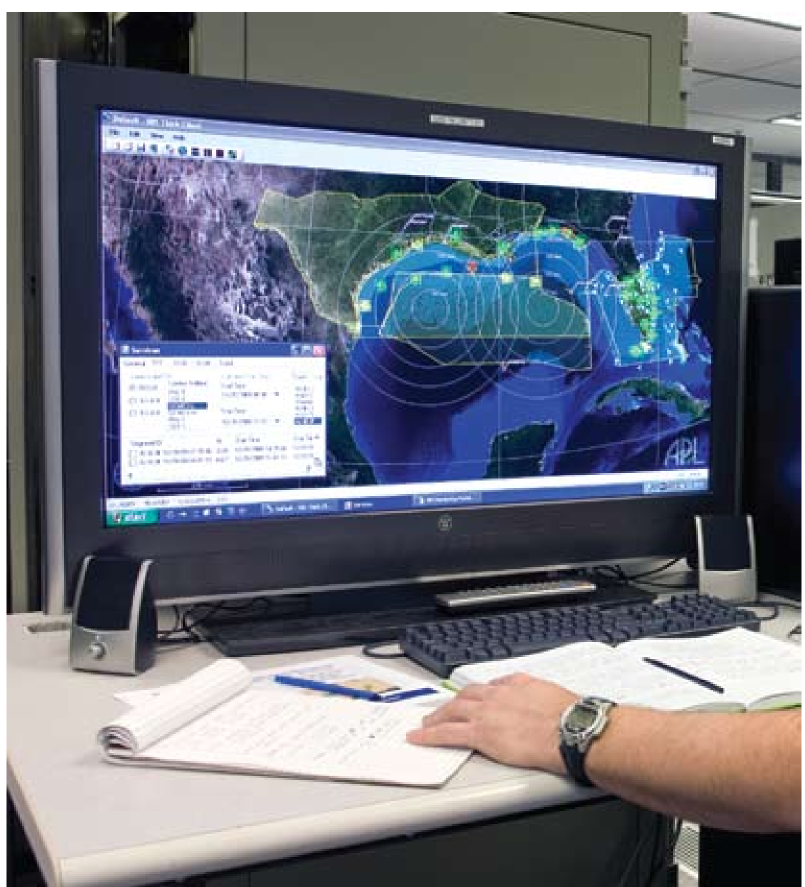
The FAA said the ADS–B system "tracks aircraft with greater accuracy, integrity and reliability that the current radar-based system. ADS–B targets on controller screens update more frequently than radar, and show information including aircraft type, call sign, heading, altitude and speed."

The go-ahead for full-scale ADS–B deployment followed use of ADS–B on a smaller scale in four areas — Alaska; the Gulf of Mexico; Louisville, Kentucky; and Philadelphia — chosen for their "target-rich environments for operational testing" or because they "presented different challenges reflecting the complexity of the nation's airspace.

"This approach ensured that ADS–B was tested in the most extreme environments, allowing the agency to uncover and resolve any anomalies before the commissioning."

For example, the FAA said that the ADS–B operation in the Gulf of Mexico — a partnership involving the agency, the Helicopter Association International and the owners and operators of platforms and helicopter companies — was implemented because the lack of radar coverage in the area "severely restricts capacity due to the separation procedures needed to maintain safety."[3]

The FAA has tested prototype ADS-B installations in several areas, including the Gulf of Mexico, depicted on the screen below.



© Chris Sorensen Photography

According to FAA plans, all areas of the United States that currently are covered by radar will, by 2013, be covered by ADS–B. Plans call for a ground network of 800 ADS–B stations; of these, 300 already have been installed.

By 2020, FAA plans call for all aircraft operating in controlled airspace in the United States to be equipped with ADS–B Out avionics to broadcast their positions. In addition, aircraft that also are equipped with ADS–B In avionics designed to receive data broadcasts will be capable of receiving weather and traffic information, and pilots of those aircraft will be able to view cockpit displays that depict their position in relation to other aircraft, bad weather and terrain.

By 2020, FAA plans call for all aircraft operating in controlled airspace in the United States to be equipped with ADS–B Out avionics.

NextGen Components

ADS–B is a key component of NextGen, designed to modernize U.S. airspace by moving away from a radar-based air traffic control system in favor of a satellite-based system and, in the process, improving safety and efficiency.

Those other components include airport surface detection equipment–model X (ASDE-X), which uses radar and other surface surveillance sources, to automatically transmit the most accurate information to air traffic control tower monitors. The FAA has said that the most significant improvement over current radar systems will be the use of global positioning system (GPS) information to depict the locations of aircraft and surface vehicles. At the end of May, the FAA said that ASDE-X was fully operational at more than two dozen U.S. airports.

Other procedures include:

- Tailored arrivals, which provide for air traffic controllers to review a flight path when an aircraft is about 200 nm (370 km) from the destination airport and adjust it to avoid bad weather, restricted airspace and other potential problems.
- Optimized profile descents, which enable smooth continuous-descent approaches rather than stepped-down approaches required by current procedures. These descents "maximize satellite-based approaches called area navigation (RNAV) and required navigation performance (RNP)," to allow aircraft to land more quickly and efficiently.
- Data communications (Data Comm), formerly known as controller/pilot data link, which will replace more error-prone voice communications between pilots and controllers.
- Systemwide information management (SWIM), which will enable communications between all FAA systems incorporated into NextGen, as well as airlines, military and security officials.
- NextGen Network Enabled Weather (NNEW), which will improve the quality of weather information available to flight crews, especially information about thunderstorms, icing and other severe weather conditions. NNEW is intended to help air traffic managers and others better manage traffic flow during periods of bad weather.

The FAA also is working with European air navigation service providers, the Single European Sky Air Traffic Management Research (SESAR) program, aircraft manufacturers and airlines to test oceanic trajectory based operations (TBOs), designed to help identify the most efficient routes and altitudes for trans-Atlantic flights.

Notes

1. ADS–B In systems receive information transmitted from ground stations and other aircraft that are equipped with ADS–B.
2. FAA. *FAA Gives Green Light to ADS–B Rollout*. Sept. 24, 2010.
3. FAA. *Fact Sheet — Next Generation Air Transportation System*. May 27, 2010.

Further Reading From FSF Publications

Rosenkrans, Wayne. "NextGen Safely." *AeroSafety World* Volume 5 (April 2010): 30–34.

Rosenkrans, Wayne. "Repurposing Avionics." *AeroSafety World* Volume 3 (December 2008): 42–45.

Rosenkrans, Wayne. "ADS–B On Board." *AeroSafety World* Volume 2 (November 2007): 44–47.

Blown Away

NTSB said that nothing in the captain's experience or training had prepared him for the winds he encountered at Denver.

BY MARK LACAGNINA

Just as the captain relaxed rudder pressure while tracking the runway centerline for takeoff on a tumultuously windy day, the Boeing 737-500 was struck by a strong gust. Like a weathervane, the airplane turned into the crosswind and then ran off the side of the runway. Five of the 110 passengers and the captain were seriously injured; 38 passengers, two flight attendants and the first officer sustained minor injuries; 67 passengers and one flight attendant escaped injury. The airplane was substantially damaged during the excursion and postcrash fire.

In its final report on the accident, which occurred at Denver International Airport the

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afternoon of Dec. 20, 2008, the U.S. National Transportation Safety Board (NTSB) said that the probable cause was "the captain's cessation of rudder input, which was needed to maintain directional control of the airplane, about four seconds before the excursion, when the airplane encountered a strong and gusty crosswind that exceeded the captain's training and experience."

The report said that the following factors contributed to the accident: "an air traffic control system that did not require or facilitate the dissemination of key, available wind information to the air traffic controllers and pilots; and inadequate crosswind training in the airline industry due to deficient simulator wind gust modeling."

The 737 veered off Runway 34R, the inner runway of the parallel pair on the northwest side of the airport.

'Some Wind Out Here'

The airplane was being operated as Continental Airlines Flight 1404 to Houston. The pilots arrived at the airport about 1700 local time — one hour before the scheduled departure time.

The captain, 50, was hired by Continental in 1997 and served as a first officer in Douglas DC-9s, 737s, 757s and 767s before transitioning as a 737 captain about 14 months before the accident. He had about 13,100 flight hours, including 6,300 hours in 737s. Before joining Continental, he was a naval aviator.

The first officer, 34, was a flight instructor and regional airline pilot before being hired by Continental in March 2007. He held a 737 type rating and had about 8,000 flight hours, including 1,500 hours as a 737 first officer.

When the first officer, the pilot monitoring, requested clearance for pushback at 1804, he told the airport ramp controller that they had received automatic terminal information service (ATIS) Information Charlie, which reported surface winds from 280 degrees at 11 kt, 10 mi (16 km) visibility, a few clouds at 4,000 ft and a surface temperature of minus 6 degrees C (21 degrees F). A notice to airmen advised that patches of snow, ice and/or slush were on the ramps and taxiways, but the runways were bare and dry, the report said.

Denver International Airport has six runways, all at least 12,000 ft (3,658 m) long. Runways 25, 34L and 34R, all on the west side of the airport, were being used for departures. The airport ground controller instructed the crew to taxi to Runway 34R.

At 1814, the airport traffic controller told the crew to taxi into position and hold for departure on Runway 34R. After the crew completed the "Before Takeoff" checklist, the captain remarked, "Looks like you got some wind out here." The first officer replied, "Yeah." The captain said, "Oh, yeah. Look at those clouds moving."

Shortly thereafter, the controller advised that the winds were from 270 degrees at 27 kt and cleared the crew for takeoff. "Although this wind was significantly stronger than the wind reported by ATIS (280 degrees at 11 knots) 20 minutes earlier, the wind was still within Continental's crosswind guidelines of 33 knots," the report said.

Elusive Centerline

As the captain moved the thrust levers forward at 1817:38, he said, "All right. Left crosswind, twenty-seven knots." He later told investigators that when the airplane began to accelerate, he shifted his attention from the engine gauges to outside visual references and concentrated on tracking the runway centerline.

"The first officer stated that after the power was set, he shifted his attention to monitoring the airspeed so that he could make the standard airspeed callouts, the first of which was 100 kt," the report said.

Recorded flight data indicated that as the airplane accelerated, the captain applied right rudder pedal inputs of increasing amplitude while holding the control wheel and control column in their neutral positions. The 737 was accelerating through about 55 kt at 1818:07, when it began to move left, away from the runway centerline. The captain responded two seconds later by moving the right rudder pedal almost all the way forward, displacing the rudder nearly to its maximum deflection of 26 degrees (Figure 1). "Almost simultaneous with the onset of this large rudder pedal input, the FDR [flight data recorder] began to record a left control wheel input," the report said.

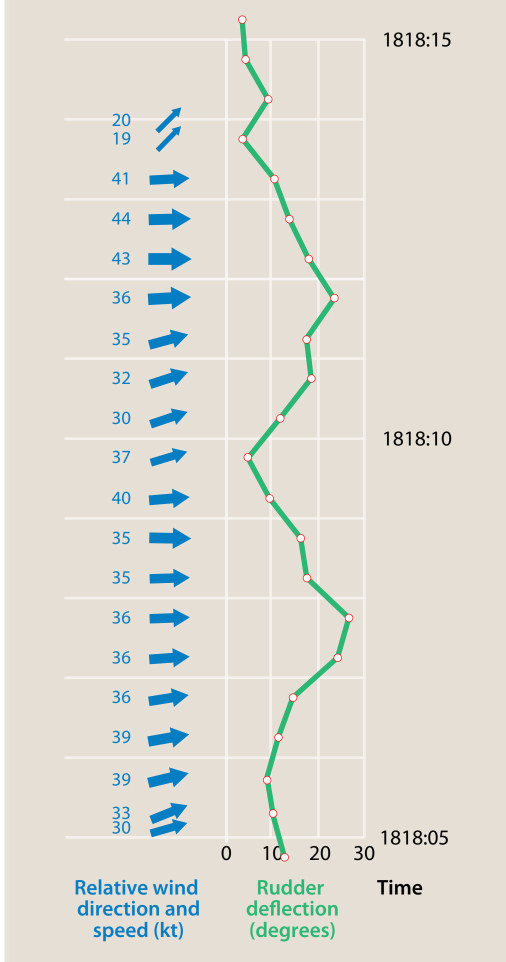
The airplane began to head back toward the runway centerline. However, as it accelerated through about 85 kt at 1818:10, "the airplane's nose reversed direction and began moving back to the left at a rate of about one degree per second," the report said. "The leftward movement of the nose continued for about two seconds and was accompanied throughout its duration by another substantial right rudder pedal input."

This right rudder input slowed the left-turning motion momentarily, but the nose again began moving rapidly to the left at 1818:13, about the same time that the pilot relaxed pressure on the right rudder pedal, returning the pedal to its neutral position.

Shortly thereafter, the cockpit voice recorder (CVR) recorded an exclamation by the captain, and "the FDR recorded the beginning of a transition from left control wheel input (consistent with crosswind takeoff technique for a left crosswind) to right control wheel input (crossing the control wheel's neutral point at 1818:14)," the report said. "The FDR did not record any more substantial right rudder pedal inputs as the airplane continued to veer to the left."

As the airplane neared the edge of the runway, the captain tried unsuccessfully to use the nosewheel-steering tiller to regain directional control. The report noted that the tiller typically is used only during low-speed taxiing.

Wind and Rudder Deflection



Source: U.S. National Transportation Safety Board, Susan Reed

Figure 1

The captain later told investigators that he had "felt the rear end of the airplane slip out hard to the right and the wheels lose traction." He perceived that the airplane had encountered a slippery patch of runway, a strong gust of wind, or both.

The first officer recalled that there was "a slight deviation left of centerline [at about 90 kt], but we seemed to be correcting back to the right." He said that the airplane then "abruptly swung approximately 30 degrees left with the tail to the right, and we were heading for the left side of the runway."

'Very Painful Bumps'

The CVR recorded an expletive voiced by the first officer just before the 737 ran off the left side of the runway at 1818:17. The captain called "reject" twice, announcing that he was rejecting the takeoff. "FDR data showed engine power reductions, as well as activation of the brakes," the report said. "Thrust reverser deployment began about three seconds after the airplane left the runway."

Groundspeed was about 110 kt when the airplane veered off the runway about 2,600 ft (792 m) from the approach threshold, on a magnetic heading of about 330 degrees. The pilots began reducing power, which also activated the autobrake, about three seconds later. The airplane crossed a taxiway and an airport service road, and came to a stop on a heading of about

The airplane had a rough ride on uneven terrain after leaving the runway at 110 kt.

U.S. National Transportation Safety Board

315 degrees just north of an aircraft rescue and fire fighting (ARFF) station located between Runway 34R and Runway 34L. The FDR and CVR recordings ended at 1818:27.

"Postaccident interviews with passengers and crewmembers, as well as evidence from the crash site, indicated that as the airplane crossed the uneven terrain before coming to a stop, it became airborne, resulting in a jarring impact when it regained contact with the ground," the report said.

The captain told investigators that he was just "along for the ride" after the airplane veered off the runway. "Both pilots stated that there were a couple of 'very painful' bumps before the airplane came to a stop," the report said. "They indicated that they were somewhat dazed or 'knocked out' for one or two minutes after the airplane stopped and made no immediate attempts to get up or leave the cockpit."

Unable to communicate with the pilots, the flight attendants initiated an evacuation when they saw a fuel-fed fire erupt on the right side of the airplane. The flight attendants, assisted by two deadheading pilots, were able to evacuate all the passengers through the three left exits before the fire entered the cabin. Although injured, the captain and first officer exited without assistance. ARFF personnel arrived about five minutes after the evacuation was completed and extinguished the fire. The most serious injuries during the excursion involved back and/or spinal column damage.

Variable Winds

Denver International Airport is at an elevation of 5,431 ft in the foothills just east of the Front Range of the Rocky Mountains. Weather conditions on the day of the accident were influenced by a stationary front extending through Colorado. Analyses performed by the U.S. National Center for Atmospheric Research (NCAR) indicated that the airport was affected by significant mountain wave activity.

"The undulating motion of these waves as they moved eastward across [the airport] resulted in strong, very localized, intermittent gusts," the report said. The NCAR analyses indicated that a 45-kt gust was moving across the runway when the captain made the remark about cloud movement while awaiting takeoff clearance.

The flight crew had received wind information from different sources and locations on the huge airport. The ATIS wind information — 280 degrees at 11 kt — was derived from the automated surface observing system (ASOS) sensor located near the center of the airport, about 2.5 mi (4.0 km) southeast of the approach end of Runway 34R.

The wind information — 270 degrees at 27 kt — provided about 20 minutes later by the airport traffic controller who cleared the crew for takeoff was based on readings from a low level wind shear alert system (LLWAS) sensor located near the departure end of Runway 34R. Those readings, as well as readings from sensors associated with the ends of the other runways in use, were displayed on a monitor at the controller's station.

The flight crew did not, however, receive wind information from a closer source — an LLWAS sensor about 3,300 ft (1,006 m) from the approach end of Runway 34R. Readings from that sensor also were displayed on the controller's monitor and were designated as "AW," for "airport wind." When the crew was cleared for takeoff, the monitor showed the airport wind as from 280 degrees at 35 kt with gusts to 40 kt.

The controller did not provide and was not required to provide the "airport wind" information to the crew. "It was common practice for [airport] controllers to issue departure runway end winds to departing aircraft," the report said.

Based on the wind information that *was* provided, the crew's decision to depart on Runway 34R rather than requesting Runway 25 for takeoff was "reasonable," the report said. "Further, other airplanes departed on Runways 34L and 34R before the accident pilots' departure; the pilots of those departing airplanes did not report any crosswind-related issues or difficulties."

Investigators estimated that the 737 encountered direct crosswind components ranging from 29 kt to 45 kt during the takeoff roll. The peak gust of 45 kt occurred about the same time that the captain relaxed pressure on the right rudder pedal. The report said that the captain likely would have been able to maintain directional control if he had maintained or rapidly reapplied right rudder input. "Performance calculations indicated that the airplane's rudder was capable of producing enough aerodynamic force to offset the weathervaning tendency created by the winds the airplane encountered during the accident takeoff roll."

The report said that the "unusually large" rudder inputs that the captain made twice during the takeoff roll likely increased the difficulty he encountered in maintaining directional control. "To avoid overshooting the baseline heading after each large right rudder pedal input, the captain had to compensate by relaxing the right rudder pedal more than he would have had to for a smaller rudder pedal advancement," the report said. "Furthermore, because of slight delays in the effect each rudder pedal adjustment had on the airplane's rate of heading change, the captain had to anticipate the effect of each adjustment ahead of time. This task was very difficult for the captain because of the highly variable and unpredictable nature of the crosswind gusts."

The captain's full-right control wheel movement and use of the nosewheel steering tiller three seconds before the excursion "likely resulted from acute stress stemming from a sudden, unexpected threat, perceived lack of control and extreme time pressure," the report said, noting that these actions were ineffective and delayed the initiation of a rejected takeoff.

Insufficient Simulation

Postaccident flight simulator tests with pilots holding 737 type ratings showed that when they removed their feet from the rudder pedals while encountering a 35-kt crosswind at an airspeed of 90 kt, the "airplane" veered off the runway within five seconds. They were able to continue or reject the takeoff successfully if they resumed corrective rudder inputs within two seconds after releasing pedal pressure; but three seconds was too late. "Participants agreed that a three-second delay in reapplication of corrective rudder inputs resulted in a situation that would be unmanageable for a line pilot," the report said.

The participants also said that the flight simulator did not accurately reflect lateral forces or provide a good "seat of the pants" feel for wind gusts.

Investigators found that Continental's annual simulator recurrent training included takeoffs and landings with a 35-kt crosswind. "However, the company's 737-500 flight simulators were not programmed to simulate gust effects below about 50 feet above the ground and, therefore, were not capable of replicating the complex disturbances that pilots would experience during takeoffs and landings in gusty surface winds," the report said. "Further, takeoff data obtained from Continental indicated that the company's pilot rarely, if ever, encountered crosswind components greater than 30 knots during actual flight operations."

Based on the findings of the investigation, NTSB issued several recommendations to the U.S. Federal Aviation Administration, including more research on mountain waves and downslope winds; a requirement that controllers provide pilots with information on the maximum wind components they might encounter on takeoff or landing; a requirement that operators of air carrier, air taxi and fractional ownership aircraft incorporate "realistic, gusty crosswind profiles" in their simulator training; and a requirement that manufacturers of transport category airplanes develop type-specific crosswind limitations that account for wind gusts.

This article is based on NTSB Accident Report NTSB/AAR-10/04, "Runway Side Excursion During Attempted Takeoff in Strong and Gusty Crosswind Conditions; Continental Airlines Flight 1404; Boeing 737-500, N18611; Denver, Colorado; December 20, 2008." The full report is available at <ntsb.gov/Publictn/A-Acc1.htm>.

Safety oversight and air service 'liberalization' are two sides of the same coin, says a specialist's new book.

Catalytic

A visionary pact by three-fourths of African civil aviation ministers — fully effective three years after their negotiations ended at Yamoussoukro, Ivory Coast — set the stage 11 years ago for comprehensive improvements to commercial air transport safety and its economic underpinnings. Few expected that initiatives to implement principles of this agreement — called the Yamoussoukro Decision[1] (*ASW,* 11/06, p. 18) — also would reveal unresolved safety disparities among states and, in some cases, even impede critical reforms, says a new book.

Aviation safety professionals will find the book a practical guide to relevant flight risk factors, organizational roles, persistent issues, recent academic research and expert opinions.

Airline deregulation — often called *air service liberalization* in international contexts — is deeply intertwined with the continent's safety issues, explains author Charles Schlumberger, principal air transport specialist, Energy, Transport and Water Department, at the World Bank Group. "Although justified, the strong focus on safety and security has become the main obstacle to timely implementation as many African states do not [comply] or only marginally comply with the International Civil Aviation Organization's [ICAO's] safety and security standards and recommended practices [SARPs]," he says. "In Africa, the two most critical problems are the lack of continued surveillance and the poor resolution of safety audits. In other words, when addressing high accident rates in Africa, the most important factors for improvement are compliance with SARPs and establishment of an adequate safety regulatory oversight regime."

The concerns grew out of his seven-year, interdisciplinary analysis of treaties, national laws, aviation regulations harmonized by regional economic communities (RECs), major accidents, economic factors and political forces. "This is significant, especially because international air services in general, and the Yamoussoukro Decision in particular, foresee the restriction or suspension of air services in the case of poor safety standards," he said.

Bilateral Balancing Acts

The Yamoussoukro Decision, effective since August 2002, culminated decades of fresh thinking and negotiations about how to thrive under twin pressures for liberalization and for reduced accident risk. Around the time frame of the decision, the African Union was formed — effective May 2001 — by African heads of state under the Abuja Treaty. This treaty provided a continuing legal basis for states to be bound to the Yamoussoukro Decision, yet the air traffic rights granted so far have been exercised by states in a only few cases, according to the book. A few disputes remain about which of 44 party states that ratified the decision today are bound to follow it.[2]

In Schlumberger's analysis, little progress on liberalization has been made despite numerous meetings in the last eight years. Also, initiatives by RECs and associated international stakeholders were, and still are, expected to be the main drivers for prioritizing work on improving African economies and air safety. Meanwhile, he said, pairs of states have acted within and across RECs according to the common principles, and the African Airlines Association in recent years has encouraged a core group of states to follow through on air service liberalization.

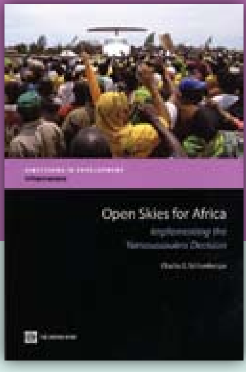
"The example of Ethiopia demonstrates that implementation … can be done successfully on a purely operational basis," he added. "In other words, even if certain [Yamoussoukro] elements … such as the executing agency are absent, implementation can be achieved between two or more states on a bilateral basis."

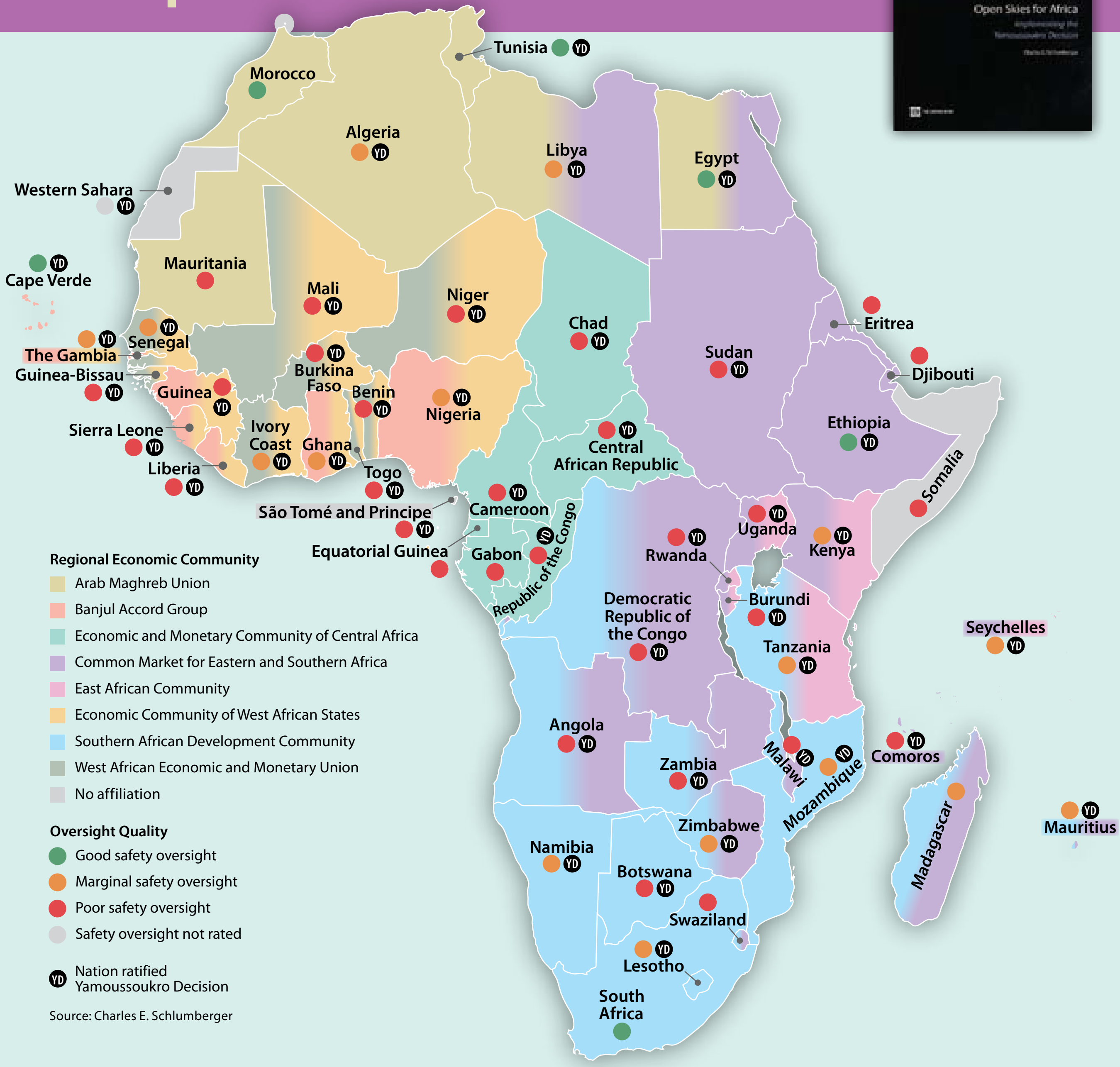
By the book's estimate — based on on-site discussions with leaders in states of the African Union — a "clear majority," 34 countries, are considered ready and willing to implement liberalization and to fulfill associated safety obligations, while 20 "maintain weak or small state-owned carriers and … are procrastinating in opening up their air service markets."

Safety and liberalization are intertwined essentially because of each African state's power to "limit the volume of traffic, the types of aircraft to be operated and the number of flights per week for environmental, safety, technical or other special considerations"

Aspirations

BY WAYNE ROSENKRANS





Susan Reed

under the decision. The baseline level of safety performance expected — called the state's *eligibility* — requires maintaining standards at least equivalent to ICAO SARPs, and establishes a further duty to respond to safety-related queries from any other state. "A party state may revoke, suspend or limit the operating authorization of a designated airline of the other party state if the airline fails to meet the eligibility criteria," he said.

Improving Safety Situation

Air carrier accident rates per million departures in 2006, for the continent as a whole, were 6.6 times the world average, based on International Air Transport Association (IATA) data, the book recalls. Discussing recent fatal accidents, Schlumberger tried to simplify their recurrent nature and context by broadly categorizing types of operators, operations and known causes.

"The first group is the major intercontinental carriers that operate between the African continent and Europe, Asia and the Americas … and have an excellent safety record," Schlumberger said. "The second group involves operators that are registered in an African country and that operate Western-built air transport category aircraft that are currently still in use in most developed countries. … The third group of carriers consists of various African carriers that operate older Western- or Eastern-built aircraft. During February 1998 through October 2007, at least 29 accidents involving such aircraft were recorded."

Obtaining reliable accident data and causes for the third group of carriers remains problematic, he says. Sometimes a majority of accidents still are not reported to authorities outside of the state of occurrence, fully investigated or assigned a probable cause. "The reasons for the accidents are therefore mostly unknown," Schlumberger said, and the linkage to government oversight factors can be vague.

"Another concern … is the large number of accidents involving flights conducted by [a nation's] air force, which in many African countries transports passengers and cargo for profit," he added. "The ministry of defense generally regulates and supervises these flights, which therefore do not need to comply with the same regulations as civilian flights."

On more positive notes, civil aviation authorities since 2000 have made a concerted effort, as shown in several of the book's examples, to revoke the air carrier certificates held by so-called flag of convenience airlines[3] as part of their reforms.

Safety Report Card

To define and compute overall good/marginal/poor ratings of African commercial aviation safety at the state level, the author cross-referenced data on fatal accidents in African air transport, state results from the ICAO Universal Safety Oversight Audit Program, results from the IATA Operational Safety Audit program (nine certified airlines in seven states), operators and states banned then by the European Union Aviation Blacklist, and results from 10 states audited by the U.S. Federal Aviation Administration International Aviation Safety Assessment Program. "The conclusion of this research leads to six states being rated as good, 16 states being considered marginal and 31 states being rated poor," the book says.

At the level of RECs, he assessed their effectiveness in promoting sound regulation of airlines and their progress in establishing safety oversight capability by a regional authority to complement state capacity (Table 1). "However, the analysis reveals that most RECs have taken only minor steps toward regional oversight, and states rated as poor can be found in most [RECs] except North Africa," he said.

Although sub-Saharan Africa has been the focus of many safety initiatives by non-African organizations, the states of northern Africa — including several Arab state parties to the Yamoussoukro Decision — have parallel challenges, the book notes. So far, the Arab Maghreb Union countries have not pursued deregulation of air services to sub-Saharan Africa, although some airlines from these states have a growing presence in the sub-Saharan airline markets through bilateral agreements. The Arab League Open Skies Agreement, meanwhile, shares some similarities with the decision, and these two agreements generally do not conflict, he said.

"Of the six Arab states of the African continent — Algeria, Egypt, Libya, Mauritania, Morocco and Tunisia — four [excluding Morocco and Mauritania] are Yamoussoukro Decision party states that are bound to the decision," Schlumberger said. "Egypt, Morocco, and Tunisia operate modern and competitive carriers and have a good safety rating, and these are the states that should jointly act as the driving force toward liberalization."

From 2001 to the present, ICAO's Cooperative Development of Operational Safety and Continuous Airworthiness Program has helped the RECs to prepare and execute action plans that complement those designed around economic development goals, including a push for all states to create autonomous civil aviation authorities. Results, however, have been mixed in some RECs, such as the Economic Community of West African States (ECOWAS).

"Despite the several ministerial meetings, the various studies and reports prepared, and the financial support by international donors such as the World Bank and the African Development Bank, ECOWAS has not adopted any legally binding legislation or regulations that could be seen as steps toward implementation of the Yamoussoukro Decision," Schlumberger said. "Member states of the two other [West African] subregional entities, West African Economic and Monetary Union (WAEMU) and Banjul Accord Group (BAG), appear to have been more successful in implementing some of the required regulatory framework."

Counterintuitive Safety Oversight vs. Liberalization of Air Service African Regional Economic Communities, 2009

REC	Liberalization Score[1]	Comments
Arab Maghreb Union	1	No safety oversight at the REC level; leaders have only acknowledged need for liberalization.
Banjul Accord Group	4	REC oversight ongoing through COSCAP plan for common safety agency; full YD liberalization in progress.
Economic and Monetary Community of Central Africa	5	REC oversight pending, including COSCAP plan for common safety agency; nearly full YD liberalization completed.
Common Market for Eastern and Southern Africa	3	No safety oversight at the REC level; full YD liberalization agreed but one agency's role still pending.
East African Community	3	Ongoing REC oversight since 2007 through common safety agency; conformity to YD to be only through bilateral air service agreements.
Economic Community of West African States	NI	No safety oversight at the REC level; no comment about YD status.
Southern African Development Community	2	No safety oversight at the REC level; no liberalization found despite stated intentions.
West Africa Economic and Monetary Union	5	REC oversight ongoing through COSCAP plan for common safety agency; YD principles fully implemented.

Total African states = 54; REC = regional economic community; NI = not included; YD = Yamoussoukro Decision; COSCAP = Cooperative Development of Operational Safety and Continued Airworthiness Program

Notes:

The map on page 33 contains the author's safety ranking of each nation and its REC membership(s).

1. On the author's scale, 1 means no observed progress toward liberalization of air service, and 5 means full liberalization of air service.

Source: Adapted with permission from Charles E. Schlumberger, *Open Skies for Africa*

Table 1

In safety terms, these subregions — like some other economic communities — have been working to create and sustain regional safety oversight agencies and common improvements to the organization of state safety oversight capacity, personnel licensing and training standards, bird hazard control, aviation medicine, aircraft operations, continuing airworthiness and transporting dangerous goods.

"WAEMU has adopted a total of 10 safety and security regulations to address the region's safety and security challenges," he said. "However, while the necessary regulations are in place, the overall safety and security situation remains unsatisfactory. … Nevertheless WAEMU's full liberalization of air services within its territory must be considered a successful step toward ultimate implementation of the Yamoussoukro Decision."

Another example was the provision for a regional safety oversight agency within the model of harmonized civil aviation regulations developed by the East African Community (EAC) air transport program. As one by one they adopt these regulations, EAC states commit to supporting this subregion's Civil Aviation Safety and Security Oversight Agency, created in 2007.

"Continued resistance to the liberalization of intra-African air services remains as yet another obstacle in the way of Africa's challenging path out of poverty," Schlumberger concluded. "The most effective single element of change has been the change in the rules of the game brought about by the Yamoussoukro Decision that, despite some shortcomings, has acted as a catalyst for change. … [I] recommend that a definite objective be set for the percentage of infrastructure investment to be dedicated to safety [by states] over the next 10 years; that is, 10 percent as recommended by the General Assembly of the United Nations. … [I also] strongly recommend that a definite time frame be fixed for establishing strong, independent and technically reliable supervision agencies, and that the target date for completing the establishment process should not extend beyond 2012."

This article is based on Open Skies for Africa: Implementing the Yamoussoukro Decision *by Charles E. Schlumberger. A pilot who holds a doctorate in civil law from the Institute of Air and Space Law at McGill University, he represents the World Bank Group, and his assignments have included numerous projects from 2002–2008 in African countries. Published in October 2010, the book is available via the Internet at <publications.worldbank.org/index.php?main_page=advanced_search_result&qs=1&bookTitle=open percent20skies percent20for percent20africa>.*

Notes

1. The agreement's full title is *Decision Relating to the Implementation of the Yamoussoukro Declaration Concerning the Liberalization of Access to Air Transport Markets in Africa.*
2. The non–Abuja Treaty states are Djibouti, Equatorial Guinea, Eritrea, Gabon, Madagascar, Mauritania, Morocco, Somalia, South Africa, and Swaziland.
3. Flag of convenience aircraft registrations are those of airlines that have headquarters outside the country of registration and do not operate listed air services to and from the country of registration.

Cultural Expectations

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A strong safety culture is the essential first ingredient in an SMS.

BY JAMES W. SMITH

How does the safety culture of an organization affect the design and implementation of its safety management system (SMS)?

Too often, people design and implement an SMS without first properly assessing their organization's safety culture for risk. The results are almost always the same: an SMS that at best is marginalized and at worst, completely ineffective — more of a "check in the box" just to gain an approval or keep a supplier happy.

As Deborah Hersman, chairman of the U.S. National Transportation Safety Board, said in an April 2009 speech to the International Society of Air Safety Investigators, SMS "functions well for companies that already are getting it right, but it may do little for companies without strong safety cultures."

The common assumption is that people will embrace the SMS, become engaged by using the hazard and incident reporting system, openly report near misses and errors, and take ownership of safety and compliance in their operation. But will they? Or will they continue to do their jobs the way they have always done them and engage in risky behaviors that are considered acceptable in their workplace? Our experience has been that they will continue to conform to their current ways of doing things — even conform to procedures in which there may be substantial risk — until they are shown how risky some of those procedures are, and then are led to a different place.

Measuring a Safety Culture

How do you measure a safety culture in an organization? There are subcultures in any large organization based on geography, leadership styles and even which shift a person works. To effectively measure a safety culture, the cultural norms of the organization must first be identified, and then there must be an examination of how the management team responds to error.

If we accept the fact that people generally behave in the manner that they believe they are expected to behave, then a good way to begin measuring a safety culture is with an employee safety culture survey. The challenge is to ensure that the right questions are being asked and that the employees trust that there will be no management retaliation when they tell the truth. For this reason, it sometimes is more effective to bring in an outside company to conduct the survey. Our experience has been that most employees are more willing to respond candidly to difficult safety- and compliance-related questions when the individual or company conducting the survey is not associated with their company and there is little likelihood of being singled out and punished for telling what really goes on in the workplace.

Safety Culture Findings

In an effort to assist aviation companies around the world, Baines Simmons has developed a diagnostic toolkit called the Safety Management and Risk Reduction Tool (SMARRT). One of the diagnostic tools in the toolkit is our Safety Culture Organizational Review Evaluation (SCORE) assessment tool, which is used to measure the safety culture and risk tolerance of an organization. Since 2007, Baines Simmons–Americas has used the SCORE tool to assess more than 2,000 maintenance technicians from both unionized and non-unionized organizations across North and South America. The organizations were representative of airlines operating under U.S. Federal Aviation Regulations Part 121; original equipment manufacturers operating under Parts 21 and 25; and maintenance, repair and overhaul (MRO) facilities operating under Part 145.

The survey results have consistently revealed two safety issues:

- The management team is almost always unaware of — or ignoring — the risk-taking that occurs on the flight line or on the hangar floor; and,
- More than 80 percent of the maintenance personnel surveyed said that it is necessary and actually acceptable to sacrifice safety and compliance to complete their jobs on time.

The management team is almost always unaware of the risk-taking that occurs on the flight line or on the hangar floor.

In May 2010, Baines Simmons–Americas invited more than 1,800 people in North and South America to participate in an abbreviated SCORE assessment via our monthly newsletter. Most of the 330 people who responded to our newsletter were either managers or senior managers in their organizations. They were asked to answer the questions the way they thought their frontline employees would answer them. We then compared the responses from the aviation managers and leaders with the data collected from the more than 2,000 maintenance technicians we had previously surveyed.

While there were a number of significant differences in the responses of the managers and the technicians, the similarities were disturbing.

For example, 52 percent of the managers agreed with the statement, “We usually

Safety Culture Assessment

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Before I start a job, I'm always given the necessary information.					
Technicians[1]	5%	36%	6%	44%	9%
Other survey respondents[2]	21%	32%	11%	26%	11%
There is often confusion between departments over some of their exact roles and responsibilities.					
Technicians	28%	47%	12%	12%	2%
Other survey respondents	26%	37%	16%	0%	21%
The procedures I use are accurate and complete.					
Technicians	9%	48%	10%	28%	6%
Other survey respondents	21%	26%	32%	11%	10%
We usually manage to complete a job despite the non-availability of the specified equipment/tools.					
Technicians	24%	57%	8%	10%	2%
Other survey respondents	5%	47%	26%	11%	11%
We often have to rush jobs due to unrealistic deadlines.					
Technicians	43%	41%	7%	7%	1%
Other survey respondents	16%	37%	32%	11%	5%
Due to limited time or resources, there have been times when i signed off for work that was not completed.					
Technicians	3%	14%	17%	38%	28%
Other survey respondents	5%	11%	16%	32%	37%
I pride myself on getting an aircraft back to service on time, even if I occasionally compromise on small details.					
Technicians	8%	29%	12%	41%	11%
Other survey respondents	5%	26%	26%	41%	21%
My immediate boss sometimes pressures me not to follow maintenance procedures.					
Technicians	5%	15%	9%	53%	18%
Other survey respondents	11%	5%	21%	42%	21%
My immediate boss would approve of my actions if I did not follow procedures in order to get an aircraft away.					
Technicians	5%	21%	21%	41%	13%
Other survey respondents	5%	5%	32%	32%	26%
Management investigates incidents to understand weakness in safety procedures, not to discipline the person.					
Technicians	5%	35%	26%	24%	10%
Other survey respondents	26%	16%	16%	21%	21%
The management has no idea of what really goes on.					
Technicians	18%	33%	20%	23%	6%
Other survey respondents	16%	21%	21%	26%	16%

Notes:

1. Technicians' responses were derived from Baines Simmons–Americas' assessments of about 2,000 maintenance personnel from 2007 to 2010.
2. Other survey respondents were 330 people — most of them managers in aviation organizations — who were asked to answer the questions in a Baines Simmons–Americas survey in the same way they believed their frontline maintenance personnel would respond.

Source: James W. Smith, Baines Simmons–Americas

Table 1

manage to complete a job despite the non-availability of the specified equipment/tools" (Table 1). In other words, they believed that their frontline employees engaged in noncompliant behavior.

Sixteen percent of the managers agreed with the statement, "Due to limited time or resources, there have been times when I signed off for work that was not completed." In other words, they knowingly condoned noncompliant behavior within their frontline workforce.

Sixteen percent of the managers also agreed with the statement, "My immediate boss sometimes pressures me not to follow maintenance procedures," and 10 percent agreed that "My immediate boss would approve of my actions if I did not follow procedures in order to get an aircraft away."

The concept of "mutually facilitated risk" is clear, and the potential consequences are apparent. After all, the safety culture of any organization is a direct reflection of its value system. Are safety and compliance really core business values or are they just slogans on a break room wall? The results of these surveys suggest that the message is clear to the technicians that production is more important than safety and compliance.

If managers are aware of the noncompliance issues and at-risk behaviors in their organization and are not proactively addressing these issues, then they are just as much to blame as the frontline technicians. However, 42 percent of the managers surveyed disagreed with the statement, "Management investigates incidents to understand weakness in safety procedures, not to discipline the person" — an indication that managers absolve themselves of any culpability and instead participate in the "blame and punishment" management model.

Repeating the Errors

A quotation sometimes attributed to Albert Einstein says insanity is doing the same thing over and over again and expecting different results. Does this definition apply here? Unfortunately, it does. Unless managers are willing to examine their technicians' working conditions — including scheduling, staffing, tooling, equipment and training — then they are doomed to repeat, and pay for, the errors that occur in the operation.

If 26 percent of a company's technicians believe — as our survey found — that their immediate bosses would approve of their actions if they did not follow procedures in order to speed up their work on an aircraft, then it is reasonable to expect the technicians to behave in that manner. If 34 percent of technicians also believe that managers investigate incidents to find someone to discipline rather than to identify and understand weaknesses in safety procedures, the technicians are unlikely to be forthcoming in admitting their errors, violations and risk in the workplace.

Technical/maintenance failure continues to be a significant cause or contributing factor in fatal civil aircraft accidents. While there is no solution that will eliminate all risk, implementing an effective SMS will go a long way toward helping to identify, understand and reduce the risk in an operation.

How to analyze, design and implement an SMS is critical. One of the most important elements in SMS design is the engagement of the frontline employees. In every organization we have worked with, the management team readily admits that the frontline employees and technicians know best where the safety/compliance gaps and risks reside in their operations. However, when we approach the technicians about an issue, their response is almost always something along the line of, "Yeah, we've told the managers about that a hundred times already, but they don't do anything about it, so we quit telling them." Eventually, the communications pipeline dries up — which explains the survey results that we routinely see in our SCORE assessments.

Our Safety Management Diagnostic tool shows us that virtually every organization has some of the elements necessary for an SMS, but often they are either not linked together or they are underutilized because they are viewed as cumbersome administrative burdens that add little or no value to the organization. For an SMS to work, it must be directly linked to daily activities, to the existing safety systems and — most importantly — to the operational and business metrics. An effective SMS not only reduces error and improves safety and compliance but also supports a shift in the corporate culture by opening the lines of communication and making safety and compliance the top priority at all levels of the organization.

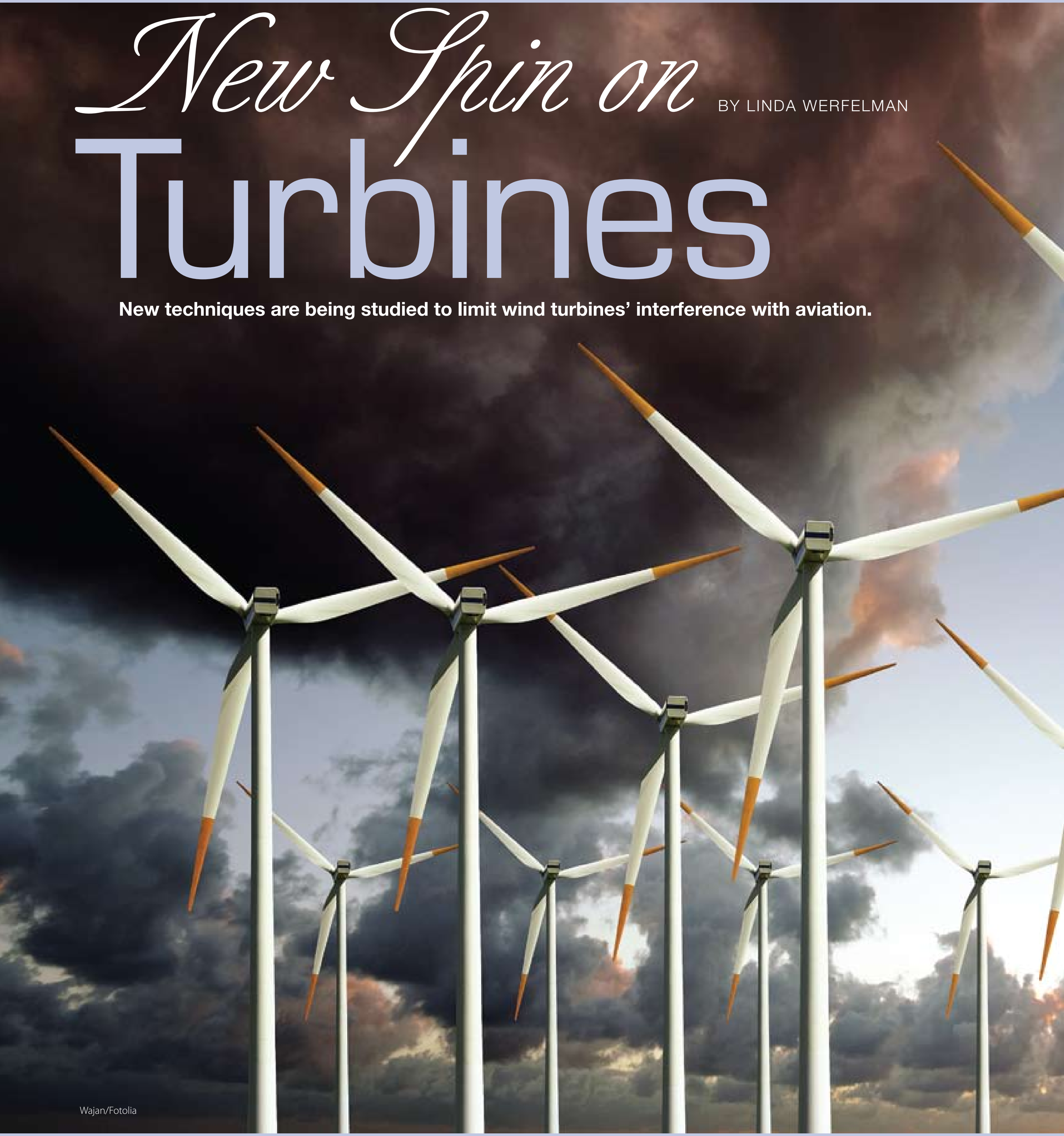
James W. Smith is the technical director for Baines Simmons–Americas.

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, 601 Madison St., Suite 300, Alexandria VA 22314-1756 USA or donoghue@flightsafety.org.

New Spin on Turbines

BY LINDA WERFELMAN

New techniques are being studied to limit wind turbines' interference with aviation.



Wajan/Fotolia

The aviation industry and advocates of wind energy — sometimes at odds because of the unintended interactions of spinning wind turbine blades and aviation radar — are seeking ways to allow the two technologies to coexist.

Wind farms, which can consist of hundreds of wind turbines, are expected to generate 200 gigawatts (GW) of power worldwide in 2010; that amount is expected to increase to 1,000 GW by 2020 — equivalent to about 12 percent of global power demand, according to data from the Global Wind Energy Council (GWEC).[1]

Wind turbines convert the wind's energy into either mechanical energy — most often for pumping water in rural areas — or electrical energy, which can be used locally or, on a broader scale, sold to electric utilities (see "How Wind Turbines Work," p. 42).

In addition to generating energy, however, wind turbines generate interference with ground-based aviation and weather radar, either by blocking radar signals or by creating false images on air traffic control (ATC) radar screens.

"Aircraft targets, and to some extent, weather features seen by NOAA [the U.S. National Oceanic and Atmospheric Administration] radars can be temporarily lost, fail to be located, shadowed by the radar signature of the turbine farm or misidentified," said a 2008 study conducted by Mitre Corp. for the U.S. Department of Homeland Security (DHS).[2]

The study cited three examples:

- "A wind farm located close to a border [between ATC sectors] might create a dead zone for detecting intruding aircraft."
- "Current weather radar software could misinterpret the high apparent shear between blade tips as a tornado."
- "Current air traffic control software could temporarily lose the tracks of aircraft flying over wind farms."

The problem is exacerbated by the continuing use of aging radar technology, according to the study and other analyses of radar interference. Older, analog radar systems are not able to

How Wind Turbines Work

Wind-electric turbine generators — or wind turbines — that generate electricity for sale to utilities typically consist of rotor blades, which rotate around a horizontal hub to convert wind energy into rotational shaft energy.[1,2]

The hub connects to a gearbox and often to a generator,[3] housed in a nacelle, located beneath or behind the blades. The rotor and nacelle typically are mounted at or near the top of a steel tower. Turbine systems also include controls, electrical cables and interconnection equipment.

Rotor diameters vary, and newer models can be as long as 80 m (262 ft). Most wind turbines have three rotor blades made of fiberglass-reinforced polyester or wood-epoxy; some turbines have only one or two blades, however.

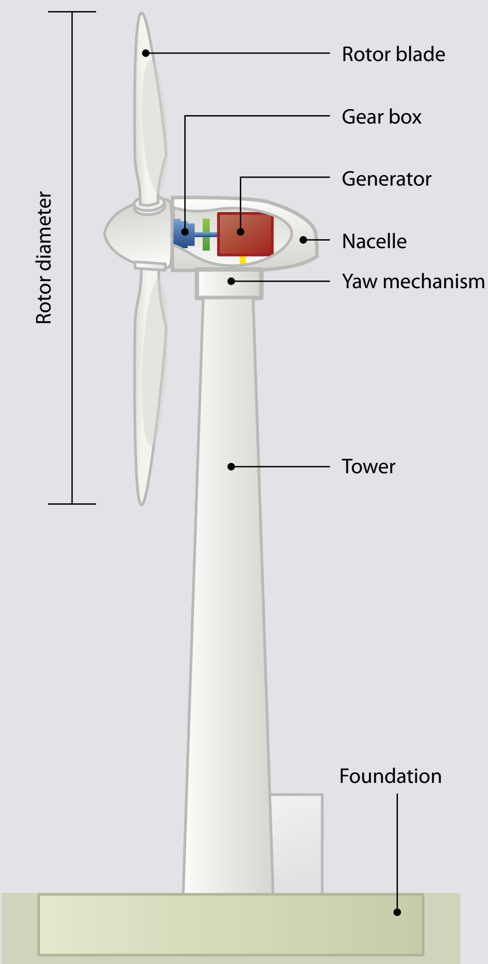
Wind turbines have a yaw mechanism that turns to align the top of the tower with the wind. Most wind turbines face into the wind, with the nacelle and tower behind them; others are downwind designs.

Most rotor blades operate at a constant speed of 10 to 30 rpm, but some rotate at a variable speed.

As wind passes the blades, the blades rotate, and the rotation drives the shaft of the generator, producing electricity that then is delivered to a utility's transmission lines — sometimes thought of as pipelines that carry electricity to areas where it is most in demand.

The output of an individual wind turbine varies, depending on the size of the turbine and the speed of the wind through the rotor. Wind turbines being manufactured now can produce as much as 5 megawatts of electricity, enough to provide electricity for one year to more than 1,400 households in the United States, where the American Wind Energy Association (AWEA) estimates average household consumption at 10,000 kilowatt hours.

— LW



Arne Nordmann/Wikimedia and Susan Reed

Notes

1. AWEA. *Wind Web Tutorial*. <www.awea.org/faq/wwt_basics.html>.
2. Renewable UK. *Wind Energy Technology*. <www.bwea.com/ref/tech.html>.
3. Some newer wind turbines have direct drive and do not require a gearbox.

differentiate between wind turbines and aircraft — or, in some cases, between wind turbines and weather systems.

Nancy Kalinowski, vice president of system operations services for the U.S. Federal Aviation Administration (FAA), said that the spinning blades of wind turbines can be "picked up by radars with a signal strength greater than a Boeing 747." The danger, she said, is that "because the radar repeatedly sees this large return, the radar will not pick up actual aircraft in the area."

Kalinowski's office is responsible for evaluating plans to build structures — including wind turbines — that are 200 ft (61 m) tall or taller that might interfere with safe use of navigable airspace. In testimony delivered in June 2010 before a subcommittee of the U.S. House of Representatives Armed Services Committee, Kalinowski said that the number of wind turbine cases presented to the FAA has increased dramatically in recent years — from 2,030 in 2004 to 25,618 in 2009. In the first six months of 2010, there were 18,685 cases, she said.

"There are real and significant issues that must be evaluated by the government prior to the approval of wind turbines," she said, noting that after the FAA receives a notice of proposed construction of a wind turbine, the agency conducts an initial study that typically takes 30 days. "The notice provides the FAA with the opportunity to identify the potential aeronautical hazards to minimize any adverse effects to aviation."

If the FAA — or the Department of Defense, NOAA or any of several other federal offices that may be required to evaluate a proposal — has an objection, that office describes the objection, and the person or company that filed the proposal offers a mitigation strategy.[3] If there is no objection, the FAA issues a Determination of No Hazard — a go-ahead for construction to begin.

In recent years, the FAA and other federal agencies contested plans for a number of proposed wind turbines near radar installations — actions that the U.S. Department of Energy said stalled the development of wind farms that would have produced thousands of megawatts of wind energy.

'Mitigation Toolbox'

A number of mitigation strategies already have been implemented for various wind turbine sites across the country, the American Wind Energy Association (AWEA) said, adding that there is "not a silver-bullet solution that can solve every potential conflict."[4]

AWEA said its goal is to establish a "mitigation toolbox" of workable solutions to provide the best solution in each individual case. These mitigation measures may call for modifications to a radar system, wind turbines or the layouts of wind farms, the AWEA said, adding that some of these possibilities require further research before they can be widely used.

"For example, in some cases, upgrading older radars with new radars or upgrading software has been shown to address concerns and accommodate additional wind energy development," the AWEA said, citing the Mitre study, which reported that 80 percent of U.S. radars were manufactured in the 1950s through the 1980s.

Stu Webster, a representative of the AWEA and director of permitting and environmental for Iberdrola Renewables, a major U.S. wind power generator, told the House Armed Services subcommittee that mitigation strategies range from providing air traffic controllers with additional training to help them differentiate between aircraft and radar screen "clutter" produced by wind farms to changing the location of some wind turbines and developing radar-absorbing materials for wind turbine blades.

The Mitre study said that several modifications have been proposed to alter the appearance of wind turbines on radar screens.

"One proposal is to put an active layer on the outside of the turbine blades to modulate dynamically the blade … signature [on Doppler radar]," the study said. "These modulations, it is claimed, could shift the Doppler frequency spectrum from the blades to lie outside the range of frequencies processed by the radar."

The study said it was unclear whether the modifications would affect the blades' aerodynamic properties, and how long the modifications might last.

Another proposal — developed by technology provider QinetiQ and Vestas Wind Systems, a wind turbine manufacturer — modifies the inside of wind turbine blades by installing layers of circuits and reflectors to dilute the strength of their radar return.

QinetiQ and Vestas say their solution uses radar-absorbing materials in a "stealth turbine" technology that also calls for radar-absorbing materials to be sprayed directly onto a wind turbine tower.[5]

Mark Roberts, QinetiQ's strategic business director for energy and environment, characterized the technology as a "genuine game-changer," which could remove a major barrier to the development of the renewable energy industry.

The Mitre study suggested that sophisticated radar data processing might be capable of "blanking out" radar returns from wind turbines, but "it would seem much easier to do so if the actual configuration of the turbines were known at every instant." This potential solution deserves further investigation, the study said.

Other proposals for solving the problem have recommended modifications of radar

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system hardware and/or software; most of these proposals are aimed at digital radar — not the older analog systems. Proposals also have called for radar design modifications, such as changes in the length and frequency of pulses, and for installation of a supplemental "gap filler" radar to compensate for a loss of radar coverage caused by wind turbine interference.

Other suggestions have included rerouting aircraft to avoid, when possible, areas affected by wind turbine radar interference; repositioning radar installations, often by increasing their height; and simultaneously using two radar beams to differentiate between aircraft and wind turbines.[6]

Radars that cannot be modified to handle wind turbine interference could instead be replaced, "in a phased upgrade," the Mitre study said, estimating the cost to replace a radar installation at between $3 million and $8 million, compared with the cost of a wind turbine — $2 million to $4 million.

Planned Upgrade

Renewable UK, a trade organization representing wind and marine renewable energy, said that this year in the United Kingdom, there are 270 operational wind farms made up of a total of 3,088 turbines. The organization estimated that half of all wind farm development proposals will be met with objections from the aviation industry because of interference with radar or with flight at low altitudes.

The organization is working with the U.K. Civil Aviation Authority, U.K. NATS (formerly known as National Air Traffic Services) and others to address these concerns.

NATS, in an effort to avoid a proliferation of numerous site-specific mitigation plans, has endorsed a plan based on its upgrade of all primary radars to a common standard. Older NATS En-Route Ltd. (NERL) primary surveillance radars of varying types and ages are being replaced with products manufactured by Raytheon Canada. Although these new radars "do not satisfactorily mitigate the wind turbine effects where they occur," NATS said in a 2008 report, a study has identified radar system modifications that will be implemented across the board.[7]

The benefits of the changes "would be negated if only a small number of radars were modified," the report said. "In addition, while there may be a small number of primary radars which are not currently subject to wind turbine interference, it is clear that this situation is very likely to change over the lifetime of these facilities."

'No Physical Constraint'

The Mitre study concluded that, despite the pending issues, "there is no fundamental physical constraint preventing detection and mitigation of windmill clutter" — and no reason that wind turbines and radar cannot coexist.

The study added that resolving the problem requires — in addition to the creation of mitigation strategies — the development of quantitative evaluation tools to determine when radar interference requires corrective action.

Notes

1. GWEC. *Wind Power to Provide a Fifth of World's Electricity by 2030*. <www.gwec.net/index.php?id=97&L=0%252525B4>.
2. Brenner, Michael et al. *Wind Farms and Radar*. Project No. 13089022. Report prepared by Mitre Corp. at the request of DHS. January 2008.
3. A related issue that Kalinowski said is not considered in the FAA's review process involves competition for land where primary aviation radars are located. Landowners have been offered "substantial financial incentives" not to renew leases with the FAA for radar installations and instead to sign agreements with companies planning to install wind turbines. Suggestions that the FAA relocate radar equipment to accommodate wind farms are "costly, disruptive, unacceptable and unworkable," Kalinowski said.
4. AWEA. *Airspace, Radar and Wind Energy*. <www.awea.org/pubs/factsheets/04-10_Radar_factsheet.pdf>.
5. QinetiQ. *QinetiQ and Vestas Claim World First in Radar Mitigation Wind Turbine Technology*. <www.qinetiq.com/home/newsroom/news_releases_homepage/2009/4th_quarter/stealth_turbine_trial.html>.
6. Webster, Stu. Testimony on behalf of AWEA before the readiness subcommittee of the U.S. House of Representatives Armed Services Committee. June 29, 2010.
7. NATS. *Mitigating the Effects of Wind Turbines on NATS En-Route Ltd (NERL) Operations*. Sept. 10, 2008.

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Growing accident numbers prompt a regulatory response.

Triage for HEMS

BY FRANCES FIORINO

Emergency medical services (EMS) aircraft in the United States each year transport about 500,000 seriously ill or injured patients and donor organs to medical facilities. The industry encompasses 1,211 rotary-wing and fixed-wing aircraft, which operate out of 857 bases (Table 1).

The recent poor safety record for helicopter EMS (HEMS) operations has prompted the U.S. Federal Aviation Administration (FAA) to issue a notice of proposed rulemaking (NPRM) that, if finalized, would mandate operational and equipment revisions. FAA Administrator Randy Babbitt says the goal is "to protect passengers, patients, medical and flight crews" (Table 2, p. 46).

The FAA in previous years has taken numerous non-regulatory actions to address HEMS safety, but in a recent safety review conducted in advance of the NPRM, the agency identified 75 commercial HEMS accidents in the 1994–2008 period that caused 88 fatalities and 29 serious injuries. Further, 127 helicopter air ambulance accidents involving 126 fatalities and 50 serious injuries occurred between 1992 and 2009 — a period in which the industry underwent strong growth (Table 3, p. 46). The U.S. National Transportation Safety Board (NTSB) in October released data showing that U.S.-registered medical helicopters were involved in 188 accidents from March 1990

Growth of U.S. HEMS Services Programs and Fleet, 1980–2010

Year	Number of Service Providers	Number of Helicopters	Number of Patients Transported/Year
1980	32	39	17,000
1990	174	231	160,000
2000	231	400	203,000
2005	272	753 rotor 150 fixed wing	500,000 average
2010	373	900 rotor 311 fixed wing	

Source: Association of Air Medical Services (AAMS). 2005 White Paper: Accessing the Future of Health Care; AAMS Atlas & Database of Air Ambulance Services (ADAMS) 2010

Table 1

Summary: Helicopter EMS Safety NPRM	
Common causal factors	Controlled flight into terrain, loss of control, inadvertent flight into instrument meteorological conditions, night flying
Proposed risk mitigations	Requirement to install helicopter terrain awareness and warning systems; establishment of operations control centers; conduct flights under FARs Part 135 when medical personnel are aboard
Estimated cost to industry	$225 million over 10-year period: $136 million for air ambulance certificate holders, $89 million for commercial helicopter operators
Estimated benefits	$83 million – $1.98 billion over 10-year period
Commentary close date	Jan. 10, 2011

EMS = emergency medical services; FARs = U.S. Federal Aviation Regulations; NPRM = Notice of Proposed Rulemaking

Source: FAA Notice of Proposed Rulemaking FAA-02010-0982, published Oct. 12, 2010

Table 2

U.S. Helicopter Accidents, 1992–2009	Accidents	Fatalities	Serious Injuries
Air ambulance operators	135	126	29
Commercial helicopters	75	88	50

Source: FAA Notice of Proposed Rulemaking FAA-02010-0982, published Oct. 12, 2010

Table 3

through August 2010. Those accidents resulted in 190 deaths.

The common causes of the crashes — inadvertent flight into instrument meteorological conditions (IMC), controlled flight into terrain (CFIT), loss of control (LOC) and night accidents — are linked by the risks inherent in these time-critical missions: flying at low altitudes into remote, unfamiliar regions over obstacles and rough terrain, often at night, and in bad weather and low-visibility conditions.

The FAA's NPRM, published Oct. 12, mainly focuses on air ambulance providers but also addresses commercial helicopters operated under U.S. Federal Aviation Regulations Part 135 and Part 91.[1]

Many of the NPRM's provisions are drawn from NTSB recommendations and the FAA's previous non-regulatory actions. If finalized, the rule would require air ambulance operators to operate under Part 135 rules whenever medical personnel are aboard, imposing more stringent weather minimums and flight crew rest and duty time requirements. Currently, repositioning flights and flights to an emergency site with medical personnel but without patients may be flown under the general flight rules of Part 91; only flights involving transport of patients are operated under Part 135.

The FAA, noting that this proposed rule could force operators to turn down flights that would meet Part 91 — but not Part 135 — requirements, or cause a flight crewmember to exceed the new flight time limitations, asked for comments about this provision's impact on the availability of services.

With inadvertent flight into IMC conditions a common factor in accidents, the proposed rule would also mandate changes in visual flight rules (VFR) and instrument flight rules (IFR) operating procedures for EMS operators. For example, the pilot-in-command would be required to hold a helicopter instrument rating, and operators would have to establish risk-analysis programs and conduct preflight safety briefings, once per shift, for medical personnel assigned to the helicopter base.

The rulemaking, if finalized, would require EMS certificate holders with 10 or more helicopters in service to establish an operations control center staffed with "operations control specialists," who would work with pilots to mitigate risks and to ensure that the pilots complete a preflight risk analysis worksheet. The FAA wants to know whether this requirement should be based on the size of the operator's fleet or the number of flights conducted. A January 2009 FAA survey of the agency's inspectors with oversight of helicopter air ambulance operations indicated that 89 percent of operators voluntarily had established some type of operations control center.

Association of Air Medical Services (AAMS) Executive Director Dawn Mancuso described a typical operations control scenario: If first-responders at the accident site determine that air ambulance transport of the crash victim is desired, they call an operations center, which transmits the request to the pilot. Mancuso says that the pilot is told only the location of a flight, not the condition of the patient(s) in order to remove the pressure to fly regardless of conditions. Only after the pilot makes the go/no-go decision is the medical team informed of the patient's condition.

Another provision of the NPRM would require air ambulance operators to equip aircraft with helicopter terrain awareness and warning systems

(H-TAWS) within three years of the rule's adoption. The FAA notes that it decided against requiring use of night vision goggles (NVGs), saying that more research is required before naming NVGs as an alternate means of compliance with the H-TAWS rule.

But the FAA's plans are not necessarily what working HEMS pilots are seeking in terms of enhancing safety. Some pilots believe that NVGs provide more significant risk mitigation than H-TAWS. One pilot told *AeroSafety World*, "I do not know of any EMS helicopter pilot who would trade in his or her NVGs for H-TAWS."

The National Emergency Medical Service Pilots Association (NEMSPA) expects to submit its formal position on the NPRM. The pilot group's position paper on NVGs states, "The majority of night flight operations … are conducted to a significantly higher degree of safety when the pilot is utilizing night vision goggles."

In addition, NEMSPA recently surveyed active HEMS pilots to determine their views on the effectiveness of the FAA's 2009 revision of Operations Specification (OpSpec) A021, a non-regulatory refinement. Among other changes, the OpSpec raised the minimum ceiling and visibility requirements for night HEMS operations.

Rex Alexander, NEMSPA president, said that of the 568 active HEMS pilots participating in the survey, more than 73 percent said NVG equipment should be available for all night VFR operations. About 18.6 percent did not see a need to require the NVG equipment, and 88 percent said the establishment of a minimum required HEMS-specific pilot training curriculum would be an important element in improving safety. When asked to rank five types of equipment important to flight safety, NVGs ranked first, followed by autopilots. H-TAWS and traffic-alert and collision avoidance system/traffic advisory system tied for third place, and "having a second pilot" came in fifth.

As to equipment, the FAA is seeking comments on a possible future requirement to install lightweight aircraft recording systems (LARSs) on air ambulance helicopters. This move would help NTSB collect data in an accident, as well as facilitate participation in flight operational quality assurance programs. The FAA notes that lightweight LARS units are relatively cheap: $6,450, plus installation and data-retrieval software.

For all commercial operators flying under Part 135, the NPRM would require that alternate airport IFR ceiling minimums be 200 ft above the published minimum and that visibility be at least 1 mi (1.6 km) for the approach, and never less than the approach's minimum visibility. It would also require operators to equip helicopters with radio altimeters. In addition, all on-demand Part 135 aircraft — not just HEMS aircraft — would be required to prepare a load manifest and transmit a copy of the document to the operations base.

The FAA estimates that complying with the NPRM's provisions in current form would, over a 10-year period, cost operators $225 million but produce a benefit of $83 million to $1.98 billion.

The FAA also notes that such a regulation would have a "significant impact" on a substantial number of small helicopter air ambulance and air tour operators. As of February 2009, the FAA listed 74 helicopter air ambulance certificate holders, 38 of which had five or fewer helicopters in their fleets; 14 had six to 10 aircraft, six operated 11 to15 helicopters, and 16 flew more than 16 aircraft.

The air medical services industry saw rapid growth in the 1980s and again in the past five years. In 2003, the first year for which data are available, AAMS[2] members reported that they had 565 helicopters at 72 bases — airports, hospitals and helipads. By 2008, the fleet had increased 24 percent to 699.

AAMS data indicate that industry growth was fueled by changes in the health care system. Insurance and financial pressures led to closures of hospitals and reductions in the number of doctors, particularly in rural areas, where about 60 percent of U.S. auto accidents occur, according to AAMS.[3]

But industry growth doesn't necessarily mean deteriorating safety levels. The U.S. Government Accountability Office (GAO) report of April 2009[4] notes that the industry lacks reliable, accurate data about actual flight hours — currently there is no requirement to report hours flown. Without that information, the industry accident rate cannot be accurately calculated, and that rate is a "critical piece of information in determining whether the increased number of accidents reflects industry growth or a declining safety record," the report said, recommending the collection of complete data on air ambulance operations.

Frances Fiorino is an aviation writer who covers air transport and general aviation safety and training issues. She resides in Washington, D.C.

Notes

1. The FAA NPRM employs the term "air ambulance," while NTSB refers to such operations as HEMS.
2. AAMS. *White Paper 2005: Assessing the Future of Health Care*. 2005.
3. Ibid.
4. GAO. *Aviation Safety: Potential Strategies to Address Air Ambulance Safety Concerns*, GAO-09-627T. April 22, 2009.

BY RICK DARBY

Talking Points

Communication between controllers and U.S. pilots in non-U.S. airspace takes extra attention.

George Bernard Shaw said that England and America are two countries divided by a common language. The same often applies to U.S. pilots trying to communicate with air traffic control (ATC) on international flights, even though their mutual language is ostensibly English — further standardized by International Civil Aviation Organization (ICAO) phraseology. When asked about their ATC communication experiences flying in non-native English-speaking countries, 52 percent of a study group of U.S. pilots reported the experiences as negative, compared with 17 percent who described them as positive or very positive.

The data are contained in the third of a series of reports by the U.S. Federal Aviation Administration (FAA) Civil Aerospace Medical Institute.[1] In responses to a questionnaire and interviews, 48 U.S. pilots described their radio communications, mainly with air traffic controllers, during international flights.

The FAA estimates the growth of international passenger traffic to and from the United States will average 4.6 percent per year through 2025.[2] As the volume of U.S. and non-U.S. air carrier traffic increases, "so will the number of transmissions necessary to provide ATC services," the report says. "Given that the present air-ground communications system is reaching pre-9/11 saturation levels during peak traffic periods, it is common for some controllers to send longer and more complex messages to reduce the number of times they need to communicate with individual aircraft and use nonstandard phraseology to decrease the amount of time on frequency. The ability to quickly decode, understand, read back and comply with these messages can be a problem for all pilots, especially those who are unfamiliar with how ATC services are delivered by controllers in a particular region."

The survey's frequently used, awkward phrase "non-native English-speaking language experiences" was in many cases interpreted by members of the pilot study group to mean any occasion when linguistic difficulty arose in an environment where English was not the controllers' first language. Their reports involved controllers and pilots of other aircraft speaking their own first language, as well as when controllers' accents proved difficult to understand.

In response to the question, "How would you rate your overall non-native English-speaking language experiences during these [international] flights?" a slight majority rated them as "negative." Sample comments from those pilots included the following.[3]

- "It increases the number of times clearances have to be repeated. It adds to the controller's workload and the pilot's also."

- "We hear controllers and pilots use their native language for conversation — as we do domestically. It perplexes me when I hear things I do not understand. First of all, it eats up airtime that somebody else may need.

Second, it distracts me from my situational awareness. I was in China this weekend, and most of the other airplanes were getting their clearances in Chinese … . If ATC is talking to Air France, it's in French. I'd really like to know what their clearances were, but I don't speak the local language. They may be talking about a thunderstorm up ahead, and we're heading there."

Hearing radio communication in a language a U.S. pilot does not understand can involve subtle issues of protocol.

- "The other problem is that it breaks radio decorum — the unwritten rules of when to chime in. If ATC talks to Air France in French, I'm waiting for the pilot to respond. I don't know whether this guy should reply or not. I thought that after counting off a few seconds enough time has passed, so I ask to do something, but I just stepped on top [blocked the reply] of Air France, because now he's trying to respond."

Pilots were asked, "How is your workload affected by your experience with non-native English-speaking language differences during a flight?" Among those who offered answers, 48 percent said it increased their workload, 37 percent said it was "workload related" and 15 percent said it required added attention.

"When controllers talk in their language, it's invariably when there's a lot going on," said one. "They revert to their language because the pilots [who speak the national language] don't understand what to do when it's said in English."

Pronunciation of names of fixes, particularly those not immediately visible on the navigation display, caused problems for some pilots: "Where are they sending me? Spell the fix and I'm out of your way."

Other pilots developed their own systems to mitigate language problems: "We went so far as to make a four-page list of Spanish words — what the fixes are; the way they're spelled; the way they sound — the way controllers pronounce them and the way we hear them."

Yet, although there was a consensus that language problems added to a pilot's workload, such problems were not necessarily frequent.

Answers to the query, "How often do you experience communication problems in non-native English-speaking airspace/airports?" were weighted toward "occasionally" (Table 1). Responses of "frequently," "often" and "without fail" combined were 23 percent of the total.

Some examples of communication problems involving non-native English-speaking environments were these:

- "Just as Bangkok Ground [Control] is hard for us to understand, they have just as much difficulty understanding us — it's occasionally hazardous."
- "The big problem is, if I don't hear my call sign, especially the [first part of our company's name] I have to have the entire transmission said again."

But, according to another pilot, "For the most part, English is very good in Costa Rica, Guatemala and Panama. In Europe, everybody is raised speaking two or three different languages."

The pilot group was asked, "Of the non-native English-speaking airports that you fly into, do you find the English language skills of other pilots and controllers comparable from one country to that of another?" Among the 48 respondents, 31 percent indicated that the English language skills of pilots and controllers are comparable across countries. Among the other pilots, 61 percent believed that English skills varied among countries, while the others did not comment or were undecided.

One pilot said, "Controllers whose understanding of the English language is restricted to ATC terminology kind of freeze up when asked a question outside the box [of standard phraseology]. Their communication is limited to basic ATC [subjects] and to what [instructions] they're planning to give you."

The report says that regardless of where pilots flew outside the Anglophone sphere, six general themes emerged: "First, when busy, controllers don't always have the time to

Frequency of Communication Problems in Non-Native English-Speaking Airspace and Airports

Frequency of Communication Problems	Number of Pilots
Rarely (less than 10% of interactions with controllers)	12
Occasionally (between 10% and 24% of interactions with controllers)	25
Frequently (between 25% and 74% of interactions with controllers)	8
Often (between 75% and 90% of interactions with controllers)	2
Without fail (more than 90% of interactions with controllers)	1

Note: Responses were based on a questionnaire and interviews of 48 U.S. pilots who flew international routes.

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

Table 1

say it right. Second, controllers can become frustrated with pilots who do not immediately grasp what is said in accented English. Third, some controllers speak too fast for pilots to understand. Fourth, controllers who are more experienced make communicating easier. Fifth, as pilots are exposed to an area more frequently, communicating becomes easier. Sixth, accented English requires increased attention."

The study inquired how often, when flying in non-native English-speaking countries, controllers used standard ICAO phraseology for routine radio communications. The most frequent response was "often," followed by "without fail" (Table 2), representing in combination 85 percent of all responses.

"The non-native English-speaking [countries] use more ICAO standards, certainly more than we do in the U.S.," said one pilot. "It's the phraseology they are trained with, and that's what they tend to give us. … My concern is when we come into the nonstandard arena, when there's something wrong with the aircraft and we have to convey a lot of information at a given time and we need very quick, good information right now — is it readily available and how would it be conveyed, standard or nonstandard?"

The ability to form spontaneous, non-routine sentences can be important in unusual or emergency situations. "When flying in a non-native English-speaking country, how often do controllers use common English for routine communications to you?" the pilots were asked — "common English" meaning conversational language rather than by-the-book ICAO-speak.

Controllers scored lower on this scale, by the pilots' reckoning, than on use of ICAO standard phraseology (Table 3).

"Common English might be used when coordinating a ground delay or taxi back to the gate, maybe the routing is nonstandard, or ATC is trying to figure out why we need to delay," said a pilot. "Some experienced controllers revert to common English to help us understand an instruction like 'taxi to holding point.' If we ask for a repeat, they may use common English so we can understand it by saying, 'Do not enter runway.'"

When the subject changed from how often controllers used common English to how well they used it, the most common assessments by pilots were "fair" and "good" (Table 4). Sample comments included the following:

- "It's been my experience that European controllers, especially the German controllers, converse well. We're relatively new flying over to Delhi [India]; we have a little difficulty in Pakistan, Afghanistan and Kazakhstan because they are new for us, as we are new to them."

- "I find that when we step outside the bounds of ATC English, it becomes more difficult for them to express what they want to say and more difficult for us to understand what they're trying to say in common English. Basically, if ground crews want to hear 'Parking brake set,' even the phrase 'Parking brake is set' is outside of the norm."

Frequency of ICAO Standard Phraseology Usage by Controllers in Non-Native English-Speaking Countries

Frequency of ICAO Phraseology Usage	Number of Pilots
Without fail (more than 90% of interactions with controllers)	13
Often (between 75% and 90% of interactions with controllers)	28
Frequently (between 25% and 74% of interactions with controllers)	6
Occasionally (between 10% and 24% of interactions with controllers)	1
Rarely (less than 10% of interactions with controllers)	0

ICAO = International Civil Aviation Organization

Note: Responses were based on a questionnaire and interviews of 48 U.S. pilots who flew international routes.

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

Table 2

Frequency of Common English Usage by Controllers in Non-Native English-Speaking Countries

Frequency of Common Language Usage	Number of Pilots
Without fail (more than 90% of interactions with controllers)	2
Often (between 75% and 90% of interactions with controllers)	8
Frequently (between 25% and 74% of interactions with controllers)	2
Occasionally (between 10% and 24% of interactions with controllers)	21
Rarely (less than 10% of interactions with controllers)	15

Note: Responses were based on a questionnaire and interviews of 48 U.S. pilots who flew international routes.

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

Table 3

Controller Common English Skills in Non-Native English-Speaking Countries

Controller Common English Skills	Number of Pilots
Their communication skills are good	17
Their communication skills are only fair	20
Their communication skills are poor	7
Their communication skills are terrible	0
Invalid — Rated British controllers	1
No selection	1
Multiple selections	2

Note: Responses were based on a questionnaire and interviews of 48 U.S. pilots who flew international routes.

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

Table 4

Amount of Attention Required to Understand Non-Native English-Speaking Controllers

Amount of Attention Required	Number of Pilots
A great amount	11
A considerable amount	20
A moderate amount	13
A limited amount	4
It is effortless	0

Note: Responses were based on a questionnaire and interviews of 48 U.S. pilots who flew international routes.

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

Table 5

How much attention does trying to understand non-native English speakers take? The most common response, reported by 42 percent of pilots, was "a considerable amount" (Table 5), followed by "a moderate amount," reported by 27 percent of pilots.

"I've found that anything outside the routine, although infrequent, requires a considerable amount of time," said a pilot. "I often ask ATC to repeat what they're saying. We recently had an airplane [crew] in China that wanted the emergency equipment [at the airport] and it never came. The controller didn't understand what they wanted, and neither did the emergency guys."

Another said, "In the non-native English-speaking countries, we really have to listen, stop doing whatever else we're doing, and listen to what they're telling us so we can understand the clearance. A lot of times, I'll pick up a pen or pencil in anticipation of what they're going to say so I have a written backup. This is unlike the U.S., where they're speaking to us as if in conversation — and we instantly say, 'Roger.'"

The report suggested the following "mitigation strategies and techniques" for U.S. pilots flying to non-native English-speaking countries:

- "Develop a visual aid to facilitate communications with non-native English-speaking controllers that lists the names of fixes with their phonetic spelling and identifier;
- "Talk slowly and deliberately to ATC to make understanding easier. Decoding one language into another is not an automatic process and takes time for less proficient speakers;
- "Learn to count in the languages of the countries you frequent;
- "Try to complete station-keeping tasks at cruise altitude (e.g., all briefing items, flight management system entries, flight attendant issues) so more attention is directed to listening to ATC when on descent;
- "Keep communications to very basic ICAO phrases. Any nonstandard requests are often difficult for non-native English-speaking controllers to understand; [and,]
- "Wear a headset or put in an earpiece instead of listening to external speakers."

Notes

1. Prinzo, O. Veronika; Campbell, Alan; Hendrix, Alfred M.; Hendrix, Ruby. "U.S. Airline Transport Pilot International Flight Language Experiences, Report 3: Language Experiences in Non-Native English-Speaking Airspace/Airports." Report no. DOT/FAA/AM-10/9. May 2010.
2. FAA. "FAA Aerospace Forecast Fiscal Years 2009–2025." 2008.
3. The report says, "[Various pilots'] discussions are combined, condensed, edited and presented from the perspective of a hypothetical, albeit typical, ATP-rated pilot in the form of a narrative." For the sake of readability, this article, like the report, treats each comment as that of one pilot although it may actually be an amalgamation.

Stop the Clock

Flight attendant fatigue is associated more with scheduling and physiological factors than duty time.

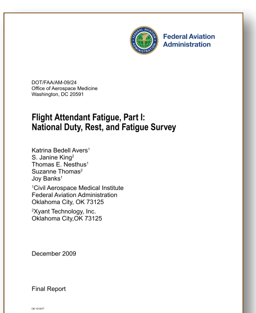
REPORTS

Beyond 'Time on Task'

Flight Attendant Fatigue, Part I: National Duty, Rest, and Fatigue Survey

Avers, Katrina Bedell; King, S. Janine; Nesthus, Thomas E.; Thomas, Suzanne; Banks, Joy. U.S. Federal Aviation Administration (FAA) Civil Aerospace Medical Institute (CAMI). Report no. DOT/FAA/AM-09/24. December 2009. 23 pp. Figures, references.

At the instigation of the U.S. Congress, CAMI has been studying flight attendant fatigue in connection with six research topics recommended in an initial report in 2007. A report on the sixth topic, fatigue countermeasures, was published previously (*ASW*, 11/09, p. 55), while the first of those recommendations, a "national survey of flight attendant field operations," led to this report.


Federal Aviation Administration

DOT/FAA/AM-09/24
Office of Aerospace Medicine
Washington, DC 20591

**Flight Attendant Fatigue, Part I:
National Duty, Rest, and Fatigue Survey**

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December 2009

Final Report

OK-10-0077

To frame its findings, the report says, "It is important to recognize that fatigue is more than sleepiness or tiredness. Fatigue has psychological, physiological and emotional implications that can impact the performance of safety-related duties, particularly during non-routine and emergency events."

Results were tallied from 9,180 cabin crewmembers who voluntarily and anonymously completed the survey. Among those who reported experiencing fatigue while on duty, 71 percent believed that their safety-related performance was affected, the report says. "Of those, 60 percent believed [that] their ability to respond to passenger needs — including service and safety-related items — was compromised, 36 percent reported cabin safety performance — e.g., arming/disarming doors, verifying seatbelts fastened — was affected, 34 percent felt their vigilance regarding cabin security … was impeded and 14 percent indicated [that] preflight safety briefings were affected."

Current U.S. regulations require that flight attendants receive a minimum rest period of nine consecutive hours after a scheduled duty period of 14 hours or less, or 12 consecutive hours of rest following up to 20 duty hours. These rest periods, however, can be adjusted downward as a trade-off for longer subsequent rest periods. The report says that those rest periods, however, "do not take into account a number of operational issues that affect fatigue, such as time-zone transitions, layover and recovery, duty day start or end times, and the individual's actual sleep need." It adds that disruption of circadian rhythm — the body's physiological "internal clock" — is a more important consideration in fatigue than "time on task."

Duty time may involve unusually fatiguing situations not accounted for by the regulations. These situations can include ill or disruptive passengers, malfunctioning cabin or galley equipment, passenger luggage not easily stowed in the available bins, and severe turbulence.

This survey was conducted "to identify the specific operational factors that may contribute to fatigue in cabin crew operations." Distributed to flight attendants representing 30 operators, the survey addressed each of the fatigue-related factors identified in a previous literature review. The factors were grouped into seven main topics: work background, workload and duty time, sleep "demographics" such as sleep at home and away from home, health, fatigue — including perceptions of fatigue, fatigue factors, fatigue effects and coping strategies — and demographic information about the flight attendants.

Although getting enough sleep is far from the only factor affecting fatigue, it is critical. The survey compared flight attendants' sleep at home and away from home. The flight attendants rated sleep-interfering factors on a five-point scale from "not at all" to "great extent." The average scores were higher for every factor in the "away" category. For example, "random noise" averaged 3.35 away, 1.89 at home. "Fear of oversleeping" averaged 3.21 and 2.06, respectively.

When asked to rate their overall quality of sleep away from home on a five-point scale from "very poor" to "very good," 18 percent reported "good" or "very good," 48 percent reported "fair" and 34 percent reported "poor" or "very poor."

Asked if they experienced fatigue while on duty, 84 percent said they had been fatigued during their previous bid period, a work period that often accounts for one month of assignments. Slightly more than half acknowledged that they had "nodded off" — experienced a brief sleep or semi-sleep — during a flight segment.

The study delved into the subjective side of the fatigue experienced — what factors the flight attendants associated with the fatigue and how it affected them.

Among those who reported being fatigued, 44 percent identified workload as a contributing factor, 42 percent mentioned work pace and 83 percent said that their work schedule was associated with fatigue.

"Flight attendants were given a list of 44 specific events … believed to contribute to fatigue in aviation operations," the report says. "They were asked to identify the frequency with which each event occurred [on a scale from 1 = never to 5 = always] and the extent to which each event contributed to their perceived fatigue [on a scale from 1 = not at all to 5 = very great extent]."

The 10 reported factors that most contributed to fatigue were a 14-hour or longer duty day; shift turnaround of less than nine hours; a 10- to 13-hour duty day; 14 or more consecutive duty days; short layovers; no breaks; missed meals; delays of three or more hours; and eight to 13 consecutive duty days.

"Examining the fatigue effect rating in conjunction with the frequency of occurrence, four of the top 10 factors received frequency ratings greater than 'occasionally,' including 10- to 13-hour duty day, missed meals, no breaks and short layovers," the report says.

Among fatigue factors associated with the work environment, flight attendants rated lack of crew rest highest in how much it affected them, though not highest in frequency. In terms of effect, lack of crew rest was followed in decreasing order by contaminated cabin air, weather conditions, malfunctioning cabin equipment and high cabin temperature.

The breakdown of factors associated with scheduling patterns showed that a duty day of 14 hours or more had the greatest effect on fatigue, although not the greatest frequency. But a 10- to 13-hour duty day was rated high both on effect and frequency.

"The amount of time between flight legs, including short layovers, was identified as one of the top 10 contributors to fatigue that occurred frequently," the report says. "Interestingly, two issues seem to be associated with layover length: first, short layovers that do not allow for meals or breaks; and second, extended waits between flight segments may contribute to long duty days with little flight time."

Flight attendants had suggestions for reducing their fatigue while on duty. "Three changes were recommended more often than the others:

Among fatigue factors associated with the work environment, flight attendants rated lack of crew rest highest in how much it affected them.

Begin the rest period on arrival at the hotel, avoid multiple-hour breaks between flights and provide food and drink on flights," the report says.

Starting the clock for rest periods when the airplane arrives at the gate is unrealistic, according to many flight attendants. "There are times when we are waiting for almost an hour for transportation and it's completely out of our hands," one wrote.

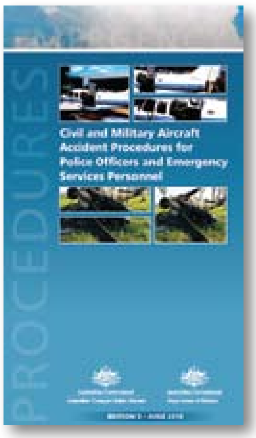
The report's recommendations for fatigue reduction primarily concern scheduling and physiological factors.

"An overall review of scheduling practices may be an important part of any attempt to address fatigue," the report says. "An examination of duty duration, continuous-duty overnights, reserve practices, reduced rest, breaks, rest periods and duty report times may be warranted.

"Missed meals accounted for the other key fatigue factor that was commonly identified by flight attendants. To some extent, this issue may be addressed by both flight attendants and by airlines. For example, airlines might provide fresh, healthy meals when flights have food service. Flight attendants, in turn, could plan ahead and generally bring healthy snacks aboard, although this is difficult during reduced-rest conditions with limited access or time to purchase food.

"Similarly, airlines could provide beverages, or flight attendants could bring some bottled water or other non-caffeinated beverage, but the issue of missed meals seems to be inherently tied to missed breaks or no breaks. In other words, preparation of a healthy meal can only be beneficial if the flight attendant has the opportunity to eat the meal."

— *Rick Darby*



At the Accident Site

Civil and Military Aircraft Accident Procedures for Police Officers and Emergency Services Personnel

Australian Transport Safety Bureau and Australian Directorate of Defence Aviation and Air Force Safety. Edition 5, June 2010. 41 pp. Photographs, illustrations.

Police and emergency personnel have their own established procedures when they are first responders to an aircraft accident, but those procedures might not be optimal for a subsequent accident investigation or even for their own safety. "As a rescue officer you should be careful to avoid becoming a casualty yourself," the guide says. "In the heat of the moment and the desire to alleviate suffering and minimize casualties, individuals sometimes place themselves at considerable personal risk of injury or death."

This is the latest edition of a guide to best practices at the scene of a crash, which will be, for many, an unusual and distressing task. Although the instructions about notification and formal reporting are specific to Australia, many of the guidelines will be applicable in other countries.

"The first people to arrive at an aircraft accident site can significantly help minimize injury and loss of life, reduce property loss through damage and fire, and prevent loss of clues and evidence as to the factors that contributed to the accident," the guide says. "To preserve evidence for an effective investigation, it is essential to appropriately manage and control the accident site."

Site control includes observing standard hazardous materials (HAZMAT) procedures, the guide says. The area should be sealed off to unauthorized persons for at least 50 m (164 ft) around the wreckage.

The guide goes into considerable detail about the rescue of any survivors from crashed aircraft. Among the points listed are these:

- "Approach the site from upwind (with the wind at your back) and downhill, if possible, to avoid inhalation of burning materials, some of which are toxic, others of which can be very irritating to the breathing tract. Look around the crash site, along the crash path, and maintain a clear observation of the accident site and associated hazards;
- "Render first aid and care to survivors until medical personnel arrive;

- "Attempt to account for all occupants. If the aircraft disintegrated in flight, the wreckage, survivors and casualties may be scattered over a large area;
- "Summon medical assistance if required and verify that this assistance has been sought. Consider shelter for casualties if the accident site poses potential hazards;
- "If you see evidence of a spreading post-accident fire or possible explosion from fuels or armaments, move survivors a safe distance from the scene; [and,]
- "Stay clear from wing-mounted tanks, armor, landing gear struts (oleos) and pressure vessels (gas bottles). These assemblies can explode with devastating violence if disturbed following impact damage and particularly if fire is present."

Although emergency services take precedence, the guide says, "It is important that wreckage, ground scars and the accident site are disturbed as little as possible. This will ensure that investigators are able to determine the factors that contributed to the accident."

Once the immediate needs are met, and if accident investigation authorities have not yet arrived, first responders should try to locate witnesses and obtain statements from them. Taking eyewitness statements might seem best left to experienced investigators for later. But, says the guide, "Preliminary eyewitness recollections detailing first reactions can be valuable to investigators. They will normally be untainted by reflection, rumor or exposure to the news media."

Among the witness recollections sought should be "the position from which the eyewitness observed the event; the time of the accident; weather conditions at the time of the accident; the direction the aircraft was heading and what it appeared to be doing; an estimate of the aircraft's height, using trees and buildings as a reference where appropriate; if the aircraft was on fire in flight; what sounds were heard; what the impact angle of the aircraft was; if any objects fell from the aircraft before impact, and if so, what the flight path of the aircraft was at the time."

— *Rick Darby*

BOOKS

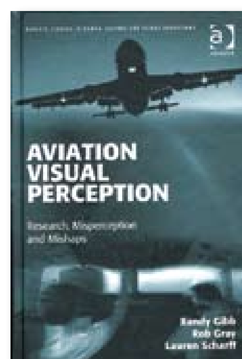
Visualize Safe Flying

Aviation Visual Perception: Research, Misperception and Mishaps

Gibb, Randy; Gray, Rob; Scharff, Lauren. Farnham, Surrey, England and Burlington, Vermont, U.S.: Ashgate, 2010. 311 pp. Figures, tables, references.

"Eyes that have evolved for bipedal hunting and gathering have some catching up to do to handle the three-dimensional variations of manned flight," says Tony Kern, a retired U.S. Air Force pilot, in the foreword. "Comprehending the complexities and limitations of human vision in aviation is essential to operators of all types of aircraft. In the past, the importance of this subject has been understated, neglected or overlooked altogether by most aviators. …

"Currently, aviators learn to adapt their ground-based vision to the aviation environment through trial and error, using techniques offered by their instructors or shared pilot-to-pilot. Vital topics such as *composite crosscheck*, *see-and-avoid scanning* and *visual illusions* are informally passed along generation to generation, evolving nearly as slowly as we are. It is not that the scientists aren't doing their jobs; they certainly are. Each year there are dozens of advances made in key areas regarding the human-machine interface. However, up until now you had to comb through dozens of scientific journals to find these studies. Even then, the relevant material was not always user-friendly or easily understood."



This book is an attempt to rectify the situation. It covers the physiology and psychology of vision in piloting applications, including what Kern calls "the finest compilation and discussion of visual illusions I have ever read, and pilots who internalize this information will be immediately safer."

— *Rick Darby*

Runway Left Behind

No taxi briefing, no taxiway signs and a nonassertive controller contributed to a risky takeoff.

BY MARK LACAGNINA

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

JETS

Crew Misidentified Intersection

Boeing 777-200. No damage. No injuries.

As the copilot, the pilot flying, lined up the 777 for takeoff from St. Kitts, West Indies, the evening of Sept. 26, 2009, the commander remarked that the runway looked very short. However, neither pilot realized that they had taxied onto the runway from an unauthorized midfield intersection, rather than from the intersection farther down the runway from which they had based their performance calculations.

At least two people recognized the error, but neither was able to bring it to the flight crew's attention in time. The airport traffic controller, a trainee, radioed a suggestive but ambiguous query, then apparently dismissed a telltale error in the commander's response and cleared the crew for takeoff. About the same time, the airline's station engineer, who was among the passengers, rushed forward and told the cabin manager that he needed to warn the pilots. He took a seat, however, when the sound of increasing thrust indicated that the flight crew already had begun the takeoff.

The commander's perception of scant runway ahead had prompted him to advise the copilot to increase power to 55 percent N_1 (engine fan speed) before releasing the wheel brakes. Witnesses estimated that the 777's main landing gear lifted off the runway about 305 m (1,000 ft) from the end of the paved surface. Recorded flight data showed that the aircraft passed 80 ft over the end of the runway. The flight was continued to the scheduled destination, Antigua, without further incident.

The aircraft was registered in England, and the Eastern Caribbean Civil Aviation Authority delegated the incident investigation to the U.K. Air Accidents Investigation Branch (AAIB).

The AAIB's final report noted that the incident occurred during the flight crew's first flight at St. Kitts' Robert L. Bradshaw International Airport, which has a single asphalt runway that is 2,316 m (7,598 ft) in length and 45 m (148 ft) wide. The weather was clear, with surface winds from 090 degrees at 10 kt, and the crew planned to depart from Runway 07.

Taxiway Alpha leads southwest from the airport terminal and ends at Intersection Alpha, which is about 400 m (1,312 ft) from the approach threshold of Runway 07. The pilots reviewed performance data for takeoff using the full runway length, as well as using the 1,915 m (6,286 ft) of runway available from Intersection Alpha. "Once the speed and thrust settings were calculated, the crew agreed that the takeoff performance was satisfactory from Intersection Alpha and that this was considered preferable to backtracking on the runway for a full-length departure," the report said.

The copilot briefed the departure but not the taxi route before the engines were started. The controller-trainee cleared the crew to taxi via Taxiway Alpha and backtrack on Runway 07. When the crew requested clearance to depart from Intersection Alpha, the trainee replied, "Roger, line up for departure."

There were no taxiway markings or signs to guide the crew from the ramp. As the copilot turned the aircraft away from the terminal, "he identified a taxiway centerline at the rear of the ramp and assumed it to be Taxiway Alpha," the report said. The centerline, however, was for a taxiway leading to Intersection Bravo, from which 1,220 m (4,003 ft) of runway is available for takeoff — about 695 m (2,280 ft) less than from Intersection Alpha. Departures from Bravo were not authorized by the airline.

As the copilot taxied out, the commander was head-down, completing the "Before Takeoff" checklist. "By the time he looked up and orientated himself, the aircraft was approaching [Bravo]," the report said.

The trainee and his supervisor assumed that the crew would turn west and backtrack on the runway. When they saw the aircraft turn east, the supervisor told the trainee to query the crew. "Do you not request, er, backtrack runway zero seven?" the trainee asked.

The commander replied, "Negative … we are happy to go from position alpha."

The supervisor later told investigators that he did not hear this transmission. The trainee said that although he realized the aircraft was at Bravo, rather than Alpha, he "did not consider correcting [the crew], as he had been told not to be forceful toward pilots." The trainee also said he believed a takeoff from Bravo was within the 777's performance capability.

The copilot realized that "something was not right" when he saw grass beneath the nose just after the aircraft became airborne, the report said. "As the commander appeared not to be unsettled by the departure and there was a member of the cabin crew on the jump seat, he did not speak his concerns to the commander during the sector."

The commander apparently did not realize the error until he was confronted by the station engineer after the 87 passengers and 14 crewmembers disembarked at Antigua. He filed an air safety report and notified the airline's flight crew manager of the incident.

Wind Shift Leads to Overrun

Boeing 737-800. Substantial damage. No injuries.

As the 737 neared Limoges–Bellegarde (France) Airport the afternoon of March 21, 2008, the automatic terminal information service (ATIS) indicated that Runway 21 was in use, with winds from 280 degrees at 13 kt with gusts to 25 kt. However, the ATIS information was nearly an hour old, and a strong cold front was approaching the airport. "The passage of a cold front causes rapid variations in wind direction and intensity, generally accompanied by heavy precipitation," said the report by the French Bureau d'Enquêtes et d'Analyses.

The ATIS information was nearly an hour old, and a strong cold front was approaching the airport.

The flight crew selected a reference landing speed of 143 kt and added 15 kt for an approach speed of 158 kt. They decided to use 30 degrees of flap for the approach, rather than 40 degrees, to improve handling in the anticipated crosswind and gusts. The autobrake was set to position 3, which is above the minimum but below the maximum setting recommended for a wet runway.

The airplane's weather radar system depicted an area of moderate precipitation near the airport, and the crew requested and received approval by air traffic control (ATC) to climb to 4,000 ft while tracking the runway centerline if they had to conduct a missed approach.

The crew encountered a 50-kt right crosswind and increasing precipitation as they began the instrument landing system (ILS) approach. The 737 was 4 nm (7 km) from the runway when the airport traffic controller cleared the crew to land and advised that the surface winds were from 330 degrees at 20 kt with gusts to 35 kt and that the runway was wet. "The crew acknowledged without reading back and continued the approach," the report said. It noted that despite the information provided by the controller, the crew was "not fully aware" that the wind had shifted and intensified.

The copilot, the pilot flying, disengaged the autopilot and autothrottle at a height of 300 ft. The airplane entered a very heavy rain shower on final approach and deviated slightly above the glideslope. "During the flare, while the rain was intensifying on the runway, the captain took control of the airplane," the report said.

The engines took almost eight seconds to 'power up' after the captain reapplied reverse thrust.

The available landing distance on Runway 21 is 2,440 m (8,005 ft). The 737 touched down to the left of the runway centerline about 690 m (2,264 ft) beyond the approach threshold at an airspeed of 147 kt and a groundspeed of 155 kt. The spoilers deployed automatically. The captain promptly applied reverse thrust but then returned the thrust levers to idle and disengaged the autobrake because he was experiencing difficulty in maneuvering the airplane toward the centerline. The engines were at idle for about 10 seconds and took almost eight seconds to "power up" after the captain reapplied reverse thrust, the report said.

The airplane overran the runway at 45 kt and came to a stop about 50 m (164 ft) beyond the threshold. "The captain called for an emergency evacuation," the report said. "The engines were damaged by the ingestion of earth and stones, and the airplane was bogged down. Extensive excavation work was required in order to be able to tow the airplane back to the runway." There were no injuries among the 175 passengers and six crewmembers.

During postaccident interviews, "the crew stated that they did not pay attention to the wind information provided by the controller when the airplane was on final," the report said. "They kept in mind a crosswind coming from the right with a headwind [component], in accordance with the ATIS. They added that they would have aborted the approach if they had been aware of the tail wind."

In-Flight Vibration Traced to Aileron

Airbus A320-232. No damage. No injuries.

Shortly after the A320 departed from Mackay, Queensland, Australia, the afternoon of May 18, 2009, the electronic centralized aircraft monitor (ECAM) displayed an "aileron servo fault" message. "A review of the flight deck documentation did not identify any specific procedures for the crew to action and [indicated] that the caution was for crew awareness only," said the report by the Australian Transport Safety Bureau (ATSB). "As there were no other caution messages and the flight controls were operating normally, the flight crew decided to climb to the cruise altitude of Flight Level (FL) 350 and continue to Melbourne."

After leveling at FL 350, the crew detected a vibration that they later described as "a light continuous shaking." The ECAM indicated a left aileron oscillation of five degrees and a fault in the autopilot's no. 1 elevator/aileron computer (ELAC). The fault caused the no. 2 ELAC to take over primary control of the ailerons.

The pilot-in-command (PIC) asked the cabin manager to visually check the left wing. The cabin manager reported that the left wing was moving up and down, and that there was "quite a bit of shaking" in the aft cabin. The copilot looked out the left window and confirmed that the left aileron was oscillating and that the left wing was moving up and down about 1 m (3 ft). The PIC varied airspeed but noticed no change in the vibration or in the aileron oscillation indicated on the ECAM.

The pilots decided to divert the flight to Gold Coast Aerodrome in Coolangatta, Queensland. The vibration, aileron oscillation and wing flexing intensified as the A320 descended through FL 200. After consulting the quick reference handbook, the crew deactivated the no. 1 ELAC. Noticing no change, they reactivated the no. 1 ELAC. The vibration and aileron oscillation ceased. "The crew reported no further control problems or ECAM messages during the remainder of the descent, approach and landing," the report said.

Examination of the aircraft revealed that the aileron oscillation had been caused by two separate faults in the autopilot system. The first was an intermittent internal fault in the no. 1 ELAC. The resulting automatic transfer of primary control of the ailerons to the no. 2 ELAC led to activation of a faulty servo that caused the aileron to oscillate. When the PIC reactivated — and thus reset — the no. 1 ELAC, the faulty servo was isolated.

"The [servo] fault was introduced during manufacture by an incorrect adjustment of the servo, which caused internal wear in a number of the servo's hydraulic control components," the report said. "The aileron servo manufacturer has incorporated a new method of adjusting the aileron servos during assembly to minimize the likelihood of a recurrence of the problem."

Investigators found that a nearly identical incident had occurred in the same aircraft eight months earlier but had not been reported to ATSB. "The operator has improved the training of its staff and the reportable event requirements in its safety management system manual in an effort to address the non-reporting risk," the report said.

Wheel Explodes During Tire Inflation

Bombardier CRJ200. Substantial damage. One serious injury.

While preparing for a flight from Manchester, England, the morning of Nov. 13, 2008, a flight crewmember noticed a small cut in a main landing gear tire and reported it to the airline's main engineering control center in Germany. The damage was determined to be beyond acceptable limits, and the flight was canceled.

The airline sent a maintenance technician and spare parts to Manchester the next morning. In addition to replacing the damaged tire, the technician was assigned to conduct a five-day maintenance check of the CRJ, which included a check of tire pressures. He decided to check the pressures in the undamaged tires before replacing the damaged tire and found that the right nosewheel tire was slightly underinflated.

The AAIB report said that the technician was not familiar with the nitrogen pressure rig that had been provided, and he had difficulty operating it. When he pressed the inflator lever, he perceived that nitrogen was not entering the tire. "He pressed the inflator lever once or twice again, and the wheel burst," the report said. "Wheel fragments were scattered across the apron, and serious injuries were inflicted on the technician."

The report noted that the nosewheels on the CRJ had not been equipped with optional overpressure relief valves. Normal inflation pressure was 163 psi (11 bar), and overinflation tests by the manufacturer had shown that the wheel would fail at about 997 psi (69 bar).

Investigators were unable to identify the manufacturer of the nitrogen pressure rig. It apparently was one-of-a-kind and displayed no operating instructions or warning labels. The rig was capable of supplying pressures far beyond those required for aircraft tires. The regulator was set for 1,000 psi (69 bar), and the delivery-pressure gauge was marked in bar, rather than in psi, with a full-scale reading of 400. The report said that a technician unfamiliar with the rig might not realize that only slight depression of the inflator lever and a small deflection of the gauge needle were required to inflate an aircraft tire.

The report noted that the CRJ200 was certified before the European Aviation Safety Agency and the U.S. Federal Aviation Administration required overpressure burst protection for the tires of newly certified transport category airplanes. The AAIB recommended that the requirement be extended to all transport airplanes.

"If overpressure burst protection had been fitted to this aircraft, it is probable that the accident would not have occurred," the report said. "This is not the first occasion on which such bursts have happened, and previous such events have resulted in fatalities."

TURBOPROPS

Too Heavy to Fly

Cessna 208B. Destroyed. Three fatalities, one serious injury.

Witnesses to the Caravan's departure said that the airplane traveled far down the 1,976-m (6,483-ft) runway with its nosewheel in the air before it lifted off and cleared the airport boundary fence by about 10 ft. The aircraft climbed about 300 ft, sank about 100 ft when the pilot apparently retracted the flaps, turned right, pitched into a nose-high attitude, stalled and spun to the ground. One passenger survived with a spinal injury. There was no fire.

The accident occurred at Eros Airport in Windhoek, Namibia, the morning of Nov. 15, 2009. Airport elevation is 5,686 ft, the outside air temperature was 19 degrees C (66 degrees F), and surface winds were from 180 degrees at 8 kt. The Nigerian Directorate of Aircraft Accident Investigations found that the Caravan was 629 lb (285 kg) over its maximum takeoff weight when it departed from Runway 19, which has an unspecified upslope with rising terrain and mountains in the departure area.

'The cargo inside the cabin was not secured and was placed between and on top of the seats all the way to the roof.'

The aircraft was operated by a South African company and was scheduled to fly to several airports in Angola. "On board the aircraft was a substantial amount of cargo, which consisted mainly of building material, several containers of paint, boat spares, tool boxes, liquid beverages and frozen meat," the report said. The handling agent at Eros Airport had weighed a "certain amount of the cargo," but additional cargo that arrived just before departure was not weighed before it was loaded into the cargo pod.

"The suitcases of the three passengers and the pilot were also not weighed and were loaded inside the cabin toward the back," the report said. "The cargo inside the cabin was not secured and was placed between and on top of the seats all the way to the roof."

The aircraft had been modified according to a supplemental type certificate that extended its maximum takeoff weight from 8,750 lb (3,969 kg) to 9,062 lb (4,110 kg). The load sheet for the flight indicated that the aircraft was within weight and balance limits. However, reconstruction of the loading by investigators showed that the actual takeoff weight was 9,691 lb (4,396 kg). The greatest error found in the pilot's calculations was his use of 4,575 lb (2,075 kg) for the aircraft's empty weight.

"The pilot obtained the aircraft empty weight from the sample loading problem in the pilot's operating handbook (POH)," the report said. The actual empty weight was 599 lb (272 kg) higher, at 5,174 lb (2,347 kg). The report provided no analysis of the aircraft's center of gravity or whether the unsecured load had shifted in flight.

Among the investigation's key findings was that the wing leading edges had been "spray-painted with a harsh anti-erosion type paint," the report said. "This type of paint results in a rough texture which can therefore affect the stalling characteristics of the wing. Verification with the aircraft manufacturer confirmed that this did not meet the original airworthiness certification requirements and was in contradiction of the manufacturer's minimum continuous airworthiness standard."

Rivet Causes AC Failure

Bombardier Q400. Minor damage. No injuries.

After departing from London Gatwick Airport with 72 passengers and four crewmembers for a flight to Düsseldorf, Germany, the morning of Dec. 21, 2009, the aircraft was climbing through 6,000 ft when the alternating current (AC) electrical system failed. The flight crew declared an urgency and requested and received clearance to return to Gatwick.

"The commander, as pilot monitoring, handed responsibility for radio communications to the copilot and began conducting procedures listed in the emergency checklist," said the AAIB report.

After the aircraft descended out of icing conditions, "the airframe appeared clear of ice, [but] the pilots elected, as a precaution, to conduct the approach using flap 35 at increased speed in accordance with company procedures for flight in icing conditions," the report said. "The landing was uneventful."

Examination of the aircraft revealed significant fire damage to the wiring loom routed within the trailing edge of the left wing center section. "The damage was localized to an area where the loom was supported by plastic tie straps attached to a support bracket riveted to the lower wing skin," the report said. One of the tie straps, the fiberglass tape wrapped around the loom and some of the 22 wires in the loom had chafed against the head of one of the blind rivets, causing electrical arcing and a fire.

"The aircraft manufacturer has since issued a modification to replace the blind rivets with solid rivets and to inspect the wiring for damage," the report said.

Icing Induces Stall in Holding Pattern

Saab 340B. Substantial damage. No injuries.

The Saab was en route in visual meteorological conditions at 12,000 ft during a scheduled flight from Moranbah to Brisbane in Queensland, Australia, on Nov. 5, 2008, when ATC told the flight crew to enter a holding pattern with two-minute legs over a nondirectional beacon (NDB) in Gayndah.

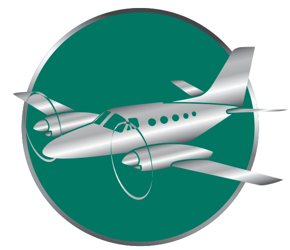
The crew reduced airspeed to 160 kt and selected engine heat before the aircraft entered clouds with an outside air temperature of minus 5 degrees C (23 degrees F) as it neared the NDB. They activated the propeller deicing systems after entering the clouds. "The pilots noticed a buildup of soft ice on the windscreen wipers and a dusting of ice on the leading edges of the wings," the ATSB report said. "They discussed activating the deice boots but decided not to."

Airspeed decreased to 133 kt, and the PIC increased power until the engines reached the maximum interstage turbine temperature (ITT). As the aircraft turned over the NDB to begin the second circuit of the holding pattern, the pilots felt a buffet. There was no aural stall warning, and the stick shaker did not activate; however, the PIC perceived the buffet as a sign of an impending stall.

"The PIC disconnected the autopilot, applied substantial power (80 to 83 percent torque), initiated a descent and maintained the left turn to remain in the holding pattern," the report said. The Saab exited the icing conditions at 10,000 ft and was landed without further incident in Brisbane. Both engines had to be replaced because their ITT limits had been exceeded during the stall recovery.

The report did not discuss the crew's decision not to activate the deice boots but noted that Saab later revised its standard operating procedures to eliminate pilot discretion and require that deice boots be activated in continuous mode when entering icing conditions.

PISTON AIRPLANES



Control Lost on Night Takeoff

Cessna 402. Destroyed. One fatality.

Visibility was 5 mi (8 km) in light rain and mist, and the ceiling was overcast at 400 ft when the pilot departed from Runway 33 at Martha's Vineyard (Massachusetts, U.S.) Airport for a positioning flight to Boston the night of Sept. 26, 2008. ATC had cleared the pilot to climb to 4,000 ft and turn right to a heading of 360 degrees, said the report by the U.S. National Transportation Safety Board (NTSB).

Recorded ATC radar data showed that the 402 climbed to 700 ft, made a slight left turn and then a right turn that continued until radar contact was lost. The airplane struck trees and crashed between two houses about 3 nm (6 km) northwest of the airport.

"Analysis of the radar and weather data indicated that, with the flight accelerating and turning just after having entered clouds, the pilot likely experienced spatial disorientation," the report said. The pilot, 61, held an airline transport pilot certificate and had 16,746 flight hours, including 2,330 hours in 402s.

'Encountered a Sinker'

Piper Chieftain. Substantial damage. No injuries.

A local weather station was reporting winds from 110 degrees at 24 kt with gusts to 35 kt as the pilot neared the destination, Nondalton, Alaska, U.S., during a positioning flight on Oct. 10, 2009. The pilot told investigators that the Chieftain "encountered a sinker" — a strong downdraft — on final approach and began to descend below the intended glide path.

"He added full engine power to stop the descent, but the airplane continued to descend, and it landed hard on the right side of the runway," the NTSB report said. "The landing gear collapsed, and [the airplane] slid about 150 yards [137 m], resulting in substantial damage to the fuselage."

Collision With an Automobile

Cessna 421B. Substantial damage. No injuries.

After landing at Hearst Castle Airstrip in San Simeon, California, U.S., the afternoon of Oct. 2, 2009, the pilot taxied the 421 to the parking area, which appeared to be level. He did not set the parking brake, as required by the checklist, before shutting down the engines, securing the airplane and leaving the cockpit to open the cabin door for the five charter passengers.

The airplane rolled backward and struck a parked automobile. The 421's empennage was substantially damaged. "Although the parking area appeared level, the pilot indicated that later analysis showed there was a gradual slope," the report said.

HELICOPTERS

External Load Snags Trees

Bell 206B. Substantial damage. One serious injury.

The helicopter was involved in an external-load operation, hauling tree limbs from a logging site in a steep ravine to a collection site at the top of the hill near Cougar, Washington, U.S., on Oct. 10, 2008. Witnesses saw the load at the end of the 60-ft (18-m) long line become entangled in trees as the helicopter departed from the logging site, the NTSB report said.

The pilot told investigators that the helicopter suddenly rolled right and that he had difficulty moving the cyclic control. "He continued to try to fly uphill to a dirt road but had little control over the helicopter," the report said. The low-rotor-speed warning horn sounded, and the pilot released the load as the helicopter yawed right, pitched nose-down and descended to the ground.

Tail Rotor Control Cable Snaps

Aerospatiale Alouette III. Substantial damage. No injuries.

The ex-military helicopter was en route to a fire-fighting base in Hogsback, South Africa, the morning of June 3, 2009. The pilot chose an open field on which to land, but on final approach, the helicopter suddenly yawed left. It was about 3 ft above the ground when the pilot lost control of the tail rotor.

"The pilot reacted quickly to correct the situation by slowly lowering the collective pitch control lever so that the helicopter could descend onto the ground," said the report by the South African Civil Aviation Authority. "The pilot's intention was to avoid a hard landing."

When the helicopter touched down, however, the torque of the main rotor caused it to yaw and roll over onto its right side, the report said. Damage was substantial, but the pilot and the crewmember aboard the helicopter were not injured.

Examination of the wreckage revealed that the tail rotor control cable had broken where it is routed around a pulley beneath the floor. The report said that the cable had been contaminated by dust and oil, which caused friction between the cable and the pulley, and the eventual failure of the cable.

R44 Hits House in Night IMC

Robinson R44 II. Destroyed. Two fatalities.

Night instrument meteorological conditions prevailed when the non-instrument-rated private pilot departed from a casino near Whiting, Indiana, U.S., for a flight to Kenosha, Wisconsin, on Sept. 21, 2008. About 30 minutes later, a policeman heard the helicopter pass overhead at about 500 ft. "He did not see the helicopter or its lights due to dense fog," said the NTSB report. "He stated that the visibility there was about 300 to 500 ft."

Shortly thereafter, the R44 crashed into a house about 1.5 nm (2.8 km) from the Kenosha airport, which was reporting 3/4 mi (1,200 m) visibility in mist and a 100-ft overcast. The pilot and passenger were killed, but none of the five occupants of the house was hurt.

Preliminary Reports, August 2010

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 1	Mount Healy, Alaska, U.S.	Fairchild C-123K	destroyed	3 fatal
The airplane apparently stalled while being maneuvered at low altitude during a cargo flight in visual meteorological conditions (VMC).				
Aug. 3	Igarka, Russia	Antonov 24RV	destroyed	12 fatal, 3 serious
The airplane crashed 700 m (2,297 ft) from the runway during an ILS approach in night instrument meteorological conditions (IMC).				
Aug. 4	Saint-Laurent du Maroni, French Guiana	Aerospatiale AS 350-B2	destroyed	1 fatal
The helicopter crashed during a cargo flight to a gold-mining site.				
Aug. 5	Sydney, Nova Scotia, Canada	Cessna 414A	destroyed	2 fatal
The 414 struck the ocean during an approach in night IMC.				
Aug. 5	Bequia, Saint Vincent and the Grenadines	Cessna 402C	destroyed	1 fatal
The 402 crashed in the sea during an air ambulance flight from Kingstown to Canouan.				
Aug. 8	Minsk, Belarus	Hughes 369HS	destroyed	1 fatal
The helicopter struck the ground while completing a loop during an air show.				
Aug. 9	Aleknagik, Alaska, U.S.	de Havilland Turbine Otter	destroyed	5 fatal, 4 serious
The airplane struck mountainous terrain shortly after departing from a lodge airstrip in marginal VMC.				
Aug. 11	Burns, Oregon, U.S.	Aero Commander 500B	destroyed	2 fatal
Thunderstorms were reported in the area when the airplane apparently broke up during a visual flight rules flight from California to Idaho.				
Aug. 12	Rio de Janeiro, Brazil	Learjet 55C	substantial	3 NA
The airplane overran the runway while landing and came to rest in Guanabara Bay. No fatalities were reported.				
Aug. 12	Giammoro, Sicily, Italy	Robinson R44	destroyed	4 fatal
The helicopter crashed into a warehouse during takeoff.				
Aug. 12	Istanbul, Turkey	Airbus A319-100	substantial	127 none
The nose landing gear collapsed when the A319 overran the runway on landing.				
Aug. 13	Mercedes, Argentina	Piper Cheyenne 400LS	destroyed	4 minor, 2 none
The landing gear separated when the airplane overran the runway during a rejected takeoff.				
Aug. 16	San Andres Island, Colombia	Boeing 737-700	destroyed	1 fatal, 17 serious, 67 minor, 42 none
Thunderstorms and heavy rain were reported when the 737 crashed short of the runway during a night approach.				
Aug. 17	Sept-Îles, Quebec, Canada	Aerospatiale AS 350-BA	destroyed	4 fatal
The helicopter crashed shortly after departing from Sept-Îles for a flight to Poste Montagnais.				
Aug. 18	Sanagi Island, Japan	Bell 412EP	destroyed	5 fatal
The coast guard helicopter crashed in the Inland Sea after striking offshore power lines while searching for a disabled ship.				
Aug. 21	Jos, Nigeria	Boeing 737-500	minor	92 none
The 737 veered off the runway during an encounter with wind shear on landing.				
Aug. 24	Yichun, Heilongjiang, China	Embraer 190LR	destroyed	42 fatal, 7 serious, 47 minor
The airplane struck trees during a night nonprecision approach in thick fog and crashed short of the runway.				
Aug. 24	Kathmandu, Nepal	Dornier 228-100	destroyed	14 fatal
After encountering adverse weather conditions at the destination, Lukla, and at an alternate, Simara, the flight crew decided to return to Kathmandu. A generator failed during descent, and the airplane crashed on a hillside.				
Aug. 25	Vitória da Conquista, Bahia, Brazil	Embraer 145LU	destroyed	35 NA
Two passengers sustained unspecified injuries when the airplane veered off the runway while landing.				
Aug. 25	Bandundu, Democratic Republic of Congo	Let 410UVP	destroyed	20 fatal, 1 serious
The airplane crashed into a house after losing power during an attempted go-around.				
Aug. 26	Tabriz, Iran	Fokker 100	substantial	2 minor, 108 none
The Fokker overran the runway while landing in heavy rain at night.				
Aug. 31	Misima, Papua New Guinea	Cessna Citation 550	destroyed	4 fatal, 1 serious
The Citation overran the runway and struck trees while landing in heavy rain.				
Aug. 31	Walnut Grove, Arkansas, U.S.	Bell 206L1	destroyed	3 fatal
Night VMC prevailed when the LongRanger crashed during an air ambulance flight.				

NA = not available

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

Selected Smoke, Fire and Fumes Events in the United States and Canada, May–June 2010

Date	Flight Phase	Airport	Classification	Sub-classification	Aircraft	Operator
May 10	Cruise	—	In-flight systems check	Fumes in cabin	Boeing 747	Delta Air Lines
During cruise, a flight attendant reported a strong burning odor in the crew bunk area. The flight crew followed the quick reference handbook (QRH) procedures and shut off all recirculating fans. The smell then dissipated. The crew bunk area fan circuit breaker had activated, and the breaker was reset.						
May 12	Cruise	—	Diversion, unscheduled landing	Fumes in cockpit/cabin	Airbus A320	United Airlines
A burning odor was detected in the cockpit and cabin at cruise altitude. The odor increased when the cabin temperature was adjusted. Maintenance found that the cabin air recirculation fan was inoperative. They replaced the fan and both cabin air recirculation filters.						
May 13	Descent	—	In-flight systems check	Smoke/fumes in cockpit	Boeing 727	Amerijet
When the throttles were retarded for descent, a strange odor and haze were detected, followed by a short burst of smoke. The flight crew advanced and retarded the throttles, and more smoke appeared. Maintenance workers found that a defective hydraulic pressurization check valve was leaking hydraulic fluid into the no. 1 engine 13-stage bleed duct. They replaced the check valve, bleed valve controller and the high-pressure shutoff valve.						
May 20	Cruise	Philadelphia (PHL)	In-flight systems check	Smoke in cabin	Douglas DC-8	Air Transport International
During cruise, the left cabin air recirculation fan stopped working and emitted a smoke odor. The crew activated the left cabin air recirculation circuit breaker and landed in PHL without further incident. Maintenance replaced the left cabin air recirculation fan.						
May 21	Cruise	—	Unscheduled landing	Fumes in cockpit	Boeing 757	Delta Air Lines
One hour into the flight, the crew detected a burning odor in the cockpit. Maintenance checked multiple systems and replaced the left air cycle machine (ACM).						
May 28	Cruise	Houston (IAH)	Diversion, unscheduled landing	Smoke in cabin	Embraer 145	Continental Express Airlines
The crew reported a smoke odor in the front of the cabin. Maintenance removed and replaced a clogged tube from the water separator.						
June 9	Cruise	—	Unscheduled landing	Fumes in cabin	Boeing 767	Delta Air Lines
The flight was diverted because of an electrical burning smell in the rear of the business cabin area. Maintenance found chafed wiring on the seat power supply wiring at seat 5E. The chafed wiring harness was replaced.						
June 12	Climb	—	Unscheduled landing	Smoke in cabin	McDonnell Douglas MD-88	Delta Air Lines
After takeoff, the crew reported smoke in the cabin. The smoke dissipated but then returned. The flight was diverted. The maintenance facility performed a duct burnout.						
June 13	Descent	—	Unscheduled landing	Smoke/vapors in cabin	Embraer ERJ-170	
Passengers smelled and saw vapors coming from air gaspers at 12,000 ft, along with very hot air. An emergency was declared, followed by an uneventful landing. Maintenance found evidence of contamination of the no. 2 air conditioning pack. The air conditioning pack was repaired.						
June 16	Climb	Boston (BOS)	Unscheduled landing	Smoke in cabin	Boeing 767	Continental Airlines
An emergency was declared for smoke in the aft cabin. The flight crew dumped fuel and landed in BOS overweight. Maintenance found the right air conditioner pack ACM was faulty and replaced it.						
June 16	Cruise	—	Unscheduled landing	Smoke in cockpit	McDonnell Douglas MD-10	FedEx
The flight crew and a jump seat occupant smelled acrid smoke and an electrical odor. The crew declared an emergency and landed. Maintenance inspection findings were pending.						
June 23	Descent	—	Emergency declared	Smoke in cockpit	Boeing 757	United Parcel Service
During descent, the crew reported that the weather radar had failed, followed by smoke in the cockpit. They also noticed an electrical burning odor. Maintenance found that the flight deck smoke detector had failed and replaced it.						
June 28	Cruise	—	Unscheduled landing	Smoke in cabin	Boeing 737	Continental Micronesia
The no. 2 generator control unit emitted acrid smoke from a possible oil or electrical source. Maintenance found that the no. 2 generator control unit had burned out. They checked the wiring, found no evidence of heat damage, and replaced the no. 2 generator control unit.						
June 30	Cruise	Denver (DEN)	Diversion, unscheduled landing	Smoke in cockpit	Airbus A320	US Airways
The flight was diverted to DEN because of smoke in the cockpit and an electrical burning odor. Maintenance found evidence of electrical arcing on a pilot's map light and replaced the light assembly.						

Source: Safety Operating Systems and Inflight Warning Systems