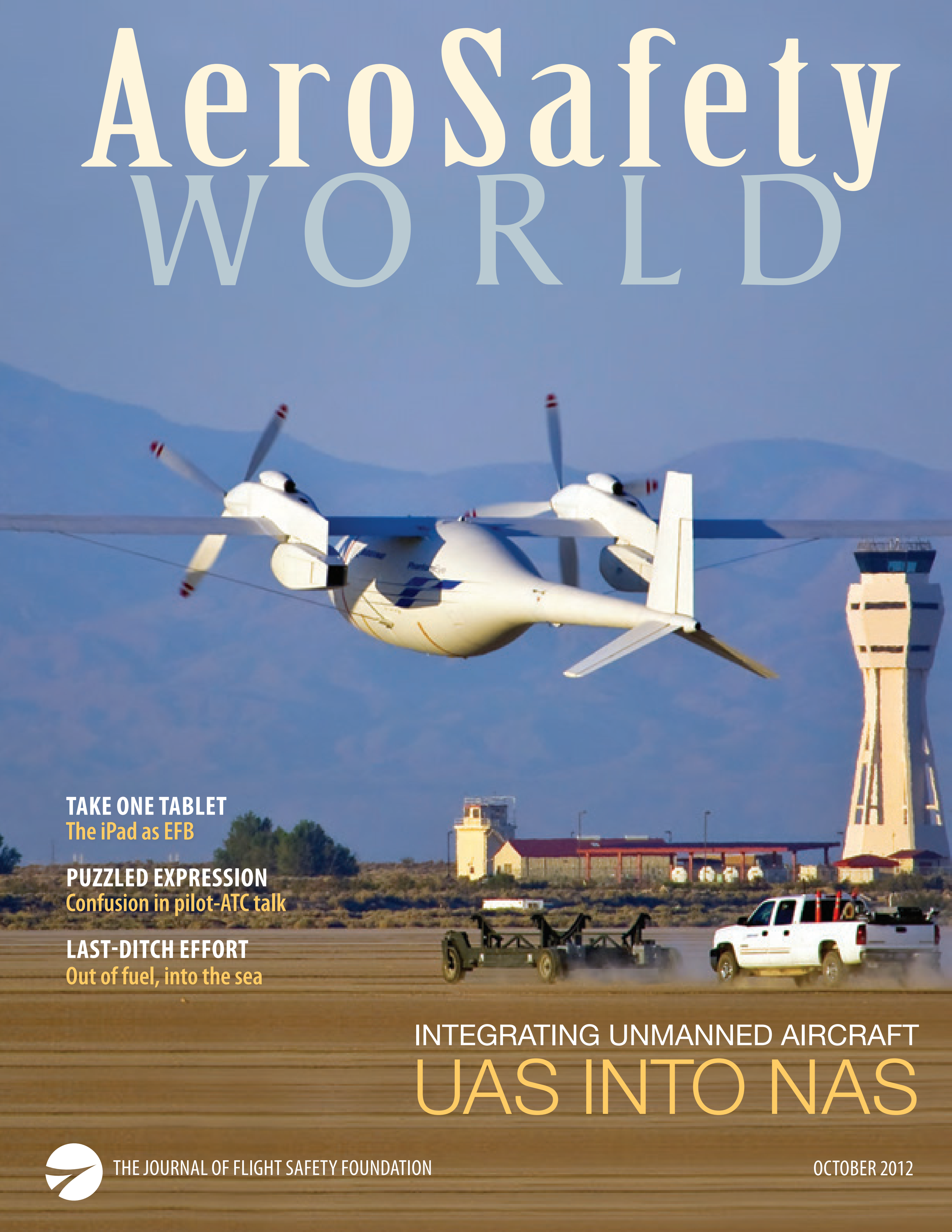
AeroSafety WORLD



TAKE ONE TABLET
The iPad as EFB

PUZZLED EXPRESSION
Confusion in pilot-ATC talk

LAST-DITCH EFFORT
Out of fuel, into the sea

INTEGRATING UNMANNED AIRCRAFT

UAS INTO NAS

THE JOURNAL OF FLIGHT SAFETY FOUNDATION

OCTOBER 2012

DATA SHARING

There is a lot of talk about data sharing as the next big safety challenge, with good reason: Data sharing is the key to achieving the next level of safety, *and* data sharing is really hard to do.

Accidents often have their roots in fairly obscure events. The most recent example is the crash of Air France 447. The pitot-tube failures and airspeed anomalies that initiated that tragedy were so rare that a single airline, even a big one, would not have been able to amass enough data to see it coming. Yet after the accident, when everyone shared their information, a dozen or so similar cases jumped out. We have been striving for proactive safety management for nearly two decades, but our data are still walled off. We can never really predict the next failure until those walls are broken down.

So why don't we just all get together and do it? Probably because it is a lot harder than it looks. It is tough sharing data between just one airline and its regulator. In many countries, regulators are required by law to prosecute any violation of which they become aware. That discourages an airline from handing over all of its information. Even so, regulators often end up with more information than they could ever analyze, and if they did dig through all of the information, they would find a lot of things they would rather not know and would rather not act upon. To really use the data, the regulators have to be blessed with great technology that lets them glean insights from the mass of data, and then be allowed some discretion as to how they will act. In the real world, both of those advantages are in short supply.

The United States has fared better than most in this regard. It has amazing technology called ASIAS (the Aviation Safety Information Analysis and Sharing system) that lets it fuse voluntary reports, flight data monitoring (FDM) data, weather, air traffic control information and other data into one comprehensive picture. The United States also has special legislation that lets regulators accept these data from airlines without being compelled to act on every possible mistake. This magic combination has allowed 43 airlines to step forward and share a stunning amount of data.

Unfortunately you cannot just bottle the U.S. experience and export it elsewhere. Other counties don't have a large enough aviation system to justify such a big investment in analytics. They would have to pool their data with neighboring countries. It is hard to develop appropriate trust between one airline and one regulator. Imagine developing that kind of trust between dozens of regulators and airlines that do not necessarily get along. Data sharing is vital, but in the real world it is not a turnkey proposition.

This is an area where the Foundation is working today, and it will be part of our focus for the foreseeable future. We can help regions find or develop information-sharing technologies. But more importantly, we also are in the position with regulators to develop the delicate arrangements that will allow them to share their data across borders, and then act responsibly on the data that the industry has entrusted to them.

William R. Voss
President and CEO
Flight Safety Foundation

AeroSafetyWORLD

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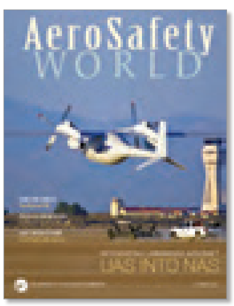

About the Cover
First autonomous flight of
Boeing Phantom Eye UAS.
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If you have an article proposal, manuscript or technical paper that you believe would make a useful contribution to the ongoing dialogue about aviation safety, we will be glad to consider it. Send it to Director of Publications Frank Jackman, 801 N. Fairfax St., Suite 400, Alexandria, VA 22314-1774 USA or jackman@flightsafety.org.

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AFRICAN Unity

In the June issue of *AeroSafety World*, I addressed the twin tragedies that had befallen African aviation earlier that month, with fatal accidents in Accra, Ghana, and, more famously, in Lagos, Nigeria. I said it was important to recognize that, despite those two accidents, progress was being made in aviation safety in Africa. Since then, another important step has been taken.

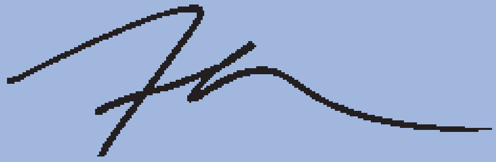
In July, the ministers of aviation, or their equivalents, and the directors general of civil aviation authorities (CAAs) from 35 African nations met in Abuja, Nigeria, for the African Union Ministerial Conference on Aviation Safety. During the five-day meeting, the delegates heard presentations from a variety of organizations, including Flight Safety Foundation, and discussed and debated a range of topics. But most importantly, the delegates approved the Abuja Declaration, which reaffirms the region's commitment to aviation safety.

Specifically, in the Abuja Declaration, the region's aviation ministers promise in part to "accelerate the establishment of, strengthen and maintain civil aviation authorities with full autonomy, powers and independence, sustainable sources of funding and resources to carry out effective safety oversight and regulation of the aviation industry."

Independent, autonomous CAAs are crucial to safety. In a brief paper presented to the Ministerial Conference, Flight Safety Foundation said: "Across the world, the Foundation has observed that political interference with technical aviation is one of the greatest threats to aviation safety. This applies to highly developed states, as well as the less developed. CAA personnel must be able to act with confidence to enforce international safety standards and develop the states' aviation industry."

The Abuja Declaration also endorses the Africa Strategic Improvement Action Plan, which the International Civil Aviation Organization (ICAO), the International Air Transport Association (IATA) and other stakeholders pledged in May to support. In addition to independent and sufficiently funded CAAs and effective and transparent safety oversight systems, the plan calls for the completion of IATA Operational Safety Audits by all African carriers; implementation of accident prevention measures focused on runway safety and loss of control; implementation of flight data analysis and implementation of safety management systems by all service providers, according to ICAO.

The Abuja Declaration still must be ratified by the Assembly of the African Union in January, but the bottom line is that the heads of aviation in 35 African countries have committed to making substantial improvements in aviation safety and to working toward a 50 percent reduction in accidents by 2015. That is a significant commitment, but it is achievable if operators and governments in Africa, with support from other stakeholders, work together with a singleness of purpose.



Frank Jackman
Editor-in-Chief
AeroSafety World

Serving Aviation Safety Interests for More Than 60 Years

Flight Safety Foundation is an international membership organization dedicated to the continuous improvement of aviation safety. Nonprofit and independent, the Foundation was launched officially in 1947 in response to the aviation industry's need for a neutral clearinghouse to disseminate objective safety information, and for a credible and knowledgeable body that would identify threats to safety, analyze the problems and recommend practical solutions to them. Since its beginning, the Foundation has acted in the public interest to produce positive influence on aviation safety. Today, the Foundation provides leadership to more than 1,075 individuals and member organizations in 130 countries.

MemberGuide

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THE FOUNDATION Needs Your Support

As chief operating officer, my job at Flight Safety Foundation is like making sure the airplane is on its flight plan — that is, that the Foundation is on the proper business path for successful operation. As happens aloft, sometimes you encounter turbulence despite your planning. That is where the Foundation finds itself at the moment.

All of the Foundation's ongoing programs and initiatives require some type of financial support. In addition, CEO Bill Voss and I usually field at least one new safety project idea each week. These ideas, many of them good, are offered by organizations and individuals that are passionate about their respective causes and the need for the Foundation to get involved. Unfortunately, however, the idea usually isn't accompanied by a funding source.

The money that funds the Foundation's operating budget comes from three primary sources: membership dues, seminar revenue and funds generated by technical programs. Most of our general and administrative (G&A) expenses — salaries, rent, the electric bill — are covered by membership dues, and are essential to provide you, our members, and the industry with the services and support to which you have become accustomed.

As mentioned in a previous column, we have restructured our seminars over the past 18 months with an eye toward providing greater value and relevance in content and geography without increasing costs. We have decided not to hold a conference in Europe in the spring of 2013 for fiscal reasons, but we have plans to offer more precisely targeted events in fast-growing regions. Seminars and other events require a year or more to plan and sometimes mind-boggling advance cash outlays, but we know they are important and the money they generate allows us to continue the seminar programs. Your attendance shows your support and makes future events possible.

In terms of technical programs, we have an excellent technical department of two. That's right, two! Jim Burin and Rudy Quevedo do an outstanding job leading and facilitating a variety of safety initiatives and programs, working with regional safety groups, making presentations, providing safety data and facilitating the Foundation's committees. Some of these initiatives contribute financially to the Foundation, some do not.

One of the technical efforts that contributes to the revenue stream is BARS, our Basic Aviation Risk Standard program run by Managing Director Greg Marshall from our office in Melbourne, Australia. BARS provides a valuable audit service for operators in the mineral and mining industry, and is expected to show a positive return on investment in 2013.

We are careful stewards of the Foundation's funds. Earlier this year, we restructured internally to make sure our costs are in line with our revenues. On the horizon is the prospect of an exciting new data sharing program that could provide a significant influx of work and funds, and which will benefit the Foundation and you.

Your support through your membership dues makes a difference! I ask you to please renew your membership in its new redesigned category today.

Capt. Kevin L. Hiatt
Chief Operating Officer
Flight Safety Foundation

OCT. 20 ➤ AAAE Safety Risk Assessment Compliance Workshop. American Association of Airport Executives. New Orleans. Janet Skelley, <janet.skelley@aaae.org>, +1 703.824.0500, ext. 180.

OCT. 22–24 ➤ SAFE Annual Symposium. SAFE Association. Reno, Nevada, U.S. Jeani Benton, <safe@peak.org>, <www.safeassociation.com>, +1 541.895.3012.

OCT. 22–26 ➤ OSHA/Aviation Ground Safety. Embry-Riddle Aeronautical University. Daytona Beach, Florida, U.S. Sarah Ochs, <case@erau.edu>, <bit.ly/wtWHln>, +1 386.226.6000. (Also APRIL 15–19, 2013.)

OCT. 22–23 ➤ A Practical Approach to Safety Management Systems. Beyond Risk Management and Curt Lewis & Associates. Calgary, Alberta, Canada. Brendan Kapuscinski, <Brendan@beyondriskmgmt.com>, <bit.ly/RYWXXe>, +1 403.804.9745.

OCT. 23–24 ➤ FRMS Forum Conference. FRMS Forum. Brisbane, Australia. <info@frmsforum.org>, <bit.ly/MZloQD>, +44 (0)7879 887489.

OCT. 23–25 ➤ 65th annual International Air Safety Seminar. Flight Safety Foundation and Latin American and Caribbean Air Transport Association. Santiago, Chile. Namratha Apparao, <apparao@flightsafety.org>, <flightsafety.org/aviation-safety-seminars/international-air-safety-seminar>, +1 703.739.6700, ext. 101.

OCT. 23–25 ➤ International Cabin Safety Conference. (L/D)max Aviation Safety Group. Amsterdam. Chrissy Kelley, Chrissy.kelley@ldmaxaviation.com, <www.ldmaxaviation.com>, 877.455.3629, ext. 3; +1 805.285.3629.

OCT. 24 ➤ Corrective Action Plans — A Practical Approach. Beyond Risk Management and Curt Lewis & Associates. Calgary, Alberta, Canada. Brendan Kapuscinski, <Brendan@beyondriskmgmt.com>, <bit.ly/SlGlO7>, +1 403.804.9745.

OCT. 25–26 ➤ A Practical Approach to Quality Assurance and Auditing. Beyond Risk Management and Curt Lewis & Associates. Calgary, Alberta, Canada. Brendan Kapuscinski, <Brendan@beyondriskmgmt.com>, <bit.ly/SRpqcf>, +1 403.804.9745.

OCT. 28–29 ➤ Flight Operations Manual Workshop: Employing IS-BAO. National Business Aviation Association. Orlando, Florida, U.S. Sarah Wolf, <swolf@nbaa.org>, <bit.ly/zBvVZl>, +1 202.783.9251.

OCT. 29–NOV. 2 ➤ Aviation Safety Program Management. Embry-Riddle Aeronautical University. Daytona Beach, Florida, U.S. Sarah Ochs, <case@erau.edu>, <bit.ly/wtWHln>, +1 386.226.6000. (Also APRIL 22–26, 2013.)

OCT. 29–NOV. 2 ➤ Global ATM Safety Conference. Civil Air Navigation Services Organisation. Cape Town, South Africa. Anouk Achterhuis, <anouk.achterhuis@canso.org>, <www.canso.org/safetyconference2012>, +31 (0)23 568 5390.

OCT. 30–NOV. 1 ➤ NBAA 2012. National Business Aviation Association. Orlando. Donna Raphael, <draphael@nbaa.org>, <www.nbaa.org/events/amc/2012>, +1 202.478.7760.

OCT. 30–NOV. 8 ➤ SMS Training Certificate Course. U.S. Transportation Safety Institute. Oklahoma City, Oklahoma, U.S. D. Smith, <d.smith@dot.gov>, <www.tsi.dot.gov>, +1 405.954.2913. (Also JAN. 8–17, MAY 14–23, JULY 30–AUG. 8, 2013).

NOV. 5–9 ➤ Aircraft Accident Investigation. Embry-Riddle Aeronautical University. Daytona Beach, Florida, U.S. Sarah Ochs, <case@erau.edu>, <bit.ly/wtWHln>, +1 386.226.6000. (Also APRIL 29–MAY 3, 2013.)

NOV. 6–7 ➤ IATA Lithium Battery Workshop. IATA Cargo Events. Houston. <idfsevents@iata.org>, <bit.ly/PfziKu>.

NOV. 6–9 ➤ Aircraft Fire and Explosion Course. BlazeTech. Woburn, Massachusetts, U.S. N. Albert Moussa, <amoussa@blazetech.com>, <www.blazetech.com/resources/pro_services/FireCourse.pdf>, +1 781.759.0700.

NOV. 8 ➤ Creating Safety Assurance: How to Move From Concepts to Action. Global Aerospace SM4 and the Kansas City Business Aviation Association. Kansas City, Missouri, U.S. <safety@global-aero.com>, <sm4.global-aero.com/upcoming-events>, +1 206.818.0877.

NOV. 13–14 ➤ Operational Safety Management for Business Aviation. Pro-Active Safety Systems. Denver. Nick Campbell, <nickcampbell@proactivesafetyinc.com>, <proactivesafetyinc.com/landing-pages/real-world-sms>, +1 303.881.7329.

NOV. 14–16 ➤ ALTA Airline Leaders Forum 2012. Latin American and Caribbean Air Transport Association. Panama City, Panama. <www.alta.aero/airlineleaders/2012>, +1 786.388.0222.

NOV. 19–30 ➤ 12th Air Navigation Conference. International Civil Aviation Organization. Montreal. <www.icao.int/Meetings/anconf12/Pages/default.aspx>.

NOV. 26 ➤ SMS Overview for Managers. CAA International. Manchester, England. <training@caainternational.com>, <bit.ly/NTqGhW>, +44 (0)1293 768700.

NOV. 29–30 ➤ Fatigue Risk Management Systems. CAA International. Manchester, England. <training@caainternational.com>, <bit.ly/S2ylHG>, +44 (0)1293 768700.

DEC. 13–14 ➤ SMS Workshop. ATC Vantage. Tampa, Florida, U.S. <info@atcvantage.com>, <bit.ly/QP3EKa>, +1 727.410.4759.

JAN. 9–11 ➤ Risk Management Conference. Airports Council International–North America. Las Vegas, Nevada, U.S. <meetings@aci-na.org>, <www.aci-na.org/event/2406>, +1 202.293.8500.

JAN. 13–15 ➤ SMS/QA Genesis Symposium. DTI Training Consortium. Orlando, Florida, U.S. <www.dtiatlanta.com/Events.html#>, +1 866.870.5490.

JAN. 16–17 ➤ Non-Destructive Testing Audit Oversight Course. CAA International. London Gatwick Airport. <training@caainternational.com>, <www.caainternational.com>, +44 (0)1293 768700.

JAN. 23–25 ➤ Airport Wildlife Hazard Management Workshop. Embry-Riddle Aeronautical University and Burbank Bob Hope Airport. Burbank, California, U.S. <training@erau.edu>, <bit.ly/OUYFIq>, +1 386.226.7694.

MARCH 12–13 ➤ Safety Across High-Consequence Industries Conference. Parks College of Engineering, Aviation and Technology, Saint Louis University. St. Louis, Missouri, U.S. Damon Lercel, <dlercel@slu.edu>, <www.slu.edu>, +1 314.977.8527.

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

If you have a safety-related conference, seminar or meeting, we'll list it. Get the information to us early. Send listings to Rick Darby at Flight Safety Foundation, 801 N. Fairfax St., Suite 400, Alexandria, VA 22314-1774 USA, or <darby@flightsafety.org>.

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

Runway Friction Measurement Standards

Mark Lacagnina's article "Skidding Off a Cliff" (*ASW*, 6/12, p. 20) summarizes findings about a number of factors causing a runway overrun with a tragic outcome, based on the English translation of the Norwegian accident report.

I would add a few comments regarding determination of the general friction characteristics which the investigative agency performed and referred to in its accident report, although not decisive for the conclusion and the outcome.

The original report states that the investigative agency performed a friction measurement using a device belonging to the public road administration. This was a "dry" measurement that yielded a friction level of about 0.7. When it comes to friction measurement for design and maintenance purposes, ICAO Document 9137, *Airport Services Manual Part 2*, governs this area. Similarly, the same, correct procedures are found in FAA Advisory Circular 150-5320. Both refer to the use of water film in conjunction with friction measurement to understand the pavement micro-texture which provides the friction characteristics. This must not be confused with operative braking action assessments.

I am of the opinion that when the investigative agency performed a friction measurement for assessing the runway friction characteristics of this runway, it should have been in conformity with the framework for such procedures set forth by ICAO in Document 9137. To this end, it is also noteworthy that aviation authorities in Norway have made an exemption from ICAO Doc 9137, Annex 14, within this particular area, which is clearly stated in *Norwegian Aeronautical Information Publications* (AIP) Gen 1.7-14. Furthermore, the same AIP does not describe the type of design and maintenance systems to be used in place of the recommended ICAO system.

Runway excursions are a frequent accident type. Flight Safety Foundation initiated an initiative a few years ago which resulted in the *Runway Excursion Risk Reduction (RERR) Toolkit*. One of the many recommendations in this tool kit is "to ensure that runways are constructed and maintained to ICAO specifications."

It is clear that providing good friction characteristics is an important constituent in reducing runway excursions. To what extent various countries follow this particular segment of the ICAO Doc. 9731 is unknown, but Norway is one that does not and is likely not the only one.

Implementing proper design and maintenance systems for runways should be an easy task for virtually all countries, because all procedures and routines are already established and published by ICAO. This is a simple yet important constituent to reduce the risk of runway excursions.

Capt. (retired) Oddvard Johnsen

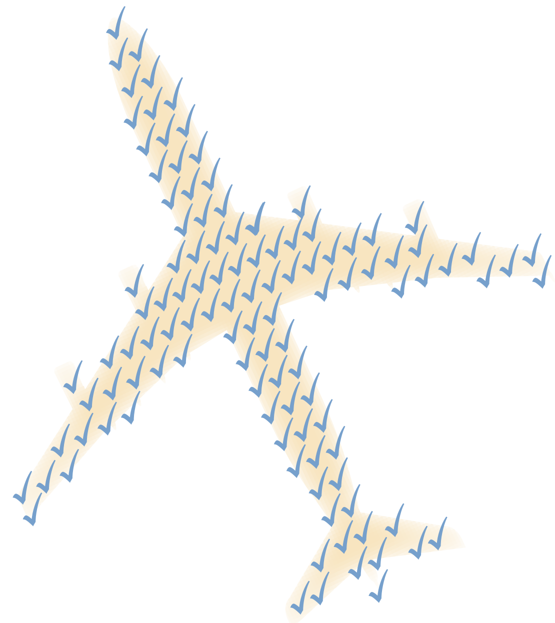
Reach Should Exceed Grasp

Sometimes, the "we" directed by "them," the salesmen of rules and theory, forget that in actual practice humanness does experience failure. That same failure can act to encourage us toward the constant improvement of our mastery of the third dimension. I applaud Cliff Jenkins's brilliant reminder (*ASW*, 8/12, p. 7) that "quality" often lives just beyond our reach, so that we will keep reaching. To the "reachers," press on.

Doug Perrill
chief pilot, B2 Flight

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

Write to Frank Jackman, director of publications, Flight Safety Foundation, 801 N. Fairfax St., Suite 400, Alexandria, VA 22314-1774 USA, or e-mail <jackman@flightsafety.org>.



FUNCTIONAL Check Flights

Flight Safety Foundation has prepared a new safety aid called the Functional Check Flight Compendium.

It isn't only pilots who are subjected to check rides. Aircraft are, too. Functional check flights (FCFs) are typically performed after heavy maintenance or transfer to a new owner or lessor. Their purpose is to make sure that everything on the aircraft works as it should.

FCFs involve risks beyond those of ordinary line flying. Some checks involve *shutting down* a necessary system in flight to see if it can be restored. These flights test backup on seldom-used systems or functions and involve procedures normally not used in line operations.

For example, in January 2009, a Boeing 737 was undergoing an elevator power–off flight test west of Norwich, Norfolk, England. "During the check, the aircraft pitched rapidly nose down, descending approximately 9,000 ft before control was recovered," said the report by the U.K. Air Accidents Investigation Branch. "A number of maintenance and airworthiness check issues were identified."

Because several accidents and serious incidents have pointed out the unusual risks associated with FCFs, Flight Safety Foundation organized an FCF steering team comprising representatives from Airbus, Boeing, Bombardier and Embraer to address the issues. Their effort first bore fruit in 2011 with a highly successful symposium in Vancouver, British Columbia, Canada. Delegates — 285 from 41 countries — representing aircraft manufacturers, regulators and operators attended.

That was only a first step. In anticipation of pending regulations by the European Aviation Safety Agency for FCFs, currently at the stage of a notice of proposed amendment, the Foundation and the steering team continued their work. Prior to and during a meeting at FSF headquarters in July 2012, the team hammered out the basic framework of the compendium.

The Functional Check Flight Compendium includes several components.

A paper by Harry Nelson, experimental test pilot for Airbus, discusses selection and training of the right people for the task, planning and preparation, execution, and what to do if maneuvering goes wrong.

A guidance document is divided into preparation, ground checks and — the longest section — flight checks. The flight checks section is subdivided into modules for various systems and procedures: for example, electrical system, engine relight, flight controls, landing gear and takeoff.

In addition, the compendium contains all the material presented at the Vancouver symposium.

Watch for the Functional Check Flight Compendium on the FSF website, <flightsafety.org>.

— *Jim Burin*
Director of Technical Programs

Susan Reed

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Photo courtesy of Key West International Airport

Safety News

Ground Anti-Collision Systems

Large airplanes should be equipped with an external-mounted camera system or other anti-collision aid to help pilots determine wingtip clearance while taxiing, the U.S. National Transportation Safety Board (NTSB) says.

In safety recommendations to the U.S. Federal Aviation Administration (FAA) and the European Aviation Safety Agency, the NTSB said that the agencies should require the anti-collision aids, which would provide a cockpit indication of wingtip positions, on "all newly manufactured and newly type-certificated large airplanes and other airplane models where the wingtips are not easily visible from the cockpit."

The agencies also should require the retrofitting of such equipment on existing large airplanes and others with wingtips that cannot easily be seen from the cockpit, the NTSB said.

Erik Tham/iStockphoto

In issuing the recommendations, the NTSB said that, since 1993, it has investigated 12 taxiing accidents — including three currently under investigation — that occurred when the wingtip of a large airplane collided with another airplane or an object on a taxiway.

"These accidents … highlight the need for an anti-collision aid," the NTSB said.

The three accidents now under investigation include:

- A May 30, 2012, accident in which an American Eagle Embraer 135 on the ramp was struck by the wingtip of an EVA Air Boeing 747-400 as the 747 taxied at Chicago O'Hare International Airport;
- A July 14, 2011, accident in which the winglet of a taxiing Delta Air Lines 767-300ER struck an Atlantic Southeast Airlines Bombardier CRJ900, which was on a perpendicular taxiway at Boston Logan International Airport; and,
- The April 11, 2011, collision of a taxiing Air France Airbus A380 and a stationary Comair Bombardier CRJ701 at John F. Kennedy International Airport in New York.

No one was injured in the accidents. Preliminary investigations revealed that in each case, the pilots of the large airplanes "could not easily view the airplanes' wingtips from the cockpit" and had difficulty determining their exact position, the NTSB said.

"Typically, pilots look out the cockpit window at the wingtips to determine wingtip path and clearance," the NTSB said. "On large airplanes, … the pilot cannot see the airplane's wingtips from the cockpit unless the pilot opens the cockpit window and extends his or her head out of the window, which is often impractical."

Speed Brake Warnings

The U.S. National Transportation Safety Board (NTSB), citing a Boeing 757's runway overrun in 2010, says airplanes need better warning systems and pilots need better training on what to do if speed brakes fail to deploy after landing (*ASW*, 9/12, p. 34).

The NTSB called on the U.S. Federal Aviation Administration (FAA) to require all operators of transport-category airplanes with speed brakes to "develop and incorporate training to specifically address recognition of a situation in which the speed brakes do not deploy as expected."

An accompanying recommendation said the FAA should require newly type-certificated transport-category airplanes to "have a clearly distinguishable and intelligible alert that warns pilots when the speed brakes have not deployed during the landing roll."

The NTSB also recommended that the FAA require Boeing to "establish guidance for pilots of all relevant airplanes to follow when an unintended thrust reverser lockout occurs."

The recommendations were prompted by the NTSB's investigation of a Dec. 29, 2010, incident in which an American Airlines 757 ran off the end of a runway after landing at Jackson Hole, Wyoming, U.S., and stopped in deep snow. None of the 185 people in the airplane were injured in the incident, which resulted in minor damage to the aircraft.

The NTSB said the probable causes of the incident were a manufacturing defect that prevented automatic deployment of the speed brakes, "the captain's failure to monitor and extend the speed brakes manually" and the initial failure of the thrust reversers to deploy.

Mental Health Check-Ups

Aviation medical examiners should devote more attention to mental health issues during routine aeromedical assessments of pilots, the Aerospace Medical Association (AsMA) says (*ASW*, 5/12, p. 29).

In a letter to Michael Huerta, acting administrator of the U.S. Federal Aviation Administration (FAA), AsMA President P. Glenn Merchant wrote that "quick and effective methods to assess pilot mental health" could easily be included in aeromedical exams.


nyul/123RF Stock Photo

By asking specific questions, aviation medical examiners could identify depression, anxiety/panic disorders and substance misuse — conditions that can be diagnosed early and treated successfully, Merchant said.

His comments reflected the opinions of an AsMA working group — specialists in aviation medicine and mental health — formed after a March incident in which a JetBlue Airbus A320 captain allegedly turned off the airplane's radios and began yelling about terrorists. A federal judge has since ruled that he was suffering from a mental disease at the time and ordered him to a government mental health facility.

The working group also concluded that "serious mental health illnesses involving sudden psychosis are relatively rare, and their onset is impossible to predict. … [Therefore,] an extensive psychiatric evaluation as part of the routine pilot aeromedical assessment is neither productive nor cost effective and therefore not warranted."

Blacklist Called 'Misguided'


Giorgio Magini/iStockphoto

The European Union's (EU's) list of airlines barred from operating within the EU does "little if anything to improve safety," says Tony Tyler, director general and CEO of the International Air Transport Association (IATA).

The list, first published in 2006 and revised about 20 times since then, was intended to publicly identify airlines that the EU considered unsafe and to spur the named operators to make improvements that would lead to their removal from the list.

However, Tyler, in a speech to aviation professionals in Astana, Kazakhstan, said, "The banned list is a misguided approach. … There is no transparency — no clarity on why some carriers are put on the list and no clear indication on what is required to get off the list."

The current version of the EU blacklist, issued in April, includes 279 air carriers from about two dozen countries, including all air carriers certified in Kazakhstan except for one carrier that operates under specific limitations.

Helicopter Safety Management

The European Helicopter Safety Team (EHEST) has developed a Safety Management Toolkit for European operators of complex aircraft.

The three-part tool kit includes:

- A safety management manual, designed as a sample to help operators in the development of their own safety management manuals;
- An emergency response plan, which the European Aviation Safety Agency eventually will require of operators; and,
- A safety management database user guide, which will include "example registers of typical helicopter hazards and risks in commercial air transport operations," EHEST said.

EHEST said that, because regulatory requirements will change over time, the tool kit will be reviewed and updated regularly.


photoerick/123RF Stock Photo

Weaknesses in Wildlife Mitigation

The U.S. Federal Aviation Administration (FAA) has been limited in its effectiveness in mitigating wildlife hazards, largely because its policies for monitoring, reporting and mitigating the hazards are voluntary, a government watchdog agency says.

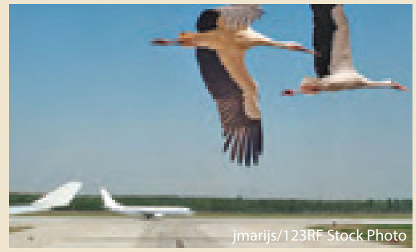
A report by the Office of Inspector General (OIG) in the U.S. Department of Transportation noted that the FAA recommends — but does not require — that aircraft operators and airports report all wildlife strikes.

"As a result, FAA's strike data are incomplete, which impacts the agency's ability to evaluate the effectiveness of its program in reducing wildlife hazards," the report said.

The document also criticized FAA oversight and enforcement actions as "not sufficient to ensure airports fully adhere to program requirements or effectively implement their wildlife hazard plans."

The report credited the FAA with effectively coordinating its actions with the Wildlife Services agency within the U.S. Department of Agriculture, but faulted its efforts to coordinate with other government agencies.

The report contained 10 recommendations aimed primarily at improving data collection, verifying that airports are fully implementing wildlife hazard management plans and increasing contact with other government agencies involved in wildlife issues.


jmarijs/123RF Stock Photo

The FAA said it would implement all or part of nine recommendations, but challenged one provision that called for reconciling wildlife strike data from airports with the FAA's National Wildlife Strike Database.

In a written response to the report, H. Clayton Foushee, the FAA's director of audit and evaluation, said that the agency has worked hard to reduce wildlife hazards and that, although wildlife strikes have increased, the percentage of damaging strikes has decreased from 20 percent of the total in 1990 to 9 percent in 2010. Over that same period, he said, bird populations have increased dramatically.

He added that the FAA "is taking a comprehensive approach to reduce the threat of wildlife strikes on aircraft through enhanced requirements and guidance, training outreach and continued data collection, analysis and research."

Personal Electronic Review

The U.S. Federal Aviation Administration (FAA) plans to establish a government-industry group to review policies governing the use by airline passengers of portable electronic devices (PEDs) and the procedures that airlines have used to determine when the devices may be used safely during flight.

The use of cell phones for voice communications during flight will not be considered, the FAA said.


franckreporter/iStockphoto

Current U.S. Federal Aviation Regulations require that, before passengers are permitted to use PEDs during some phases of flight, operators must determine that their use will not interfere with aircraft radio frequencies.

The group will review the testing methods used by airlines to determine what types of PEDs passengers may use and when they may use them, and also "look at the establishment of technological standards associated with the use of PEDs during any phase of flight," the FAA said.

"We're looking for information to help air carriers and operators decide if they can allow more widespread use of electronic devices in today's aircraft," said Acting FAA Administrator Michael Huerta. "We also want solid safety data to make sure tomorrow's aircraft designs are protected from interference."

In Other News …

The Australian Civil Aviation Safety Authority has released a collection of booklets and a DVD aimed at helping small and medium-sized operators and aviation maintenance organizations develop their own **safety management systems**. … The U.S. Federal Aviation Administration (FAA) has proposed a $400,000 **civil penalty** against Atlantic Southeast Airlines for allegedly operating a Bombardier regional jet that was not in compliance with regulations. Airline maintenance personnel returned the airplane to service after routine maintenance without an authorized signature on the airworthiness release or the required entry in the flight discrepancy log, the FAA said. Atlantic Southeast has 30 days to respond after receiving notice of the proposed penalty from the FAA.

Compiled and edited by Linda Werfelman.

Pressure Gradient

BY WAYNE ROSENKRANS

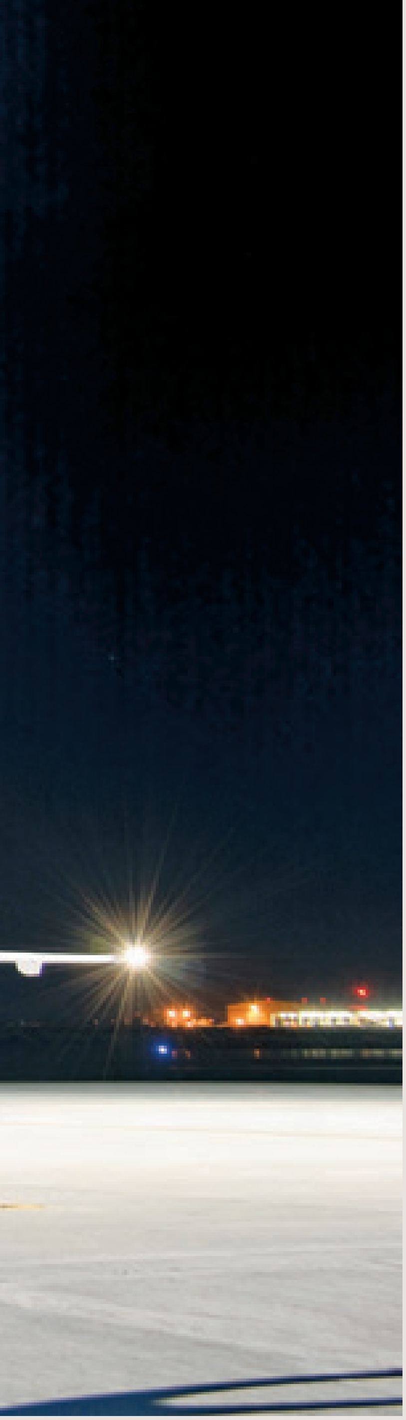
Cautious cooperation precedes deadlines to integrate unmanned aircraft systems into U.S. civil airspace.

The persistent divide between advocates and skeptics of unmanned aircraft systems (UASs) being integrated safely into the U.S. National Airspace System (NAS) shows signs of narrowing, according to speakers at two recent industry events. Open-ended speculation, criticism and resistance appear to be yielding to an urgent need for cooperation among stakeholders to mitigate risks implicit in the federally mandated UAS integration process set in motion in early 2012 (*ASW*, 3/12, p. 34). Presenters typically described UAS integration as a vital common interest.

The views were shared at the 2012 ALPA Air Safety Forum conducted in Washington by the Air Line Pilots Association, International (ALPA) and at ISASI 2012, a seminar conducted in Baltimore by the International Society of Air Safety Investigators (ISASI).

"The amount of time already elapsed in bringing forth civil, certified, routine [UAS] operations has frustrated many proponents and advocates, and has resulted in lobbying and political pressure," said Ellis Chernoff, a FedEx Express captain and the ALPA UAS Team lead. "Committee deadlines and legislative mandates

Photo: Tony Landis / NASA © General Atomics Aeronautical Systems



The remote pilot of NASA's Ikhana, a modified General Atomics Aeronautical Systems MQ-9 Predator B, in March conducted the engine run-up before a flight test of the use of ADS-B for tracking unmanned aircraft.

have been the obvious response. But there can be no shortcut to safety, and we have a responsibility to our pilot membership and to the public we serve to hold fast to the highest standards of safety and to get the details right."

He was referring to the U.S. Federal Aviation Administration (FAA) Modernization and Reform Act of 2012 — containing provisions for the safe integration of UASs into the NAS no later than Sept. 30, 2015 — that was signed into law in February.

"In manned aviation, it's expected that pilots see and avoid traffic and other hazards," said Bill de Groh, an American Eagle Airlines captain and chairman, ALPA Aircraft Design and Operations Group. "A new concept is introduced [for UASs], called *sense-and-avoid,* and attempts to close this gap. … UAs must be compatible with TCAS [traffic-alert and collision avoidance system]–equipped aircraft but also remain safely separated from all air traffic. ADS-B In [automatic dependent surveillance–broadcast] may eventually offer a possible solution to this issue" (see "Sense-and-Avoid Update," p. 18). The FAA defines sense-and-avoid as "the capability of a UAS to remain well clear from and avoid collisions with other airborne traffic."

FAA Perspective

By mid-2012, the FAA was reorganizing its UAS-related work under the new Unmanned Aircraft Systems Integration Office (AFS-80) within the Flight Standards Service, while addressing the law's requirements. "We're not going to do anything that compromises safety when it comes to the integration of unmanned aircraft into the National Airspace System," said FAA Acting Administrator Michael Huerta. In this context, the FAA has requested and received extensive public input about specific aspects of UAS integration, including the management of six UAS test sites (to be selected by December), training requirements, operator experience, uses of airspace, collecting safety data and coordinating further research and development work.

The U.S. government has had a policy of accommodation of UASs in the NAS, allowing private recreational flights by model aircraft; allowing UA operation without approval only in active restricted areas and warning areas; issuing certificates of authorization or waiver (COAs) only to public use UAs; or issuing special airworthiness certificates in the experimental category and special flight permits for UA flight testing (*ASW*, 7/08, p. 34).

Under COAs, UAs currently operate in most classes of airspace but flight over populated areas is not approved. The details of integration into the NAS within three years and later into the Next Generation Air Transportation System (NextGen) are still being decided.

The new FAA office focuses on the "safe, efficient and timely" integration of UASs into the NAS, said Richard Prosek, manager of the UAS Integration Office. An FAA *Civil/Public UAS NAS Integration Roadmap* mandated by the law is being developed by this office, led by UAS Executive James H. Williams, and the FAA concept of operations is being produced by the FAA NextGen Office. Recommendations from the FAA UAS Aviation Rulemaking Committee, established in June, were to have been incorporated into the comprehensive plan by the end of September, Prosek said. The Joint Planning and Development Office, comprising multiple government-military entities, has responsibility for the comprehensive plan.

In May, a presentation by Williams listed UA reliability, UA certification standards, certification of ground control stations, pilot qualification standards, dedicated protected radio spectrum, sense-and-avoid capability, and NextGen ground system design as critical issues in integration. A notice of proposed rule making is scheduled for release in late 2012 "to enable small [UAs] to operate safely in limited portions of the NAS and gather data."

Window of Opportunity

From the perspective of UAS manufacturers, integration will have profound societal benefits, including long-term economic competitiveness. "No one in this industry expects that we're going to wake up [in the United States on

Sense-and-Avoid Research Update

U.S. researchers in September observed the performance of two mature sense-and-avoid algorithms for unmanned aircraft systems (UASs) during a series of flight tests near Grand Forks, North Dakota. Flights comprised 120 encounters in which automatic maneuvers by a UA-surrogate airplane were expected to resolve virtual traffic conflicts with an intruder aircraft, participants said.

Complete results await final reports, but examples of successful conflict-avoidance maneuvers were replayed for *AeroSafety World* and other media representatives in a Web conference–based telephone briefing about the Limited Deployment–Cooperative Airspace Project (LD–CAP). The briefing was led by representatives of the U.S. National Aeronautics and Space Administration (NASA) Langley Research Center, MITRE Corp. and the University of North Dakota on behalf of all the research partners.

"What we want to do is create the scientific data that the community needs to make decisions about how to mitigate [UASs'] lack of see-and-avoid with a sense-and-avoid solution," said Andy Lacher, MITRE's UAS integration lead. "We're using the [flight] data to validate our computer models and inform the community about the performance and the viability of a cooperative, autonomous, sense-and-avoid algorithm. … We're conducting this research using a [NASA-owned] surrogate unmanned aircraft — an SR22, a Cirrus aircraft. … The sensor we are focused on in this research is automatic dependent surveillance–broadcast [ADS-B]. … It's a good sensor source to be used for determining whether you can have an automatic algorithm."

RTCA Special Committee 203 and other standards bodies will consider these and other data in producing a set of sense-and-avoid technical standards, he noted.

The flight data animation replays showed algorithms commanding the autopilot of the SR22 surrogate UA to turn well clear to avoid conflicts with the intruder airplane. UA maneuvers not replayed at the briefing included climbs, descents and speed adjustments for successful avoidance of the intruder, Lacher said.

"We are focusing on conflict avoidance under visual flight rules in … airspace where aircraft [pilots] may not be receiving ATC [air traffic control] separation services," he said. "We are not necessarily focused on collision avoidance, and [there] are some real differences between [traffic-alert and collision avoidance systems] and the [LD-CAP] activities."

Flight testing essentially helps to assess the sense-and-avoid technology readiness level in winds and atmospheric conditions, said Frank Jones, LD-CAP deployment lead, NASA Langley. Before the flight tests, computer simulations already had analyzed more than 2 million encounters between a virtual UA and a virtual intruder aircraft, he said.

LD-CAP's agenda covers the development and testing of algorithms that rely on ADS-B; identifying methods of commanding UA sense-and-avoid maneuvers to avoid conflict with manned aircraft that lack ADS-B; education of the general aviation community about ADS-B benefits; and reducing the size, weight and cost of ADS-B equipment.

— WR

To read an expanded version of this article, go to <flightsafety.org/aerosafety-world-magazine/october-2012/sense-and-avoid>.

A general-purpose computer and the flying pilot's UAS interface with the autopilot occupy one rear seat of NASA's Cirrus SR22 surrogate UA during sense-and-avoid flight tests.

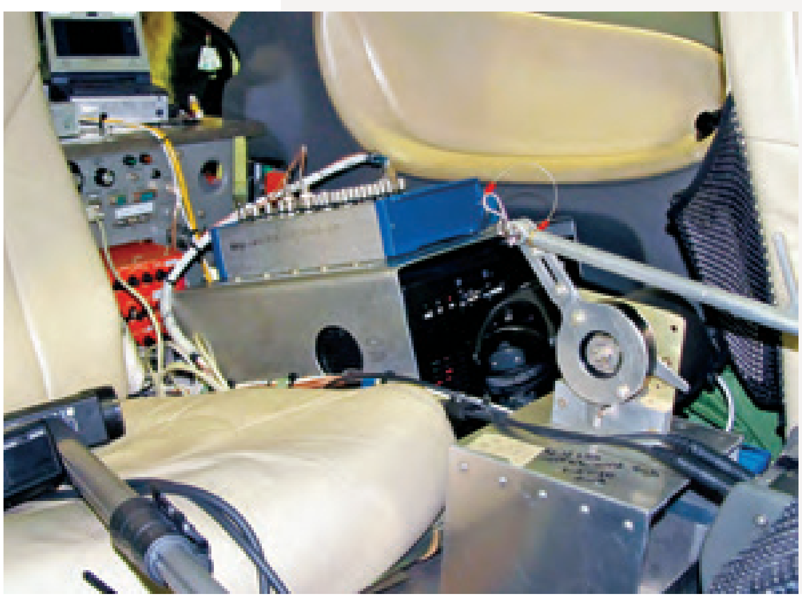


Photo by Dan Gunderson, MPR News

Sept. 30,] 2015, and find the skies darkened with unmanned aircraft systems — that's just not reality," said Paul McDuffee, associate vice president of government relations and strategy, Insitu, a subsidiary of The Boeing Co. "We're going to start operating systems where it makes sense to operate them. We are not going to push the envelope beyond our capabilities. … Until routine access to airspace, and routine and regular use of UASs occurs, we're looking at a situation where the economics may not be what everyone anticipates."

From the vantage point of military pilots flying the largest UAs, called Group 4 and Group 5, these aircraft are the closest to readiness for integration. "Potentially, [they] can operate in the vast majority of the airspace that [airline pilots] will operate [in]," said U.S. Air Force Col. Carl King, remotely piloted aircraft liaison for the U.S. Department of Defense to the FAA. "I'm not going to suggest that we share it, but those are the systems that we train our operators to fly, basically, in all classes of airspace as we get there."

Pilots of these UAs have radio communication with air traffic control (ATC) for traffic separation in controlled airspace but not yet a safe replacement for human see-and-avoid capability. Currently, multiple sensor systems depict traffic to the UA pilots on their ground control station displays.

"Obviously, sense-and-avoid is a big issue that we have within the aircraft," King said. "[For now, our] center screen [is] a big blow-up of the world that we are flying in, and that will scale in and out. … This is not … an 'I can go anywhere' kind of system, but this does help us get situational awareness to see where the rest of our aircraft are. We can do some significant deconfliction [but] it is not a sense-and-avoid system quite yet."

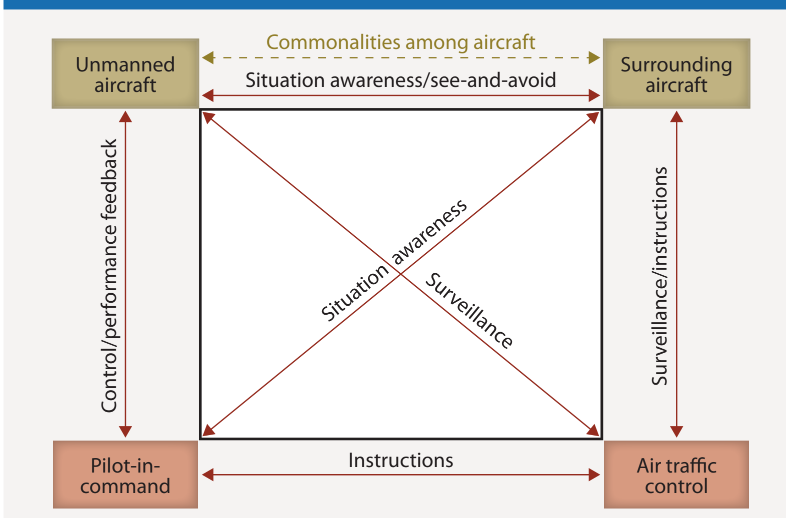
Remaining Concerns

ALPA pilots collectively express a number of safety-related concerns about integration. "Whether unmanned aircraft are 'accommodated' or 'fully integrated' into the NAS, responsibility for safety remains the same, even though the tasks and details of operations are different," said ALPA's Chernoff. "The skies are plenty crowded, and there must be a means to fly the correct altitude, determine legal visibility [and] maintain required cloud clearance and required ground track. This is not a simple matter, and the systems that support this are far more complex than in typical [manned] light aircraft."

Except for line-of-sight control of the smallest UAs, ALPA argues that UA pilot certification must include an instrument rating. "In unmanned aviation [with the next generation of pilots], the new pilot might start out with advanced systems and displays, and the training and qualification must take that into account," Chernoff said.

So far, ALPA has not been sold on the efficacy of some proposed sense-and-avoid solutions based on high-resolution surveillance radar on the ground. "It can provide simple intruder alerts allowing limited UAS flight operations in a particular area without creating special-activity

UAS Kite: Visualizing the Criticality of Hazards



UAS = unmanned aircraft system

Note: In this conceptual model of interdependencies, a UAS-related hazard occurs in controlled airspace when something affects the normal operation of any entity at the corners, and a potential undesired outcome results. Disruption or degradation of any of the communication segment/interdependency lines shown, which may be one-way-only, also may increase risk from the perspective of an accident investigator or regulator.

Source: Thomas A. Farrier

Figure 1

airspace — or it can provide some level of conflict resolution for the remote pilot," he said. "While it might be useful in testing and validating a true airborne collision–avoidance system, it can never be a substitute for one."

Forensic Challenges

By the time integration materializes, civilian accident investigators will need to be prepared for known forensic challenges (*ASW,* 12/07, p. 42) and some unique complexities involved in UA crashes and UA-related crashes. Moreover, the profession should have a voice today in the UAS risk mitigations under development to help prevent accidents, some accident investigators said.

Tom Farrier, chairman of ISASI's UAS Working Group, said that integration steps must fully consider all that will be required for effective accident investigation. "As the numbers go up, you're going to have more and more interactions between manned and unmanned aircraft, and we can't predict how they are going to happen," Farrier said. Some investigators anticipate that the most probable categories of UAS accidents will be the crash of a manned aircraft as the result of a collision with an unmanned aircraft, and a fatality or a major injury that results directly from unmanned aircraft operations of some type, he said.

Investigators lack data for UAS events equivalent to that in the Boeing *Statistical Summary of Commercial Jet Airplane Accidents*, he said, and this lack of data impedes their prioritization of risk reductions. "There simply is not enough data," Farrier said. "Some of the … military services have some of that kind of information, but they don't want to give it to us."

Investigators must be alert for causal factors such as component reliability when identical or nearly identical engines or other parts are common to both UA fleets and manned-aircraft fleets, so that all stakeholders can be alerted to findings and safety recommendations, he added.

UAS architectures can be more complex in their possible points of failure (Figure 1, p. 19) than generic diagrams indicate, Farrier said. One example is a UA that only operates autonomously on a brief, temporary basis — in some cases, after the pilot has been following the flight path by pilotage, comparing the on-board camera's terrain imagery to a surface map displayed inside the UAS ground station — and outside the visual range of the pilot.

"There have been a number of losses of aircraft being operated in just this manner where it seems pretty obvious that the [UA] had just flown too far away to 'hear' its ground control station," he said. "Quite a few of them don't seem to [enable the pilot to recapture the UA]. Perhaps their lost-link profile brings them in contact with some kind of surface feature before they can get back in the link. Maybe they are just failing to respond to on-board programming [and] when it's actually put to the real test, it doesn't work. We call those fly-aways. I think there are a lot of fly-aways. … So we need to document these kinds of events, and in some cases, it may be prudent to expend some investigative resources just to develop an idea of whether this is a pattern within a given operator or operation."

The ISASI UAS Working Group has begun to develop a description of UASs generic enough to accommodate the entire spectrum of investigations. The description is expected to be helpful in directing specific investigative tasks. "The no. 1 thing that I think you can bear in mind is … if it's an aircraft, it's going to crash like an aircraft. … With the unmanned aircraft, you are going to have the added question of, 'Was the link between the pilot-in-command and the aircraft intact or not?'" Farrier said. "And that becomes a lot more difficult task to accomplish because, in part, not too many people in our profession really are familiar with how the electromagnetic spectrum works [for UASs], and how the different protocols, developed for passing along commands, are being processed aboard the [UA]."

To read an expanded version of this article, go to <flightsafety.org/aerosafety-world-magazine/october-2012/uas-deadline-cooperation>.

Hunting Down Fatigue

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Researchers credit a voluntary reporting system with detecting unsuspected sources of fatigue.

BY LINDA WERFELMAN

A system of anonymous, voluntary reporting of fatigue by pilots and flight attendants can be used to help identify and correct fatigue hazards that might otherwise remain unknown, according to a study of a fatigue reporting system at one airline.[1]

The study of approximately 309 pilots and 674 flight attendants[2] at the short- and medium-haul airline from Sept. 1, 2010, to Aug. 31, 2011, found that the rate of fatigue-report submission among pilots was 103 reports per 1,000 persons; the rate among flight attendants was 68 reports per 1,000 persons. The report on the study — published in the August issue of *Aviation, Space, and Environmental Medicine* — did not name the airline, but all three authors were medical or crewing officials with BMI, British Midland International.

Data for the study were gathered from fatigue report forms (FRFs), which were submitted by pilots and flight attendants to provide information about fatigue-related work events.

"Crews were requested to complete an FRF if they stood themselves down due to fatigue, were unable to attend work due to fatigue, had a general concern about fatigue or a fatigue-related safety event had occurred," the report said.

During the one-year period, crewmembers submitted 78 FRFs; of that number, 32 reports were submitted by pilots and 46 by flight attendants. Two individuals submitted more than one FRF. The study determined that 81 percent of FRFs submitted by pilots and 93 percent of those from flight attendants described events in which the crewmember was unable to work because of fatigue.

The paper FRFs asked for information about the crewmember's recent sleep and duty time, the time of day of the event and related "aspects of fatigue-related impairment," the report said.

The study's goal was to collect data to help identify fatigue hazards and fatigue mitigation strategies, the report said, adding that self-reporting of fatigue can identify problems that elude fatigue prediction modeling software.

Among the fatigue-related problems discovered through the self-reporting process were the quality of hotel accommodations, commuting distances between the airport and hotel or home, and the "hassle factor" associated with individual airport conditions or technical problems.

For example, the report said, several FRFs that cited "rostered duty pattern" fatigue were submitted by crewmembers on the Tehran, Iran, to London route. The FRFs said that "Tehran-London flight duty … [had] a high 'hassle factor,'" the report said. "This resulted in a decision by the crewing manager to schedule days off following this particular trip.

"Several reports were received relating to the overnight London-Moscow-London flight, a long duty, which ends within the window of circadian low.[3] A metric altimetry operation used within Russian airspace, novel to most flight crew, could increase their workload. A decision was taken to avoid scheduling this duty at the end of a [six-day] block of work."

Both examples, the report said, involved schedules that complied with regulatory flight time limitations, labor union requirements and the System for Aircrew Fatigue Evaluation (SAFE) software.

Report Analysis

When an FRF was submitted, it was reviewed by the airline's medical officer. His findings, along with the report, were forwarded to the crewing manager for an independent review. When both agreed that fatigue was the primary cause of the episode described by the crewmember, the FRF was assigned to one of five primary causal categories (see "Fatigue Categories"):

Category 1 — rostered duty patterns;

Category 2 — operational disruption;

Category 3 — layover accommodation;

Category 4 — domestic [issues]; and,

Category 5 — no obvious cause.

The categories were determined after a review of the results of a small-scale study conducted immediately before the main study, the report said, noting that the aviation industry lacks any standard for categorizing fatigue reports according to cause.

Analysis of the FRFs showed that 27 percent of reports were associated with the rostered duty pattern — more than any other category — and among them were the reports involving the flights from London to Moscow and Tehran (Figure 1, p. 24). Operational disruption was cited for 24 percent, domestic for 23 percent, and layover accommodation for 17 percent. Nine percent of reports had no obvious cause or were considered "invalid," in most cases because further investigation determined that the crewmember was ill rather than fatigued.

Fatigue reports that were linked to operational disruption included 10 reports submitted in December 2011 that cited heavy snow in the United Kingdom, the report said. "Many London airports were snow-closed, and crews found themselves delayed or stranded down-route," the document added.

Fatigue Categories

The study of crewmembers' fatigue reports assigned each report to one of the five following primary causal categories:[1]

- "Category 1: Rostered duty patterns — effect of early starts, trends related to the time of day, effect of multiple sectors, effectiveness of daytime versus overnight sleep, effect of working several consecutive days. The investigator used this category when no other identifiable cause was found and the associated duty had a moderately high, albeit acceptable, [score in an analysis using the System for Aircrew Fatigue Evaluation (SAFE)].
- "Category 2: Operational disruption — flight delays, last-minute roster changes, flight diversions, adverse weather, etc., explicitly stated on the report or discovered after investigation of actual duty worked.
- "Category 3: Layover accommodation — problems with the layover hotel accommodation or transport provided by the company explicitly stated on the report.
- "Category 4: Domestic — domestic in origin, child care, lengthy commute, misread roster, or noisy neighbors explicitly stated on the report. (Actual commute time was recorded by the reporter on the FRF [fatigue report form]. A commute time more than two hours immediately before the start of a duty was considered to be a risk factor if not explicitly stated by the reporter and no other cause was identified.)
- "Category 5: No obvious cause was determined for the fatigue or the report was related to sickness rather than fatigue."

— LW

Note

1. Houston, Stephen; Dawson, Karen; Butler, Sean. "Fatigue Reporting Among Aircrew: Incidence Rate and Primary Causes." *Aviation, Space, and Environmental Medicine* Volume 83 (August 2012): 800–804.

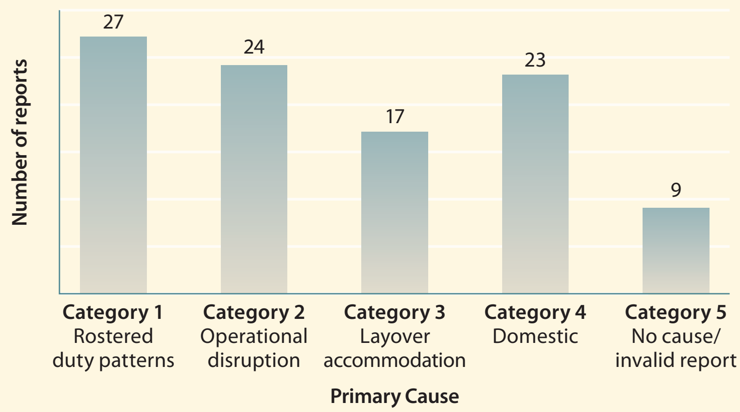
Of the FRFs with a domestic cause, most were associated with commuting to work, the report said. Most of the study participants drove to work, and information in the narrative section of the FRFs indicated that they experienced difficulty with "extraordinarily heavy traffic because of road closures, accidents or poor weather conditions" and that these problems resulted in longer commutes.

Other domestic causes of fatigue included childcare requirements that interrupted the crewmember's rest, misreading a duty roster and a noisy neighbor.

The mean monthly report frequency was 6.5, although the number of FRFs filed each month ranged from one in August 2011 to 15 the previous month (Figure 2). The report traced the increase to the airline's introduction in May of a new hotel for crew layovers; that month, the number of FRFs increased to 11, up from just two that had been submitted in April. Fourteen FRFs were submitted in June and 15 in July.

"There were problems with excessive noise caused mainly by wedding celebrations in the hotel grounds," the report said. "There were nine reports citing 'hotel noise' as the cause for fatigue submitted during [May, June and July]. By the end of July, at the airline's request, the hotel had installed double-glazing in the crew bedrooms, and no further noise reports were received."

Primary Causes of Fatigue Reports, 2010–2011

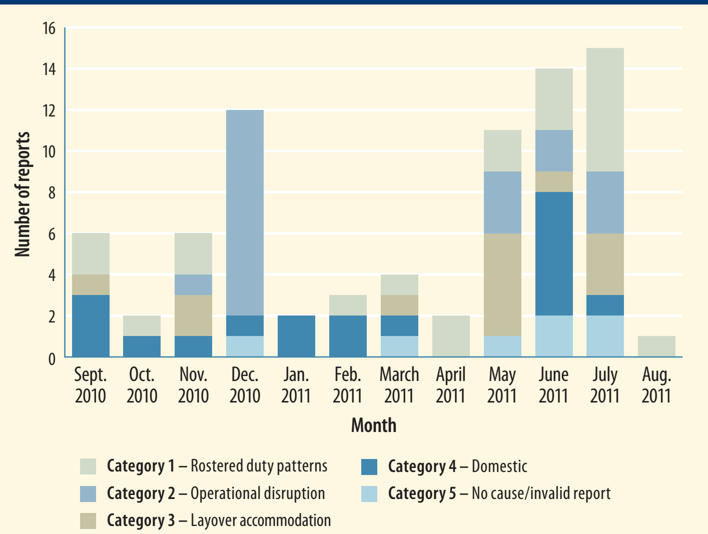


Note: Based on a study of voluntary fatigue reports filed by 309 pilots and 674 flight attendants at one airline from Sept. 1, 2010, through Aug. 31, 2011.

Source: Houston, Stephen; Dawson, Karen; Butler, Sean. "Fatigue Reporting Among Aircrew: Incidence Rate and Primary Causes." *Aviation, Space, and Environmental Medicine* Volume 83 (August 2012): 800–804.

Figure 1

Primary Causes of Fatigue Reports, by Month



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Source: Houston, Stephen; Dawson, Karen; Butler, Sean. "Fatigue Reporting Among Aircrew: Incidence Rate and Primary Causes." *Aviation, Space, and Environmental Medicine* Volume 83 (August 2012): 800–804.

Figure 2

Just Culture

During the course of the study, crewmembers were reminded of the airline's confidentiality and voluntary reporting protections, the report said.

"There must be the expectation that the information will be dealt with fairly and in the interests of safety," the document added. "High reporting rates may indicate an organizational culture committed to identifying and reducing fatigue rather than a truly high [fatigue] rate."

Notes

1. Houston, Stephen; Dawson, Karen; Butler, Sean. "Fatigue Reporting Among Aircrew: Incidence Rate and Primary Causes." *Aviation, Space, and Environmental Medicine* Volume 83 (August 2012): 800–804.
2. These numbers represented the "midpoint size" of the crew population in February 2011.
3. The circadian low is the time of day when an individual experiences the greatest sleepiness, based on his or her body clock.

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Putting It Into **Words**

Non-standard phrases, slang and rapid-fire speech hinder pilot–controller communications.

BY LINDA WERFELMAN

Non-standard phraseology and local pilots' use of languages other than standard aviation English "routinely" cause misunderstandings in radio communication between pilots and air traffic controllers — difficulties that raise concerns even though they are rarely cited as causal or contributing factors in aviation accidents and incidents, according to a study of aviation phraseology.

The study — conducted by the International Air Transport Association (IATA) in collaboration with the International Federation of Air Line Pilots' Associations (IFALPA) and the International Federation of Air Traffic Controllers' Associations (IFATCA) — cited "ambiguity in general aviation language" and the use of slang instead of standard phraseology as leading factors in increasing the likelihood of communication errors.

Other problems included the "rate of speech delivery" — typically, a pilot or controller speaking too quickly to be understood — and the accents and pronunciation difficulties of non-native English speakers, the report on the study said.

The document characterized the use of non-standard phraseology as "a major obstacle to pilots' and controllers' effective communications. Standard phraseology helps significantly by reducing any ambiguities of spoken language and hence promotes a common understanding among people of different native languages or of the same native language but who use or understand words differently."

The report, published by IATA in late 2011, was based on the anonymous responses of 2,070 airline pilots and 568 air traffic controllers around the world to similar questionnaires that were devised for members of each group.

Of the participating pilots, 55 percent were airline captains and 40 percent were airline first officers; the remaining 5 percent held a variety of other positions, including those as managers, safety officers or instructors. Ninety-two percent of questionnaire respondents were jet pilots, 6

How frequently are you in a situation where ICAO standard phraseology is NOT used?

Airline Pilots	Response
At least once per flight	44%
At least once per 10 flights	38%
At least once per 100 flights	12%
Never	6%

Note: Based on survey responses from 2,070 airline pilots.

Source: International Air Transport Association

Table 1

How often do you report in your company safety reporting systems events where ICAO standard phraseology is NOT used?

Airline Pilots	Response
Only when safety is directly affected	57%
Never	42%
Every event	1%

Note: Based on survey responses from 2,070 airline pilots.

Source: International Air Transport Association

Table 2

In what region do you most often experience an event where ICAO standard phraseology is NOT used?

Airline Pilots	Response
Africa	14%
Asia Pacific	10%
Commonwealth of Independent States	3%
Europe	22%
Latin America and the Caribbean	12%
Middle East and North Africa	9%
North America	27%
North Asia	4%

Note: Based on survey responses from 2,070 airline pilots.

Source: International Air Transport Association

Table 3

percent were turboprop pilots and 2 percent were helicopter pilots.

The geographical distribution of respondents was considered "adequate" from all regions, with 40 percent based in Europe and 22 percent in North America. Nevertheless, the report said that pilots in North Asia and the Commonwealth of Independent States "did not participate in the numbers originally expected" and therefore were subsequently asked to complete questionnaires that had been translated into Chinese and Russian.

Of all pilots responding, 56 percent worked on international flights, and 30 percent were scheduled on a combination of international and domestic flights.

Sixty-two percent said that, when they were operating in countries where English was not the native language, they spoke to controllers in standard aviation English, while the remaining 38 percent used the country's native language at least part of the time.

"It is almost certain that pilots in other aircraft with little or no knowledge of the local language operated in the same airspace and on the same frequencies as these pilots, leading to a potential degradation of situational awareness," the report said.

Forty-four percent said that they experienced "a situation where ICAO [International Civil Aviation Organization] standard phraseology is not used" at least once during each flight (Table 1). Forty-two percent said that they never reported those lapses, and a majority said that they filed a report "only when safety is directly affected" (Table 2).

Episodes of non-standard phraseology were most frequent in North America and Europe, the report said (Table 3).

Pilots reported that they most often experienced non-standard phraseology while operating in their home regions, the report said. The report's findings also indicated that 27 percent of pilots participating in the questionnaire said that their encounters with non-standard phraseology occurred most often in North America; of that group, 40 percent were pilots based in North America (Table 4).

Two Languages

Forty-eight percent of pilots identified specific airports where standard phraseology is not used. At the top of the list was Charles de Gaulle Airport in Paris, where the most frequent complaint involved not phraseology but the use of both English and French. John F. Kennedy International Airport in New York received the second-largest number of complaints, with pilots citing the use of "local phraseology, or a term other than ICAO standard."

Fifty-four percent of pilots reported specific procedures or practices by pilots or air traffic control (ATC) that resulted in misunderstandings or errors. Among the most common were "the use of mixed languages with international crews speaking English with ATC and the local crews speaking the country's language," the report said, identifying this as the most frequently mentioned complaint.

"Pilots indicated that this resulted in their situational awareness being reduced," the report added. "They had difficulty deciding when to make a radio call without interfering in another crew/ATC communication. This issue was compounded by frequency congestion and may have led to crews 'stepping on' each other's transmissions."

Also among their complaints was a "lack of standardization in communications" — including use of slang, improper use of the phonetic alphabet and the failure to use ICAO's standard terminology when repeating aircraft call signs. "This condition was most commonly

Problematic Regions Cited by Origin of Respondents

Airline Pilots	Problematic Region	Reporting Operators' Region of Origin							
		AFI	ASPAC	EUR	CIS	NAM	NASIA	LATAM	MENA
	North Asia (NASIA)	1	4	15	6	8	12	0	23
	North America (NAM)	2	31	164	5	209	8	14	93
	Middle East and North Africa (MENA)	3	6	29	6	12	0	0	112
	Latin America and the Caribbean (LATAM)	0	1	54	0	104	0	57	17
	Europe (EUR)	10	5	360	3	16	3	0	38
	Commonwealth of Independent States (CIS)	0	1	29	10	7	1	0	10
	Asia Pacific (ASPAC)	3	71	30	1	32	3	0	61
	Africa (AFI)	76	3	98	3	4	1	1	81

Note: Based on survey responses from 2,070 airline pilots.

Source: International Air Transport Association

Table 4

noted in communication within the [United States]," the report said.

Some also cited confusion in references to "to" or "two," and the report noted, "When using altitude, the use of the word 'to' could be very problematic." As an example, the report said that a controller's statement of "cleared *to* seven thousand" could be interpreted by a pilot as "cleared two-seven thousand."

Other pilots complained of "similar [flight] numbers on different airlines," "usage of native language with all domestic traffic" and mistaking a flight level clearance for a heading.

Another told of situations at "large U.S. airports … [where] controllers talk too fast, so you can't quite get all the clearance, but you don't want to ask for a readback because they are so busy. Area of most trouble is with ground control, then tower. It gets progressively better as you go to terminal, then center."

Eighty-seven percent of pilots said they had experienced no communication problems using controller-pilot data-link communications (CPDLC), and 2 percent indicated that they were unaware of the system. However, 13 percent offered specific complaints about CPDLC, most frequently citing the "number/length of free text messages, unknown abbreviations and use of non-standard phraseology" and "conditional clearances for a specific time or location that can be ambiguous."

Common Complaints

The most common observation by pilots on international routes was the use of a local language instead of standard aviation English in exchanges between local pilots and ATC.

"The fact that a local language was used … was felt to reduce the situational awareness of non-native pilots," the report said. "Pilots believed that the use of a single language (English) would help to improve their situational awareness and avoid other communication problems."

Other respondents discussed the rate of speech, complaining that in many cases, controllers spoke too quickly to be easily understood. The report cited an earlier study by the U.S. Federal Aviation Administration (FAA) that found that controllers' rate of speech was the biggest problem for U.S. pilots (*ASW*, 10/10, p. 48).[1]

In response to a question on the IATA survey, one pilot said, "Most controllers in Australia speak too fast and in a slang that is very difficult to understand. … Also, in the USA, they often speak too fast and with a very strong accent. It is funny to see (hear) that most problems arise in so-called English-speaking countries. Also, India is a big problem, as they often seem to think that the faster they speak, the better they know the language."

Pilots also said that they were more likely to misunderstand when controllers grouped several instructions into a single radio transmission — and that their difficulty intensified when controllers delivered multiple instructions while speaking quickly.

"Too much information in a single message," one pilot complained. "Speed, headings and altitudes are not given in a standard and logical way, sometimes in different order. A logical order … could help a lot."

IATA recommended that ATC instructions be given with "an even rate of speech not exceeding 100 words per minute." In addition, the radio transmissions should be "short and include concise instructions, and not be given during critical phases of flight (e.g., at high speed during landing rollout)," the report said.

Pilots also said that they sometimes believed that controllers were not listening during readbacks of their instructions, that controllers sometimes failed to detect mistakes in readbacks and that they "needed an acknowledgment to their readback to close the communication loop," the report said.

"At times, they were told not to read back the clearance but to just listen, and this was not acceptable, in the opinion of the survey respondents."

Controller Responses

In responses to a similar survey, however, the air traffic controllers said that the lack of proper readbacks — including failure to include an aircraft call sign — by pilots constituted their greatest concern.

"Not using a call sign in the readback happens hundreds of times a day," one controller said. "Sometimes it is more critical than others. Nevertheless, it should *not* be acceptable."

The responding controllers also complained of pilots' failure to request a lower airspeed when company procedures preclude them from flying at the speed assigned by ATC, and their comments indicated that standard instrument departures and standard terminal arrival route procedures "routinely create issues for controllers," the report said.

Responses to the ATC survey came from 568 air traffic controllers, 55 percent of whom were based in Europe, 30 percent in North America, 11 percent in the Asia Pacific, 2 percent in South America and the Caribbean and 1 percent each in Africa and the Commonwealth of Independent States.

Thirty-four percent worked in area control centers, 28 percent in air traffic control towers and 27 percent in approach control, with the remainder in a variety of other jobs.

Forty-six percent said that they used languages other than English in at least some of their communications with pilots.

A majority of controllers said that at least once a day they encounter situations in which ICAO standard phraseology is not used. Twenty-five percent said the problem occurs "at least weekly," and 11 percent said it occurs "at least monthly." Twelve percent said that they never encounter the situation (Table 5).

Fifty-eight percent said that they have formally reported events involving a lack of standard phraseology "only when safety is directly affected," and 35 percent said that they have never submitted such a report. Two percent said that they have reported every event. Five percent said that they worked in systems that had no formal reporting mechanism (Table 6).

North American pilots were singled out more than others for not using ICAO standard phraseology (Table 7).

In both surveys, pilots and controllers from North America were singled out most often for not using ICAO standard phraseology, the report noted, adding that the trends "should be acknowledged and acted upon by the appropriate authorities."

How frequently are you in a situation where ICAO standard phraseology is NOT used?

Air Traffic Controllers	Response
At least daily	52%
At least weekly	25%
At least monthly	11%
Never	12%

Note: Based on survey responses from 568 air traffic controllers.

Source: International Air Transport Association

Table 5

How often do you report in your safety reporting systems events where ICAO standard phraseology is NOT used?

Air Traffic Controllers	Response
Only when safety is directly affected	58%
Never	35%
Do not have a safety reporting system	5%
Every event	1%

Note: Based on survey responses from 568 air traffic controllers.

Source: International Air Transport Association

Table 6

Specify the originating region that most often airline operators are from which do NOT use ICAO standard phraseology?

Air Traffic Controllers	Response
Africa	1%
Asia Pacific	6%
Commonwealth of Independent States	3%
Europe	16%
Middle East and North Africa	4%
Not applicable	36%
North America	26%
North Asia	5%
Latin America and the Caribbean	3%

Note: Based on survey responses from 568 air traffic controllers.

Source: International Air Transport Association

Table 7

This article is based on Phraseology, *a pilots/air traffic controllers phraseology study, conducted by IATA, in collaboration with IFALPA and IFATCA, and published by IATA.*

Note

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/Airport,* DOT/FAA/AM-10/09. May 2010.

SMALL AIRLINE, BIG CHANGES

Launching an SMS brings new challenges.

BY LINDA WITTENMYER

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In January 2009, when Armando Martinez became director of safety at Miami Air International, the safety management system (SMS) concept still was being refined, but already vendors were showing up at our door offering solutions. Working for a small air carrier, Martinez knew that we did not have unlimited dollars or time to throw at any problem, much less one that didn't produce revenue, so he began to network with others from the industry and the U.S. Federal Aviation Administration (FAA) to get their perspectives and to see what resources were available.

During the process, we learned several things. First, the FAA was looking for small carriers to volunteer to participate in the pilot program. Second, we already had a program to track accidents and incidents and it could be expanded to handle SMS requirements: the Aviation Safety Action Program Web-Based Application Tool (ASAP/WBAT) developed by Universal Technical Resource Services (UTRS). Last, the bond that would hold it all together, and the key to successful implementation of a robust SMS, would be the development of a content management system (CMS) built around the principles of the SMS framework.

Then-CEO Ross Fischer (a founder of Miami Air in 1990) gave us our marching orders: Miami Air would volunteer to participate in the FAA's SMS pilot program. He knew that not only would we be part of the process, but also that Miami Air would receive extensive assistance.

Miami Air is a member of the National Air Carrier Association (NACA), and we worked with other NACA members to expand the use of the WBAT software to track safety incidents and audits. Armed with these cost-free resources, Martinez felt Miami Air was poised to begin the process. Free is good, when you are a small

Good safety practices support lower insurance premiums and the ability to maintain valuable contracts.

carrier. With backing from the CEO, my offer of part-time help as his executive assistant, and a fair but small budget, we launched Miami Air on the path toward implementing an SMS.

Roadblocks

The management team at Miami Air always has had a strong positive attitude toward safety. Good safety practices support lower insurance premiums and the ability to maintain valuable contracts with government agencies as well as serve high-end customers such as sports teams, all of which enhance the bottom line. However, the "silo mentality," though not pervasive, was a problem when it became apparent that everyone — operations, maintenance, quality assurance, finance and all other company departments — would have to be placed under the umbrella of the Safety Department. The cooperation we received from upper management was essential to the attitude adjustments necessary to engender a cohesive workforce that supported the SMS at every level.

In an effort to alleviate some of the apprehension that accompanies change, we tried to make the process as simple as possible. During the implementation, we realized we only had to ask for two completely new things for company personnel to do. First, we had to train and encourage every employee to use WBAT for reporting safety concerns, incidents and accidents.

Second, we asked management to document the results of risk assessments as hazards or risks were encountered during the normal course of business. In the past, management promptly addressed risks and hazards, but the actions rarely were documented. Given the longevity of the management group at Miami Air, there was a strong reliance on "tribal knowledge" and the fact that if the same hazard was encountered again, the people who had handled it in the past were there to provide the necessary guidance to avoid or mitigate it.

Another problem was finding a method to manage the company's SMS. Researching, analyzing and recording responses according to SMS expectations were daunting tasks. We went back to management to request a full-time analyst to help manage the SMS implementation. In February 2011, we hired Dustin Quiel to manage the project. With Quiel's help, we could cover not only the handling of day-to-day SMS responsibilities, but we also had an opportunity to grasp the complexities of the changes that would be required to comply with this new regulatory mandate. He found ways to integrate data from existing company programs as well as put SMS to work in the most effective and least painful way.

Photos: © Miami Air

Falling Short

A new problem arose: The answers we considered acceptable were falling short of FAA requirements. The guidance of Derek Cheatham — our FAA mentor for this process through frequent calibration meetings — became our touchstone for resolving problems. Cheatham challenged our answers, pointed out the shortfalls and provided encouragement to keep to the process.

The flexibility of the WBAT program became more evident, and after extensive discussions with Nicky S. Armour and Harry Van Soestbergen of UTRS, an SMS implementation module was developed, allowing us to easily track our progress.

During the 11th WBAT conference in October 2011, however, the FAA shocked the industry when it announced a cut in funding for the UTRS WBAT project. Miami Air, along with many other carriers, already was heavily reliant on the WBAT system, having implemented a combination of the WBAT modules, including the SMS implementation, on-the-job injury reporting, audits, ASAP and incident reporting.

Fischer immediately began writing letters to the FAA stressing the importance of the support needed by small carriers to implement SMS. He emphasized that the WBAT system was an essential aid in implementing SMS for many companies operating on thin margins. Through the efforts of a letter-writing campaign, WBAT funding was continued, though with reduced manpower. However, we recognize that eventually with further budget cuts, WBAT funding will again come under serious scrutiny.

The Process

To exit SMS Level One,[1] Miami Air developed an overall plan to meet major landmarks and an additional plan for accomplishing each SMS framework requirement. The Safety Department determined which of the detailed gap analysis questions it could research and answer and apportioned the rest to the other departments.

The basic steps to exit Level One were:

- Assess and record the extent to which Miami Air complied with the detailed gap analysis questions;
- Formulate an implementation timeline; and,
- Schedule the Level One exit with the FAA's SMS Program Office.

If we thought getting through Level One was a hard work, we learned that a more labor-intensive stage was just beginning. Implementation of the plan was the next step, and it required documentation, enforcement, training and meticulous record keeping. In addition to moving forward with Level Two, Fischer left his position as CEO to become chairman of the company's board of directors. Jim Proia, also a founder of Miami Air and writer of all the manuals for the airline's initial certification, succeeded him. Proia's knowledge and expertise made the leadership transition seamless. He was already on-board with the implementation and a staunch supporter of the SMS. Additionally, Proia had been instrumental in acquiring the CMS, as he was thoroughly knowledgeable on technical publications at Miami Air.

Implementation required that internal and external audits be scheduled, recorded and analyzed in WBAT. Additionally, extensive changes had to be made to the safety manual and other manuals throughout the organization. Finally, we had to achieve consistencies and interfacing of our company manuals, and we had to create an organization manual to delineate the lines of authority and the responsibility for SMS.

The key component of this process required that Miami Air purchase a CMS to help us comply with SMS requirements. After much research, we purchased and helped develop a low-cost product from SiberLogic, a software developer from Canada. Alex Povzner, president of SiberLogic, was interested in adapting his company's software for the aviation industry and SMS requirements. This product would help ensure that we had consistency and common interfacing across our manuals, managed change and maintained a hazard registry.

Out of Level Two

Other requirements we had to address to exit Level Two were creating a risk matrix, a risk management flowchart, including the safety risk management and safety assurance processes, and safety objectives. Again, good risk management was in place at Miami Air, but it had never been thoroughly analyzed or documented in a way that was accessible to everyone. Now, we had to put the various components together, publish them and enforce the consistent use of these tools throughout the organization. We had to write safety objectives and communicate them to management and staff.

Currently at Miami Air, all employees initially are trained in the use of the WBAT reporting system and require annual recurrent training. Each year, we tailor the recurrent training to incorporate lessons learned. This demonstrates that management uses the information provided by employees to mitigate or eliminate hazards.

As a result, we have consistently seen a growth in the use of the WBAT reporting system since implementation in 2009. With the creation of a safety committee that includes staff members from every department, we have found that employees are more comfortable about sharing safety concerns without fear of reprisal or recrimination. We are always gratified when an employee takes the time to share concerns or suggestions with members of management because it shows that what we are doing with our SMS is effective within the Safety Department and throughout Miami Air. Everyone understands they are part of the safety process. They have learned that their input is of value to the company and management takes their concerns seriously.

All employees needed to understand what "just culture" means and the difference between acceptable and unacceptable behavior. An honest mistake is acceptable, but a willful violation will never be tolerated. Miami Air has established a safety reporting hotline and although anonymous reporting is an FAA-required element of an SMS, employees still prefer to approach Martinez personally with their concerns. We have been able to nurture a just culture based on trust.

To accomplish this, and as part of the overall SMS implementation, we created training modules to teach management and the general staff about the safety culture of Miami Air, the SMS rationale, the reporting aspect of the WBAT program and their roles in maintaining the highest practical level of safety. This training helped management and other employees understand the importance of cooperation in safety, because the main theme of SMS is that there should be a balance between the highest practical level of safety and profitability.

Miami Air previously had encouraged the use of tools to keep safety in the forefront of all of its operations, but there seldom had been any coordination between departments using these tools. Flight Operations had its manuals, policies and procedures, in addition to the flight operational quality assurance and ASAP programs. Maintenance had TRAX and CASS, its own set of procedures and safety programs.[2] Under the SMS, all programs need to be universal throughout the organization. Risks and hazards have to be identified, reported and managed using the same procedures. All outputs of these processes have to be pooled for analysis.

Currently, we are working to link our reporting system to our SiberLogic CMS, which will enable us to streamline our SMS processes.

Content Management

As a small company, we could not afford to make a bad decision about the CMS, one of the most expensive components of the project. During the development of the CMS, we discovered we would need additional help to convert all of our manuals into the format required by the software (extensible hypertext markup language, or XHTML), while our Publications Departments were still required to continue performing their day-to-day functions. Management then authorized the hiring of two interns to help with the conversion.

Converting and publishing manuals in the CMS was a difficult and time-consuming task, but became much easier with the continuous technical support provided by staff at SiberLogic. They expanded the software to include a hazard registry, the ability to show compliance with U.S. Federal Aviation Regulations, operations specifications, FAA Air Transportation Oversight safety attribute inspections, and any other compliance standards such as International Air Transport Association Operational Safety Audits, those of the Department of Defense, etc. These features increased the efficiency of the company's Technical Publications Departments and allowed the Safety Department to monitor hazards, assess the impact of changes, and ensure compliance — specific requirements of an SMS. SiberLogic's Povzner and his team have worked with us to improve this software and create new features.

We also have made strides in educating our vendors and customers on our SMS program. We train our vendors on Miami Air procedures and encourage them to share safety concerns with us.

Education, integration and cooperation are integral tools in implementing and maintaining a robust and effective SMS. Miami Air's success involved the tools, talent and support of its management team and the assistance provided by the FAA at all levels, from our local principal operations inspectors to the SMS Program Office in Washington.

The next challenge is demonstrating that the procedures, training and tools are working together as designed to achieve our goals of continuously operating with the highest practical level of safety. This will require objective evidence that we comply with the processes and elements of our SMS. Part of measuring the success of our SMS is positive communication of safety goals, response to incidents and safety concerns, and being proactive and predictive with gathered safety data.

Lessons Learned

We have learned many things during this SMS journey and I would like to share some, with a caution that the culture, procedures and level of management support of every organization are different. We advise others:

- Start as soon as possible. This is a lengthy process and the SMS Part 5 regulation will have a strict timeline.
- Involve your company's management and your local FAA office as much as possible and as early as possible.
- Establish a benchmark for your company and compare it to the SMS requirements. This will give you a clear picture of what your gaps are and the effort (e.g., manpower, budget) required.
- Do not reinvent the wheel. Familiarize yourself with all the programs currently in use in your company and build your SMS compliance on them.
- Use all available resources. A lot of free information is available. SMS and safety conferences are great sources of information. Network and share, talk to other carriers about their programs.
- There will naturally be some friction as you implement SMS. Do not be discouraged.

Armando Martinez and Dustin Quiel contributed to this article.

Notes

1. Level One and Level Two are two of the four stages for developing an SMS. These definitions come from the SMS implementation guide and SMS framework documents published by the FAA. Level One is the planning stage, where an operator creates a plan for implementation of its SMS. Level Two is the actual implementation. Level Three is the demonstration (via safety assurance audits) of the SMS to show whether the implementation is working as designed. Level Four is the permanent stage of continuous improvement.
2. TRAX is software used by Miami Air's maintenance department for auditing, training, compliance trending and tracking. CASS stands for Continuous Airworthiness Surveillance System.

Environmental regulator prioritizes operational safety while introducing wastewater rules for U.S. airports.

Deicing for Safe Taxiing

BY WAYNE ROSENKRANS

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U.S. airports are being required, under a new federal environmental rule, to comply with technology-based guidelines intended to limit the use of toxic pavement deicers and the discharge of hazardous aircraft deicing fluids. In developing the final rule, which took effect June 15, the U.S. Environmental Protection Agency (EPA) discarded initial proposals that, in part, would have limited the deicing of airplanes at airport gates and required expanded use of centralized deicing pads and glycol-collection trucks. Organizations representing airports, airlines and airline pilots had opposed those proposals, citing safety concerns, among other issues.

Although EPA has jurisdiction over environmental concerns, the Federal Aviation Administration (FAA) is responsible for regulating and providing guidance on safely conducting these activities.

The new regulation,[1] following a three-year analysis of public comments and data, addresses issues intended to improve the management of wastewater discharges from airport deicing operations — typically stormwater polluted by deicing fluid reaching nearby surface waters or exceeding the capacity of publicly owned water-treatment works. The focus of EPA's rule making was the application of deicing and anti-icing fluids to aircraft, and the application of solid and liquid deicing products to airport movement-area pavement.

The regulation implements effluent-limitations guidelines and source performance standards under the Clean Water Act, according to the environmental agency.[2,3] "The requirements generally apply to wastewater associated with the deicing of airfield pavement at primary airports," EPA said. "The rule requires all such airports to comply with requirements based on substitution of less toxic pavement deicers that do not contain urea. The rule also establishes [new source performance standards] for wastewater discharges associated with aircraft deicing for a subset of new airports. These airports must also meet requirements based on collection of deicing fluid and treatment of the collected fluid."

The broader initial proposal was criticized, in part, by aviation industry commenters as likely to increase risk during winter flight operations and as an overreach of EPA authority. Some argued that U.S. airports are too diverse for national rules to be practicable.

EPA estimated that the aviation industry's compliance with the final rule annually would cost $3.5 million to reduce the discharge of deicing-related pollutants by 16 million pounds (7.3 million kg). "The final rule is expected to decrease [chemical oxygen depletion] discharges associated with airport runway deicing and anti-icing activities by approximately 12.0 million pounds [5.4 million kg] per year," EPA said. "The rule is also estimated to reduce ammonia discharges by 4.4 million pounds [2.0 million kg, disregarding any future airport construction]."

Environmental Concerns

Even those who objected to EPA's entire regulation typically agreed in their public docket comments that mitigating risks of accidents during flight operations and mitigating environmental harm near airports are both important societal goals. Some airports presented data documenting minimal local environmental effects from deicing fluids because of existing programs, natural dilution of wastewater or other reasons.

"Airports in the United States discharge deicing wastewater to a wide variety of water body types, including streams, rivers, lakes and estuaries," EPA said. "Many airports discharge deicing wastewater to small streams with limited waste dilution and assimilation capacities. Impacts from deicing wastewater discharges have been documented in a variety of surface waters adjacent to or downstream of a number of airports in the United States. Some locations experienced acute impact events, whereas other locations have experienced chronically degraded conditions. … Documented human use impacts include contamination of surface drinking water sources, contamination of groundwater drinking water sources, degraded surface water aesthetics due to noxious odors and discolored water in residential areas and parklands, and degradation of fisheries." Other observed impacts to surface waters include reductions in dissolved oxygen, fish kills and reduced organism abundance and species diversity, the agency said.

Deicing for Safe Taxiing

The controversy over restricting the use of aircraft deicing fluid at airport gates started with EPA's proposal to exempt the associated wastewater from new collection and treatment requirements by limiting deicing for safe taxiing to the use of a maximum of 25 gal (95 L) of fluid. "Deicing for safe taxiing means the application of [aircraft deicing fluid] necessary to remove snow or ice to prevent damage to a taxiing aircraft," EPA said, and includes removal of frost, ice and snow from various critical components such as windshields and engine intake ducts or heavy snow before taxiing the aircraft to a deicing pad for full deicing/anti-icing.

"This [proposal] was intended to apply to airports with [centralized deicing pads], and to prohibit conducting complete deicing of an aircraft at a terminal area without a collection system, instead of using the deicing pad," the agency said. EPA said that public comments alleged that the agency had failed to consider wide differences among airports in winter conditions and factors such as the application flexibility required by cargo aircraft during layovers of more than 24 hours.

The Air Line Pilots Association, International (ALPA) said in 2010, "Several factors must be taken into account to properly conduct deicing operations of an aircraft preparing for takeoff. These include differences in the type, rate and temperature of precipitation, all of which may increase the need for [aircraft deicing fluid]; the length, width and applicable surfaces of the most demanding airplane; the amount of holdover time required for an aircraft to safely taxi and be in a position for takeoff following the aircraft's initial or subsequent deicing; and the proficiency of ground personnel to properly perform assigned deicing operations. … Poor deicing technique by applying [fluids] to non-critical surfaces could result in consuming the fixed 25 gal of [fluid as proposed] before it is applied to the correct surfaces. … We believe that [the threat of an EPA penalty or violation] could result in circumstances where ground personnel may not complete the deicing to the FAA standard, potentially jeopardizing the safety of the flight." ALPA added that a proposed requirement for glycol-collection vehicle operators to attend all deicing activities (except for pre-taxi deicing) likely would degrade their situational awareness and increase the risk of apron-area collisions.

The Massachusetts Port Authority was among commenters that noted that "EPA is proposing to assume the responsibility of requiring airlines to use a specific deicing technology [contrary to FAA policy] and to quantify the amount of deicing that is adequate (with its proposed 25-gal allowance for taxiing). Thus, the proposed rule would inappropriately extend EPA's regulatory reach from pollution reduction to aviation safety matters."

Airlines for America noted that EPA's restriction on deicing for safe taxiing "would effectively eliminate any aircraft departures which cannot operate because 25 gal of [fluid] is inadequate to clear engine intakes and other critical areas for safe taxiing. No airline would compromise safety, or suggest that its pilots-in-command compromise flight safety by taxiing an inadequately deiced aircraft."

EPA ultimately concurred that a number of these and related concerns were valid. "EPA agrees with the commenters, and therefore the final rule does not limit the amount of [aircraft deicing fluid] sprayed for the purposes of safe taxiing, nor does EPA require an airport to collect and treat [aircraft deicing fluid] applied for safe taxiing purposes," the agency said in May.

Deicing Pad Realities

This announcement also explained the outcome of EPA's original proposal to emphasize centralized deicing pads. As noted, in the final rule, the applicability of a new requirement was changed from new and existing airports to new airports only. "A [centralized deicing pad] is a paved area on an airfield built specifically for aircraft deicing operations," EPA said. "EPA estimates that [these pads] allow airports to collect at least 60 percent of the available [aircraft deicing fluid]."

EPA noted some stakeholder concerns about using centralized deicing pads for all deicing operations because of safety problems and airfield traffic issues. ALPA, for example, said, "Our primary objective is to ensure that the aircraft has been prepared in the FAA-approved manner, that it remains clean of snow and ice, and that it is in a condition to complete a safe takeoff. If this goal is accomplished through the use of a [centralized deicing pad], the location of that facility must not interfere with the safety of airport and flight operations."

In the case of Boston-Logan International Airport, for example, the Massachusetts Port Authority said, "If aircraft were required to taxi from the gate to a centralized deicing pad located in one part of the airport, then to a departure runway in another part of the airport, the number of runway crossings occurring during taxiing — and thus the number of potential runway incursions — would greatly increase. … [Another safety] reason to have pads at each set of runway ends is to minimize the time between deicing/anti-icing and departure. [Another] reason for locating a pad at each set of runway ends is to prevent pad use from interfering with runway use." The FAA also advised EPA that at existing land-constrained airports, construction and operation of centralized deicing pads for all deicing operations would not be able to meet FAA design standards.

In the end, EPA said, "EPA has concluded that the lack of remaining available land, coupled with their existing layouts, has left these airports in a position where a [centralized deicing pad] conforming to FAA's advisory circulars on deicing pad design (e.g., in a location that aircraft can travel to safely and efficiently to conduct deicing operations) cannot be constructed. … With respect to new airports, the use of [centralized deicing pads] does not present the space/land, safety or operational issues that would be raised in connection with the use of deicing pads at existing sources."

Control Measures

EPA is responsible for addressing deicing discharges under protocols that recognize changing technology and the potential side effects of regulatory strategies. "[These] regulations address control of the wastewater discharges from deicing operations based on product substitution, wastewater collection practices used by airports, and treatment practices for the collected wastewater," the agency said. "New source airports [i.e., future airports] within the scope of this rule are required to collect spent aircraft deicing fluid … and meet numerical discharge limits. Those airports and certain existing airports performing airfield pavement deicing are to use non-urea-containing deicers, or alternatively, meet a numeric effluent limitation for ammonia. The requirements are implemented in [Clean Water Act] discharge permits. … Currently, most airport deicing discharges are covered by a general permit issued by either EPA or … [a] state agency."

Under the new regulatory scheme, U.S. airports annually using more than 100,000 gal (379,000 L) of glycol-based deicing chemicals and/or 100 tons (101,600 kg) or more of urea-containing deicers initially must monitor discharges for biochemical oxygen demand, chemical oxygen demand, ammonia and pH (acidity/alkalinity). The standards "reflect effluent reductions that are achievable based on the best available demonstrated control technology" for all categories of pollutants, EPA said.

"No single technology or [pollution prevention] approach is capable of collecting or eliminating all applied [fluid], as a portion of the fluid is designed to adhere to the aircraft until after takeoff, in order to ensure safe operations," EPA said. "After considering other options, EPA selected site-specific aircraft deicing discharge controls as most feasible given the diversity of the affected U.S. airports. … There are limited instances where an airport in a warm climate that performs only defrosting and gets little to no precipitation may, in fact, not discharge any deicing materials."

Introducing discharge controls means that the final rule's provisions do not "establish effluent limitation guidelines … for aircraft deicing discharges, but instead, leave the determination of … requirements for each airport to the discretion of the [federal/state] permit writer on a case-by-case, 'best professional judgment' basis based on site-specific conditions [that consider localized operational constraints (e.g., traffic patterns), land availability, safety considerations, and potential impacts to flight schedules]," EPA said.

"In addition to applying the proposed departure threshold, EPA is making [the standards'] collection requirements for [aircraft deicing fluids] applicable based on whether the airport is located within specific colder climatic zones … as documented by the National Oceanic and Atmospheric Administration (NOAA)."

Airlines for America had said in 2010 that EPA's original proposal for regulating airport deicing would violate basic federal aviation policy "by failing to acknowledge that safety considerations must override all other considerations and must be the final decision criterion for all deicing-related operational and design decisions by airlines and airports; [and] by relegating to a secondary consideration the federal mandate and industry commitment to the safety of the flying public in the context of the most challenging ground icing conditions. … Safety is the 'gatekeeper' issue whenever a project, initiative or regulation has the potential to affect ground and/or air operations — if safety would be compromised, the project or initiative fails by definition. Safety is even more central in the context of this rule making because, as EPA recognizes, safety is the sole purpose and aim of aircraft and airfield deicing and anti-icing activities."

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In summary, faced with these aviation safety–related objections and arguments about factors such as flight delays and space/operational constraints of existing airports, "EPA found that its 'model facility' approach was not a suitable substitute for a detailed analysis of the site constraints at each airport," the agency said. "For example, a permit authority may need to evaluate existing traffic patterns at an airport, not only of the aircraft, but also of the service vehicles to determine if additional [glycol] collection vehicles would lead to unacceptable safety concerns."

'Safety considerations must override … all deicing-related operational and design decisions by airlines and airports.'

Notes

1. EPA. "Effluent Limitations Guidelines and New Source Performance Standards for the Airport Deicing Category; Final Rule." In *Federal Register,* Volume 77, No. 95, Rules and Regulations, p. 29168, May 16, 2012.
2. These standards and guidelines "will be incorporated into National Pollutant Discharge Elimination System … permits issued by the [federal/state] permitting authority," EPA said.
3. The official title is *Federal Water Pollution Control Act Amendments of 1972.*

Susan Reed and TUBS/Wikimedia Commons

BY MARK LACAGNINA

An EMS crew chose to ditch, rather than risk flaming out during another approach to a remote island airport.

Between Rocks and a Wet Place

Incomplete preflight and en route planning by the flight crew of an emergency medical services (EMS) aircraft, and the crew's late recognition of the slim chances for a safe landing on a small South Pacific island, forced a tough decision: to attempt another approach in darkness and deteriorating weather conditions — and risk a flameout over hostile terrain — or to ditch the aircraft with power before the fuel tanks ran dry, said the Australian Transport Safety Bureau (ATSB).

The crew of the Israel Aircraft Industries Westwind 1124A chose the latter. Unable to see the ocean surface, they used their radar altimeter to time the flare. All six occupants survived the hard impact with the sea and were able to escape from the partially submerged aircraft before it sank. Their survival of the Nov. 18, 2009, ditching was facilitated by the underwater-escape training that they had received, said the ATSB in a final report released in August.

The accident occurred at Norfolk Island, a planned refueling and rest stop for an EMS trip from Sydney, Australia, to Apia, Samoa, and back to Melbourne, Australia. The island, a self-governing territory of Australia, is about 1,420 km (767 nm) off the east coast of Australia and about 3,000 km (1,620 nm) southwest of Samoa.

The aircraft was ditched on the return flight to the island, after the pilots, a physician and a flight nurse had flown to Samoa, taken an eight-hour rest break and boarded a patient and a passenger.

Partial Fuel Load

Before the late-afternoon departure from Samoa, the pilot-in-command (PIC), who had 3,596 flight hours, including 923 hours in the Westwind,

Norfolk Island was a planned refueling and rest stop for a trip from Sydney to Apia, Samoa, and then back to Melbourne.

telephoned Airservices Australia to file a flight plan and to receive a weather briefing. The forecast for Norfolk Island called for visibilities greater than 10 km (16 mi), scattered clouds at 2,000 ft and light southwesterly winds. The briefing officer also told the PIC that the ceiling was expected to become 2,000 ft broken a few hours after the estimated time of arrival.

"The PIC did not obtain any other en route or terminal meteorological information, notices to airmen (NOTAMs) or additional briefing information from the briefing officer, such as the availability of facilities at any potential alternate aerodromes," the report said.

The Westwind's main tanks were topped, but no fuel was added to the tip tanks for the flight to Norfolk Island. Investigators estimated that the aircraft departed from Samoa with 7,330 lb (3,325 kg) of fuel; maximum fuel capacity is 8,870 lb (4,023 kg).

The copilot was the pilot flying; she had 1,954 flight hours, including 649 hours in type. As the aircraft neared the planned cruising altitude of Flight Level (FL) 350 (approximately 35,000 ft), air traffic control (ATC) told the crew that they would have to descend to FL 270 due to crossing traffic. Concerned with the increased fuel consumption at the lower cruise altitude, the PIC requested and received clearance to climb to FL 390 instead.

Higher Headwind

"The PIC reported that, once established at FL 390, he reviewed the fuel required for the remainder of the flight against the fuel remaining in the aircraft," the report said. "He recalled that the 80-kt headwind experienced thus far was greater than expected" and extended the estimated time of arrival at Norfolk Island by 30 minutes.

"The flight crew reported calculating that, due to the increased headwind, the flight could not be completed with the required fuel reserves intact and that they adjusted the engine thrust setting to achieve a more efficient, but slower, cruise speed. The flight crew recalled satisfying themselves that the revised engine thrust setting would allow the aircraft to complete the flight with the required fuel reserves intact."

About two-and-a-half hours into the flight, the PIC asked ATC for the current weather conditions at the destination. The controller said that a special report had just been issued, indicating that visibility was greater than 10 km and that the ceiling was overcast at 1,100 ft. "These conditions were less than the alternate minima for Norfolk Island Airport but above the landing minima," the report said. "The PIC acknowledged receipt of that weather report but did not enquire as to the availability of an amended TAF [terminal area forecast] for the island."

The pilots told investigators that initially they did not recognize the significance of the lower-than-forecast weather conditions on the island. "They advised that if either had realised that significance, they would have initiated planning in case of the need for an en route diversion," the report said.

A special report issued about an hour later got the crew's attention. The reported visibility was 7,000 m (4.4 mi), and the clouds were scattered at 500 ft, broken at 1,100 ft and overcast at 1,500 ft. Although the weather conditions had deteriorated, they were still above landing minimums. And, uncertain that the aircraft had enough fuel to divert to the nearest suitable alternate — Nouméa, New Caledonia — the crew decided to continue to Norfolk Island.

Below Minimums

The Westwind was about 296 km (160 nm) from Norfolk Island when the airport Unicom operator told the crew that visibility was 6,000 m (3.8 mi) and that there were broken clouds at 300 ft, 800 ft and 1,100 ft. About 10 minutes later, the Unicom operator radioed that a rain shower had reduced visibility to 4,500 m (2.8 mi) and that the lowest broken ceiling was now at 200 ft.

The crew had planned to conduct the VHF omnidirectional range (VOR) approach to Runway 29, which had a minimum descent altitude (MDA) of 484 ft and required 3,800 m (2.4 mi) visibility. (The airport had "special category" area navigation approaches that provided lower

IAI 1124A Westwind II

In 1961, Rockwell Standard's Aero Commander division, under the leadership of Ted Smith, began the development of a new light business jet called the Model 1121 Jet Commander. Powered by General Electric CJ610-1 turbojet engines producing 2,850 lb (1,293 kg) thrust and with accommodations for two pilots and up to eight passengers, the aircraft entered production in 1964.

When Rockwell Standard was acquired by Sabreliner-manufacturer North American Aviation in 1967, the tooling, production and marketing rights for the Jet Commander were sold to Israel Aircraft Industries (IAI) to satisfy U.S. anti-trust laws. IAI initially produced the Model 1121A, with increased fuel capacity and a higher gross weight, and the Model 1121B, with uprated engines. The company introduced the Model 1123, initially called the Commodore Jet but later renamed Westwind, in 1970 with a longer fuselage to accommodate 10 passengers, wing tip fuel tanks and CJ610-9 engines producing 3,100 lb (1,406 kg) thrust.

Garrett AiResearch (now Honeywell) TFE731 turbofan engines, rated at 3,700 lb (1,678 kg) thrust, replaced the turbojet engines when the Model 1124 Westwind I debuted in 1978. The Model 1124A Westwind II was introduced in 1979 with a "supercritical" wing and winglets to improve performance and fuel consumption.

A total of 442 Jet Commanders and Westwinds were built before IAI introduced an all-new business jet, the Model 1125 Astra, in 1987.

Source: *The Encyclopedia of Civil Aircraft*

minimums, but the Westwind had not been approved for such approaches.)

"The crew reported agreeing that the expected weather would mean that visual reference with the runway [might] be difficult to obtain and that the PIC would closely monitor the approach by the copilot," the report said. "During the briefing for the first approach, the crew agreed that if visual reference with the runway was not obtained, the PIC would take over control of the aircraft for any subsequent approaches."

Missed Approaches

Recorded radio transmissions indicated that the crew conducted a missed approach at 1004 coordinated universal time (UTC; 2134 local time). As planned, the PIC assumed control of the aircraft, which had about 1,300 lb (590 kg) of fuel remaining. He decided to conduct the VOR approach to Runway 11, which had a lower MDA of 429 ft and required 3,000 m (1.9 mi) visibility, although there would be a 10-kt tailwind.

The second approach also resulted in a go-around. "At this time, the flight crew decided that they would ditch the aircraft in the sea before the fuel was exhausted," the report said.

The copilot briefed the medical crew and the passenger for the ditching, and told the Unicom operator, "We're going to have to ditch. We have no fuel."

The aircraft was equipped with two life rafts and enough life jackets for all the occupants. The physician, flight nurse and passenger donned life jackets, and the two life rafts were removed from their storage compartments and placed in the aisle. "The flight crew recalled having insufficient time to put on their life jackets between deciding to ditch and the ditching," the report said.

The physician decided not to put a life jacket on the stretcher-bound patient, because it might hinder the release of her restraints after the ditching. "The doctor ensured that the patient's harness straps were secure and instructed the patient to cross her arms in front of her body for the ditching," the report said.

Change of Plan

During the second missed approach, the pilots decided that ditching the aircraft to the southeast would risk a collision with a nearby island. "The flight crew decided to conduct one more instrument approach for Runway 29 as, if they did not become visual off that approach, the missed approach procedure track of 273 degrees would take the aircraft to the west of Norfolk

Island, over open sea and clear of any obstacles for the planned ditching," the report said.

The PIC said that he purposely descended below the MDA on the third approach, in an unsuccessful attempt to establish visual contact with the runway. At 1025 UTC (2155 local), the copilot told the Unicom operator that they were "going to proceed with the ditching." A subsequent radio transmission from the aircraft was unintelligible.

The crew conducted a climb to 1,200 ft, turned west toward the sea and initiated a descent while monitoring radio altitude. The PIC initiated a flare at 40 ft. "The flight crew recalled that, although they had selected the landing lights on, they did not see the sea before impacting the water" at about 100 kt with the landing gear retracted, the report said. "The occupants recalled two or three large impacts when the aircraft contacted the water" about 5 km (3 nm) from shore.

Cabin Floods Quickly

The flight nurse and the copilot were seriously injured on impact; the passenger, the patient, the physician and the PIC sustained minor or no injuries. Water entered rapidly through a tear in the fuselage, and the plug-type cabin door could not be opened fully.

The PIC ensured that the copilot, who had been dazed when her head struck the control yoke, was responsive before he left the cockpit. Finding that the cabin door was not usable, he opened the left emergency exit and escaped through it.

The physician released the patient's restraints and opened the right emergency exit. "The nurse, doctor and patient exited the aircraft through the starboard emergency exit," the report said. "All three reported holding onto each other as they departed 'in a train.'"

The passenger and the copilot were the last to exit the aircraft. The passenger, who was seated near the front of the cabin, said that there was little breathing room between the surface of the incoming water and the cabin roof. He and the copilot swam toward the rear of the cabin, located the emergency exits by touch and escaped from the aircraft. "The passenger believed that he swam upwards some distance after exiting the aircraft before reaching the surface of the water," the report said.

The flight crew and medical crew told investigators that the ditching training they had received had assisted their escape from the aircraft, which sank in 48 m (157 ft) of water and was not recovered. The pilots had taken "wet-drill training" that included practice in ditching procedures and escape from a ditched aircraft; the physician and flight nurse, who frequently flew in EMS helicopters, had taken helicopter underwater escape training, which "exposes trainees to simulated helicopter ditching and controlled underwater escape exercises, [including] simulated dark conditions and with simulated failed or obstructed exits," the report said.

The life rafts and two personal locator beacons had been left behind when the occupants exited the aircraft. "The PIC stated that he returned to the aircraft in an attempt to retrieve a life raft, but the 1.5-m to 2-m [5-ft to 7-ft] swells and the jagged edges surrounding the broken fuselage made it hazardous to be near the aircraft, so he abandoned any attempt to retrieve a raft," the report said.

Unknown Location

The aircraft's 406 MHz emergency locator transmitter (ELT) had activated automatically on impact. However, only one distress signal was received by Australian Search and Rescue, which "was able to identify the owner of the ELT but was not able to assess its location from the one transmission," the report said.

The Unicom operator had alerted the Emergency Operations Centre on the airport after the Westwind crew reported the second missed approach. However, because the Unicom operator was not aware of the crew's intention to ditch west of the island after the missed approach to Runway 29, the search was being staged from Kingston Jetty, which is on the southeast coast of the island and along the missed approach path for Runway 11.

Nevertheless, a firefighter en route along the west coast of the island to Kingston Jetty considered the possibility that the aircraft had been ditched to the west. He stopped on the western cliffs and saw the faint glow of the torch (flashlight) that the PIC was shining toward the shore. The firefighter passed the information to the Emergency Operations Centre, and it was relayed to the crew of a marine vessel, which turned toward the sighting and made the rescue.

ATSB concluded that the accident occurred in part because "the flight crew's delayed awareness of the deteriorating weather at Norfolk Island combined with incomplete flight planning to influence the decision to continue to the island, rather than divert to a suitable alternate."

The report noted that the Australian Civil Aviation Safety Authority is developing new regulations regarding preflight and in-flight fuel planning, selection of alternate airports and operations with extended diversion times.

This article is based on ATSB Transport Safety Report AO-2009-072, "Ditching — Israel Aircraft Industries Westwind 1124A, VH-NGA, 5 KM SW of Norfolk Island Airport, 18 November 2009." The report is available at <atsb.gov.au/publications/safety-investigation-reports.aspx>.

The Age of the iPad

BY MARIO PIEROBON

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The tablet computer — especially the iPad — is increasingly in use as an electronic flight bag.

No other piece of equipment in the recent history of aviation technology has become as popular with pilots as quickly as Apple's iPad tablet computer, which increasingly is being used as an electronic flight bag (EFB).

Airbus and Boeing both seem convinced of the role the iPad and other tablet computers will play in the future of information management technology for air navigation. In early 2012, Airbus CEO Tom Enders said the iPad is "changing the way pilots interact with the aircraft" and that the "impact of such products, from outside the world of aviation, is starting to dictate what people expect from us, and we can't ignore that."[1]

In July, Airbus launched an iPad EFB solution, "FlySmart with Airbus," that includes apps (applications) with which pilots can compute performance calculations and consult Airbus flight operations manuals. Airbus plans a second set of iPad apps that it said "will add more performance, as well as load sheets, flight folder and navigation charts applications."

Boeing also recognizes that the iPad has "gained rapid, unprecedented popularity as an EFB in all aviation market segments."[2] Jeppesen, a Boeing subsidiary, has developed a charting app that the U.S. Federal Aviation Administration (FAA) authorized for use in February 2011. In December 2011, American Airlines was the first airline authorized by the FAA to use Jeppesen charts on iPads in all phases of flight; and many air carriers are evaluating mobile EFB platforms that include iPads, and are using simulator and in-flight studies to help develop procedures and training programs, and to validate the use of the equipment in all phases of flight, according to Boeing.

The iPad's success does not come by chance. The technology debuted when flight operations departments already were considering EFBs but had been limited by the often-prohibitive cost of EFB hardware. The much lower acquisition cost of the iPad seems to have enabled a speedier transition to EFB technology.

Because of the recent evolution of EFB technology and the expected large-scale introduction of mobile devices onto the flight decks of commercial airlines, the FAA recently released Advisory Circular (AC) 120-76B containing guidelines for the certification, airworthiness and operational use of EFBs (*ASW*, 5/12).

According to definitions in the updated AC, the iPad can be used as either a Class 1 or Class 2 EFB. Class 1 EFBs are not typically

The FAA requires each operator to apply individually for approval to use the iPad as an EFB.

mounted to the aircraft, and they are not connected to aircraft systems for data. Class 2 EFBs typically are mounted, but can be easily removed from their mounts by the flight crew, and they may connect to data ports (wired or wireless) or installed antennas. iPads cannot be Class 3 EFBs, which are permanently installed in the aircraft.

According to the AC's definitions, the iPad is capable of hosting Type A and Type B software applications. Type A applications are intended primarily for use during flight planning on the ground or during non-critical phases of flight. Type B applications provide aeronautical information required to be accessible at the pilot station and are intended for flight planning and all phases of flight.

Because the iPad already is used by many flight departments as an EFB during all phases of flight, there are few, if any, issues with regard to the iPad's certification. However, the FAA requires each operator to apply individually for approval to use the iPad as an EFB. Therefore, operators must consider the safety requirements set forth in the AC, especially those dealing with issues of long-standing concern such as electromagnetic interference, rapid decompression and the human factors/automation issues.

Non-Interference Testing

For some time, there has been concern that an iPad, as a transmitting portable electronic device (T-PED), could interfere with flight deck avionics. In particular, it has been reported that "Apple uses a capacitive touch screen, which detects a finger electro-statically and is susceptible to electromagnetic interference."[3] Within the pilot community, there seems to be a consensus that this concern is overstated.

The FAA, however, says in the AC that "to operate a PED during all phases of flight, the user/operator is responsible for ensuring that the PED will not interfere in any way with the operation of aircraft equipment." The AC describes two non-interference testing methods, either of which may be used by applicants.

Method 1 comprises two steps. Step 1 requires an electromagnetic interference (EMI) test in accordance with RTCA/DO-160, the standard for environmental tests of avionics hardware published by RTCA, formerly known as the Radio Technical Commission for Aeronautics.

"An evaluation of the results of the … test can be used to determine if an adequate margin exists between the EMI emitted by the PED and the interference susceptibility threshold of aircraft equipment," the AC says. If Step 1 determines that adequate margins exist, then Method 1 is complete. Step 2 testing is necessary only if Step 1 identifies inadequate margins for interference. According to the AC, Step 2 testing is specific to each aircraft model in which the PED will be operated. The operator must test the specific PED equipment in operation on the aircraft to show that no interference with equipment occurs from the operation of the PED. "Step 2 testing is conducted in an actual aircraft, and credit may be given to other similarly equipped aircraft of the same make and model as the one tested."

Method 2 calls for "a complete test in each aircraft using standard industry practices," the AC says. "This should be to the extent normally considered acceptable for non-interference testing of a PED in an aircraft for all phases of flight. Credit may be given to other aircraft of the same make and model equipped with the same avionics as the one tested."

The need for each operator to receive approval for iPad operation as an EFB, and in particular the need for each user/operator to conduct EMI testing, has prompted the emergence of companies that supply customized testing, which could be an option for operators that do not have the necessary in-house testing expertise.

Rapid Decompression Testing

iPads meant to utilize Type B software applications in pressurized aircraft must undergo rapid decompression survivability testing that complies with RTCA/DO-160. Tests are not required if only Type A software applications are used, if alternate procedures or paper backups are available, or if the iPad is meant for use in unpressurized aircraft.

With regard to decompression testing, the AC says that "similarity of a particular EFB to a unit already tested may be used to comply with this requirement. It is the responsibility of the operator to provide the rationale for the similarity." Soon after its release in March 2012, the iPad 3 was tested successfully for rapid decompression at 51,000 ft equivalent altitude, the maximum service ceiling of business aircraft.

Interestingly, in a video available online from Jeppesen, the company recommends that "if an EFB is involved in an actual rapid decompression event on an airplane, it is probably a good idea to remove that EFB from service, at least for use during critical phases of flight." [4]

Human Factors Issues

The AC contains a section dedicated to "EFB system design considerations" that touches on the human factors/automation issues associated with using the iPad as an EFB.

In addition to the iPad's user-friendliness, Apple's tablet is appreciated in the flying community because of its battery life, the stability of its applications and the fact that the approach plates are well lighted and easily viewed by pilots, even at night.

One of the benefits of the iPad is the potential for reduced workload. In fact, the AC requires that "the EFB software design should minimize flight crew workload and head-down time." The document includes instructions to "avoid complex, multi-step data entry tasks during takeoff, landing and other critical phases of flight. An evaluation of EFB intended functions should include a qualitative

'The iPad can also be used to calculate cold weather temperature corrections.'

assessment of incremental pilot workload, as well as pilot system interfaces and their safety implications."

Lino Palumbo, a training captain at Air Canada Jazz who flies Bombardier CRJs, offered specific examples of the iPad's benefits. "The 100/200 model is an early model with a very critical wing with many restrictions and also an airworthiness directive on the flaps. It requires precise performance calculations and frequent use of company manuals to calculate these restrictions. It is very tedious to look for this information in three different manuals. Most of these can easily be carried on an iPad for quick reference, and — even better — a company application, custom-made, can be created to even more precisely compute performance numbers. In flight, the iPad can also be used to calculate cold weather temperature corrections. Flying in cold regions like Canada implies that often approaches are flown in temperatures well below 0 degrees C; these approach altitudes do not take into account the temperature and can make you fly lower on approach then the actual altitudes. Corrections are normally calculated with a chart, but now this can quickly be done with this application."

Digital Charting

Some charting applications not only reduce pilot head-down time and workload, but also enhance situational awareness because the iPad graphically overlays the position of an aircraft on a chart. "During taxi at a busy airport with multiple taxiways, it was always difficult to see where you were on the airport," Palumbo said. "With the iPad, you can now expand the taxi charts so that you can see the taxiways better. There is also a function allowing pinpointing where you are exactly on the taxi chart. This can aid the pilots to reduce errors and taxi safely to and from runways, reducing runway incursions."

The International Air Transport Association (IATA) also sees advantages in using electronic charts rather than paper ones. "Paper charts are frequently removed from the flight deck (for update, etc.), [are] far more easily lost once removed from the binder, [and] more easily damaged or destroyed," said Perry Flint, IATA's head of corporate communications for the Americas. "Paper charts are cumbersome and not easily accessible; accessing them at a time of high workload can create a distraction for the crew and a lot of head-own time. By contrast, EFB data are easily and quickly located by a few finger strokes and minimal disruption."

Updated Information

Additional safety and operational benefits can be obtained if the transition to iPad technology is managed to ensure pilots have the most up to date information available on their devices before flying. "An iPad should be used as preflight, in-flight and post-flight tool," Palumbo said. "The typical day of a pilot should begin by reviewing all weather and NOTAMs [notices to airmen] pertaining to the flights of the day. MyRadar and AeroWeather applications can be used for the most updated weather information. As a pilot, you can receive live radar images at your location and destination to make accurate decisions. … With AeroWeather, you can view the latest TAFs [terminal area forecasts], METARs [aviation routine weather reports] and NOTAMs of multiple airports at the same time. It also gives you headwind comments for the runway, a very useful tool to determine any crosswind components for takeoff and landing. Personally, I also keep all my Jeppesen approach plates using the Jeppesen application. As [pilots], we all dread doing these important updates, [but] we now can have our plates up to date with the latest amendment. This reduces time and errors made during amendments."

iPad technology also may contribute to enhanced aircraft operational performance.

"The accuracy of the average performance calculation completed by the EFB is clearly superior to the average performance calculation completed by hand," Flint said. "The EFB is capable of storing huge amounts of information that now becomes instantly available to crews, information that was either previously available but not easily accessible even if the source was known, or simply not available because of space/weight constraints on the flight deck. Not only do EFBs contain chart data and performance information, they also contain all sorts of other relevant aircraft and company information, all available easily in one location. This is of incalculable benefit at times of non-routine operations."

Understand All Ramifications

In 2002, Sanjay S. Vakil and R. John Hansman of the Massachusetts Institute of Technology said that, in the past, "most accidents were caused by problems with the physical skills involved with flying the aircraft, or through errors of judgement. The new problems involve issues of management of the complex aircraft and associated automation systems. Within the set of errors attributed to flight crews, automation problems are emerging as a key safety area."[5]

The authors also noted that, "in the absence of a simple, consistent and communicable model of flight automation, pilots appear to create their own models of the flight automation. These ad hoc models have several shortcomings. The most obvious of these is that the models may not accurately reflect the actual systems. Further, since these models are created independently by individual pilots, specific ad hoc models may not be accurate."

While these remarks were originally made when EFBs were not yet a major flight deck instrument, they nevertheless apply to the additional automation introduced by iPad technology.

A Boeing 747 captain and flight instructor who retired from a major European airline more than 10 years ago shares the concern about the development of inappropriate mental models and provides an interesting perspective: "The younger generations of pilots will have little, if any, difficulties adapting to the iPad. However, the risk for this category of pilots is that [if] they accept this technology without a critical spirit, trusting it blindly, … they will be totally without backups and appropriate skills in case of a total EFB system failure. On the other hand, older generations of pilots are likely not to trust the iPad as a new piece of equipment and favor their instinct instead".

The importance of carefully transitioning to iPad technology is not to be underestimated, he said, adding, "If an operator is to transition to EFB technology and/or to become almost totally paperless, it is fundamental to proceed gradually and with a lot of training (including simulator time) related to the introduction of the new system."

In laying the groundwork for the transition from paper, the AC says that "at least two operational EFBs are required to remove paper products that contain aeronautical charts, checklists or other data required by the operating rules" and that "the design of the EFB function requires that no single failure or common mode error may cause the loss of required aeronautical information." The recommended gradual implementation of iPad technology implies a transition time during which proficiency in the new technology is built and a current paper backup is in the airplane.

Future Functions

In the future, the iPad will have other functions on the flight deck.

In a white paper titled "The Value of Back Office Integration," IMDC, an in-flight technology consulting firm, noted "an increasing awareness that the data recovered from the aircraft is growing in significance as EFBs assume a more important role in maintenance operations."[6]

In 2008, Boeing introduced the Electronic Logbook (ELB), which "connects the airplane systems to the airline information technology infrastructure, providing data to the appropriate departments that allow them to strategically react to airplane problems. This knowledge helps the airline schedule the airplane operation so that all deferred faults can be resolved during a time when the airplane is available, thereby

'No single failure or common mode error may cause the loss of required aeronautical information.'

reducing costs," Boeing said.[7] The Boeing Class 3 EFB "has evolved from a simple flight bag replacement to a generalized computer system that can link information provided by airplane systems, flight crews and cabin crews to the airline when the airplane is remote from the airline home base. Integrated with the Boeing ELB, it provides real-time administrative information from the airplanes to the airline so that the airline can make high-value operational decisions."

The trend for EFB-enabled data transfer from the aircraft seems to have started and the iPad could be part of that trend. The next challenge for the iPad will likely be consistently enabling the seamless, paperless transfer of information from the aircraft to an airline-hosted ground system.

Mario Pierobon works in business development and project support at Great Circle Services in Lucerne, Switzerland, and was formerly with the International Air Transport Association in Montreal.

Notes

1. "iPad makes its way to the Airbus cockpit" Airbus, *Noticias Airbus* No. 140 January–February 2012.
2. "Operational Efficiency of Dynamic Navigation Charting" The Boeing Company, *Aero Quarterly* Q2 2012.
3. "Advancing Vision", Graham Warwick, *Aviation Week & Space Technology*, May 14, 2012.
4. Jeppesen and Garwood Labs Rapid Decompression Test – Jeppesen Training (Published on March 23, 2012), <www.youtube.com/watch?v=xvQAUyMBeiY> [accessed Aug. 20, 2012].
5. Approaches to mitigating complexity-driven issues in commercial auto flight systems, Sanjay S. Vakil, R. John Hansman, *Reliability Engineering and System Safety* 75 (2002) pp 133-145.
6. "The Value of Back Office Integration" Electronic Flight Bag (EFB) White Paper, IMDC (NA).
7. "Electronic Flight Bag: Real-Time Information Across an Airline's Enterprise", Boeing, *Aero Quarterly* Q2 2008.

BY RICK DARBY

Side Ways

Unconventional cabin features, such as side-facing seats, on small transport aircraft need exemptions from the FARs.

"Multiple-place side-facing seats" received the most requests for exemptions from U.S. Federal Aviation Regulations (FARs) Part 25, *Airworthiness Standards: Transport Category Airplanes*, according to a study published by the U.S. Federal Aviation Administration.[1]

The cabins in smaller transport category aircraft, particularly those used for corporate operations (Table 1), often vary in design from those of conventional airliners. In U.S.-registered aircraft, the cabin fixtures that deviate from the FARs must receive FAA approval.

For example, FARs Part 25.811 says that there must be a passenger emergency exit locator sign above the aisle near each passenger emergency exit, or at another overhead location if it is more practical because of low headroom, and that the sign must be visible to occupants approaching along the main passenger aisle. A petition seeking exemption from the requirement argued that the intent of the requirement for an exit locator sign to be placed overhead is "peculiar to aircraft with a much larger cabin."[2] Because space or ceiling height is limited in smaller transport category aircraft, aircraft manufacturers have requested that the emergency exit marker installed on the sidewall also function as an emergency exit locator sign. The basis of the request was that installing an emergency exit locator sign on an overhead location in a cabin with limited ceiling height would create a head-strike hazard to occupants.

ELOS Applications for Exemption to Cabin Safety Requirements

Rank	Category	Number of ELOS/Original Exemption Applications	Number of Repeat Applications for Exemption	Total Number of Applications for ELOS/Exemption	Number of Aircraft Models	Affected FARs
1	Multiple-place side-facing seat	13	10	23	11	25.785, 25.562
2	Interior door	8	6	14	9*	25.813
3	Exit signs – visibility	6		6	9*	25.811, 25.812
4	HIC for front row seats	5	13	18	5	25.785, 25.562
5	Emergency exit (type and arrangement)	5	1	6	6*	25.807, 25.783, 25.809
6	Stretcher	5	3	8	5	25.785, 25.562
7	Dynamic seat testing	4		4	4	25.562
8	Emergency exit – ditching scenario	4		4	6*	25.807, 25.1557
9	Emergency exit (access)	2		2	1	25.813
10	Floor distortion test – crew seats	2	4	6	2	25.562
11	Width of aisle – evacuation	2		2	2	25.815
12	Width of aisle – executive seats	2		2	2	25.815
13	Door to cargo compartment	1		1	1	25.857, 25.1447
14	Emergency exit marking (exterior)	1		1	1	25.811
15	Emergency exit marking (operating instructions)	1		1	1	25.811

ELOS = equivalent level of safety; FARs = U.S. Federal Aviation Regulations; HIC = head injury criteria

Note: Data are for transport category airplanes with a maximum certificated passenger capacity up to 60 seats.

* There are application(s) for more than one aircraft model.

Source: U.S. Federal Aviation Administration

Table 1

Two related types of deviations can be permitted from the cabin safety FARs. "ELOS [equivalent level of safety] findings are made when literal compliance with a certification regulation cannot be shown and compensating factors exist which can be shown to provide an equivalent level of safety," the report says. Alternatively, "an exemption is a petition for a request to the certificating authority by an individual or entity asking for relief from the requirements of a regulation in effect. The authority's response to the petition is one of the following: granted, partially granted or denied."

A review of the FAA database found a total of 98 ELOS findings and exemption applications appropriate for the agency's study. "The applications were classified under 15 categories, and the categories having more than four original applications were given further consideration," the report says (Table 2).

Exemption applications were classified as original or repeat.[3] In all, there were 14 ELOS findings, 38 exemptions granted, 36 exemptions partially granted and 10 requests for exemptions denied.

In number of ELOS and original exemption applications (23), the total number granted and the number of aircraft models affected, "multiple-place side-facing seat" topped the list.

Many corporate jets include seats parallel to the side of the cabin, as distinguished from the theater-type, forward-facing seats in airliners. FARs Part 25.562 and Part 25.785 require that seats that can be occupied during takeoff and landing and their fittings (such as the restraint system) "must be designed so that a person making proper use of those facilities will not suffer serious injury in an emergency landing as a result of [specified] inertia forces." However, the dynamic forces to which occupants of side-facing seats, especially multiple seat rows, are subject are different from those in forward-facing seats.

"The FAA stated that side-facing seats are considered a novel design for transport category airplanes … which were not considered when this airworthiness requirement was formulated," the report says. "The FAA produced Issue Paper CI-1, dated Nov. 12, 1997, entitled 'Dynamic Test Requirements for Side-Facing Divans (Sofas),' which addressed the injury criteria particular to multiple-place side-facing seats. Transport Canada has also issued a Policy Letter on side-facing seats for Transport Category Airplanes (PL

Airplane Types Pertinent to ELOS Exemptions

Multiple-place side-facing seat (11)	Bombardier BD-100-1A10 (Challenger 300), Bombardier BD700-1A10 Global Express, Bombardier BD700-1A11 Global 5000, Cessna 680, Cessna 750 (Citation X), Dassault Falcon 2000, Dassault Falcon 2000EX, Embraer EMB135-BJ Legacy, Gulfstream 200 / Israel Aircraft Industries Galaxy, Gulfstream G150
Interior door (9)	Bombardier BD-100-1A10 (Challenger 300), Bombardier BD700-1A10 Global Express, Bombardier BD700-1A11 Global 5000, Cessna 560XL, Cessna 680, Dassault Falcon Mystere Falcon 900 and Falcon 900EX, Gulfstream GV-SP
Exit signs – visibility (9)	Bombardier BD-100-1A10 (Challenger 300), Bombardier BD700-1A10 Global Express, Cessna 680, Cessna 750 (Citation X), Dassault Falcon 50, 900, and 900EX, Gulfstream GV-SP and GIV-X
HIC for front row seats (5)	Dornier 328, Embraer EMB-145, Jetstream Series 4100, Learjet 45, Saab 2000
Emergency exit (type and arrangement) (6)	Embraer EMB-120 [EMB-120, -120RT, -120ER], Gulfstream GIV-X, Gulfstream GV-SP, Learjet 45
Stretcher (5)	Cessna 560XL, Cessna 750 (Citation X), Dassault Falcon 2000, Gulfstream GV, Learjet 45 Serial Number 168
Dynamic seat testing (4)	Bombardier BD700-1A10 Global Express, Cessna 750 (Citation X), Dornier 328-100, Jetstream Series 4100
Emergency exit – ditching scenario (6)	Cessna 680, de Havilland DHC-8-311
Emergency exit (access) (1)	Astra SPX Floor
Floor distortion test – crew seats (2)	Dornier 328, Saab 2000
Width of aisle – evacuation (2)	Bombardier BD700-1A10 Global Express, Cessna 560XL
Width of aisle – executive seats (2)	Gulfstream GIV , Gulfstream GV
Door to cargo compartment (1)	Embraer EMB-135BJ
Emergency exit marking (exterior) (1)	Learjet 31A
Emergency exit marking (operating instruction) (1)	Cessna 680

ELOS = equivalent level of safety; HIC = head injury criteria

Note: Data are for transport category airplanes with a maximum certificated passenger capacity up to 60 seats.

Source: U.S. Federal Aviation Administration

Table 2

Fatal Accidents, Fatalities and Rates, Canada, 2002–2011

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Accidents	265	308	253	260	261	277	245	246	250	230
Fatal accidents	26	34	23	36	29	30	21	28	31	30
Fatalities	45	63	43	59	49	44	43	64	64	64
Aircraft movements (thousands)	6,649	6,369	6,183	6,156	6,308	6,824	6,852	6,540	6,412	6,245
Accidents per 100,000 aircraft movements	4.0	4.8	4.1	4.2	4.1	4.1	3.6	3.8	3.9	3.7
Fatal accidents per 100,000 aircraft movements	0.4	0.5	0.4	0.6	0.5	0.4	0.3	0.4	0.5	0.5
Fatalities per 100,000 aircraft movements	0.7	1.0	0.7	1.0	0.8	0.6	0.6	1.0	1.0	1.0

Note: 2011 aircraft movements are estimated. Data exclude ultralights and other aircraft types.

Source: Transportation Safety Board of Canada

Table 3

No. 525-003, effective date 1 December 2003), which provides guidelines concerning the application of airworthiness standards required for the approval of side-facing seats."

Fourteen ELOS findings and exemption applications related to interior doors. FARs Part 25.813 says, "No door may be installed between any passenger seat that is occupiable for takeoff and landing and any passenger emergency exit, such that the door crosses any egress path (including aisles, cross-aisles and passageways)."

The petitions for ELOS findings and exemptions derive from "executive configurations," with their inclusion of private compartments for meetings, hence extra doors. "The grant or denial of exemption took into consideration the locations of emergency exits in the cabin, the design of the door and the type of operation the aircraft is intended for," the report says.

Most applications contended that "the difference between the commercial transport category aircraft used in airline operation and aircraft specifically used for corporate operations (whether private or non-scheduled commercial) was not segregated in the FARs Part 25 rules," the report says. Applicants also argued that corporate fleets using Part 25 aircraft have "grown to a point where it is contended that the certification agencies need to consider new revised design rules for aircraft involved in this class of operation." However, the FAA has not been concerned whether the aircraft was intended for airline or corporate operation, but whether it was intended for commercial or private use. In granting the exemptions, the FAA required that the aircraft not be operated for hire or common carriage.

Canadian Air Safety Improves Again

The number and rate of aviation accidents for Canadian-registered aircraft decreased in 2011 compared to 2010 and the preceding nine-year period, according to Transportation Safety Board of Canada (TBS) data (Table 3).[4] Accidents totaled 230 last year, a 6 percent decrease from 2010. Of those, 192 involved airplanes, 35 helicopters, and three balloons, gliders or gyrocopters.

"The accident rate for Canadian-registered aircraft decreased from the 2010 accident rate of 5.8 accidents per 100,000 flying hours to 5.7," the report says. "Statistical analysis …indicates a significant downward trend in accident rates over the past 10 years."

Rates for fatal accidents and fatalities remained unchanged between 2010 and 2011.

"In 2011, 30 fatal accidents involved Canadian-registered aircraft other than ultralights, slightly lower than last year's total of 31, but the same as the 2006–2010 average of 30," the report says. "The number of fatalities was higher than the five-year average (56), and the number of serious injuries (37) decreased from the five-year average (40)."

Reportable incidents totaled 675, including 573 involving Canadian-registered aircraft.[5] In 2011, the most frequent incident types were declared emergency (41 percent), risk of collision or loss of separation (18 percent) and engine failure (14 percent).

The 675 reportable incidents represented a 17 percent decrease from the 815 in 2010 and were the fewest of any year in the preceding nine (Table 4, p. 52). The most notable improvement was in the category "risk of collision/loss of separation," with 120 such incidents reported in 2011 versus 206 in 2010, a year-to-year decline of 42 percent.

Canadian Reportable Incidents, 2002–2011										
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Incidents by type	**844**	**782**	**865**	**796**	**807**	**874**	**887**	**788**	**815**	**675**
Risk of collision/loss of separation	189	142	216	174	168	168	172	153	206	120
Declared emergency	279	279	264	222	260	298	314	312	310	275
Engine failure	151	122	134	139	130	129	120	106	87	95
Smoke/fire	98	96	90	99	102	123	107	97	81	88
Collision	22	16	21	12	21	13	8	9	4	7
Control difficulties	31	41	43	44	41	41	39	24	32	31
Crew unable to perform duties	38	49	55	67	57	65	78	59	50	24
Dangerous goods–related	1	2	0	1	2	3	1	3	1	0
Depressurization	18	21	9	14	9	13	17	6	11	16
Fuel shortage	3	6	13	10	6	8	7	4	9	6
Failure to remain in landing area	8	3	11	11	7	9	18	9	14	11
Incorrect fuel	1	0	2	1	1	0	1	0	0	0
Slung load released	3	4	5	1	3	3	5	3	9	1
Transmission or gearbox failure	2	1	2	1	0	1	0	3	1	1
Incidents by operator type	**844**	**782**	**865**	**796**	**807**	**874**	**887**	**788**	**815**	**675**
Commercial	774	736	819	732	773	823	857	749	776	635
Airliner	560	524	578	488	528	563	590	498	519	445
Commuter	84	68	91	89	80	75	94	87	85	75
Air taxi	42	34	37	39	52	25	36	43	31	29
Aerial work	18	33	38	22	20	20	24	31	26	15
Foreign/other commercial type	126	121	144	151	165	196	181	138	170	111
State	34	26	29	28	21	29	17	23	26	14
Corporate	47	34	34	45	30	43	21	29	20	22
Private/other operator type	47	19	37	40	31	24	33	27	32	25
Incidents by aircraft type	**844**	**782**	**865**	**796**	**807**	**874**	**887**	**788**	**815**	**675**
Airplane	823	758	845	779	787	854	870	770	790	657
Helicopter	23	30	28	20	29	22	19	21	33	20
Ultralight/other aircraft type	1	0	0	1	1	0	1	1	1	0

Note: Reportable incidents include those involving airplanes with a maximum certificated takeoff weight (MCTOW) above 5,700 kg (12,666 lb) and helicopters with a MCTOW over 2,250 kg (4,960 lb). Breakdowns may not add up to totals because incidents can be counted in more than one category. For example, an incident involving an airplane and a helicopter is counted in each category, but only once in the total.

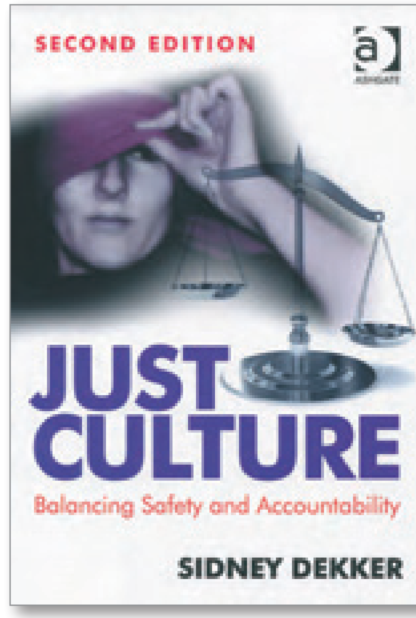
Source: Transportation Safety Board of Canada

Table 4

Reportable incidents involving airliners decreased from 519 to 445, or 14 percent, between 2010 and 2011. The corresponding reduction for commuter aircraft was from 85 to 75, or 12 percent, and for air taxis from 31 to 29, or 6 percent.

Notes

1. FAA. *An Evaluation of Equivalent Levels of Safety Findings and Exemptions Relating to Cabin Safety Regulations for Smaller Transport Airplanes.* Commissioned by Transport Canada in cooperation with the FAA and the U.K. Civil Aviation Authority under the auspices of the International Cabin Safety Research Technical Group. DOT/FAA/AR-09/32. September 2012.
2. The report data are for airplanes with a maximum certificated passenger capacity of 60 seats. Applications for exemptions reflect FAA actions from 1994 through 2006.
3. The report says, "Exemption extension applications have been identified as a 'repeat.' Exemption applications for the same regulation(s) on the same airplane type, but from different applicants, are also annotated as a 'repeat.'"
4. TSB. *Statistical Summary Aviation Occurrences 2011*. <www.tsb.gc.ca/eng/stats/aviation/2011/ss11.pdf>.
5. Reportable incidents include those involving airplanes with a maximum certificated takeoff weight (MCTOW) above 5,700 kg (12,566 lb) and helicopters with a MCTOW over 2,250 kg (4,960 lb).



Line Drawing

'Drawing the line' between mistakes and unacceptable behavior may not be the most important aspect of just culture.

BY RICK DARBY

BOOKS

Paradoxes of Accountability

Just Culture: Balancing Safety and Accountability

Dekker, Sidney. Aldershot, Hampshire, England, and Burlington, Vermont, U.S.: Ashgate, 2012. Second edition. 171 pp. Figure, table, references, index.

It has been four years since the publication of the first edition of Dekker's *Just Culture* (*ASW*, 4/08, p. 53). The author says that the first edition was partly a response to the trend of criminalizing aviation accidents. Although criminalization remains a serious issue and has a place in this second edition, he has shifted his emphasis to the struggle *within organizations* to understand, create and maintain a just culture.

"Many of these organizations have found that simplistic guidance about pigeonholing human acts does not take them very far," Dekker says. "In fact, it leaves all the hard work of deciding what is just, of what is the right thing to do, fully to them. Just recommending these organizations to divide human behavior up into errors, at-risk acts or recklessness is really quite useless. Somebody still needs to decide what category to assign behavior to, and that means that somebody will have gotten the power to do so."

The second edition is organized differently from the first, he says, around the many issues arising from a nurse's error that resulted in the death of a girl. Besides the reorganization, he says, "I have written new material on ethics, and on caring for the second victim [i.e., the person who committed the error]. Taking care of the professional who was involved in the incident is at least as important as anything else you might do to create a just culture in your organization."

The last subject — a humane concern for the person who unwittingly was involved in causing an accident or serious incident — is unusual in discussions of just culture.

"For most professionals, an error that leads to an incident or death is antithetical to their identities," Dekker says. "In fact, it could be argued that people punish themselves quite harshly in the wake of failure, and that you or your organization or society can hardly make such punishment any worse. The research is pretty clear on this: Having made an error in the execution of a job that involves error management and prevention is something that causes excessive stress, depression, anxiety and other psychological ill-health."

For an example of how devastating such feelings can be, recall the fatal accident on Jan. 8, 2003, at Charlotte-Douglas International Airport, Charlotte, North Carolina, U.S. The Beechcraft 1900D crashed on takeoff, killing 21 people in the impact and post-crash fire. The U.S. National Transportation Safety Board, in its report, said that the probable cause was "the airplane's loss of pitch control during takeoff. The loss of pitch control resulted from the incorrect rigging of the elevator system compounded by the airplane's aft center of gravity, which was substantially aft of the certified aft limit." Among the contributing causes was the "quality assurance inspector's failure to detect the incorrect rigging of the elevator control system."

'The question is — who is going to hold you accountable, and by what means?'

So at least two people, the technician who performed the elevator system rigging and the inspector who signed for it, were directly connected with the disaster. We do not know what happened to them or what their subsequent status would be under a just culture. But it is safe to assume that even if they were not formally penalized, they were emotionally blighted for a long time, perhaps for life.

Dekker says, "In the best case, professionals seek to process and learn from the mistake, discussing details of their error with their employer, contributing to its systematic investigation and helping with putting safety checks in place. The role of the organization in facilitating such coping (e.g., through peer and managerial support and appropriate structures and processes for learning from failure) is hugely important. …

"If this condition is met, employee support, and particularly peer support, appears to be one of the most important mediating variables in managing stress, anxiety and depression in the aftermath of error, and one of the strongest predictors of coming out psychologically healthy."

The author is sensitive to the many paradoxes involved in seemingly simple, clear-cut safety-related concepts. In other books, he has expressed skepticism about programs and campaigns intended to warn employees against committing errors, because almost no one chooses error; knowing an action is erroneous means not doing it. The employee who does the wrong thing believes, at the time, it is the right thing.

Setting aside questions of punishment, it seems plain common sense that an employee should be *accountable* for his or her actions. But in Dekker's view, here is another paradox: "If your job makes you responsible for a number of things, then you might be held accountable for not living up to that responsibility. The question is — who is going to hold you accountable, and by what means? This is where the processes of putative justice and learning can start to diverge.

"Suppose you are held accountable by somebody who has no knowledge of the messy, conflicted details of your responsibilities. That sort of accountability might not help you and your organization learn and improve. And it might not even be seen as just. Accountability that works for safety, and that is just, should be intimately informed by the responsibilities for which you are being held accountable."

One of Dekker's typically provocative chapter titles is, in presumably ironic quotation marks, "You Have Nothing to Fear if You've Done Nothing Wrong." In it, he discusses the idea — central to most notions of just culture — of drawing a line between honest mistakes and unacceptable behavior. The latter does not necessarily mean only deliberate misbehavior, or the aviation industry, being steeped in professionalism and ideals of responsibility, would scarcely need to worry about just culture. It must also include negligence, which is obviously unacceptable.

Now, however, the subject begins to blur. Dekker cites a definition of negligence from the Global Aviation Information Network that reads as if its author was trying to capture every nuance:

"Negligence is conduct that falls below the standard required as normal in the community. It applies to a person who fails to use the reasonable level of skill expected of a person engaged in that particular activity, whether by omitting to do something that a prudent and reasonable person would do in the circumstances or by doing something that no prudent or reasonable person would have done in the circumstances.

"To raise a question of negligence, there needs to be a duty of care on the person, and harm must be caused by the negligent action. In other words, where there is a duty to exercise care, reasonable care must be taken to avoid acts or omissions which can reasonably be foreseen to be likely to cause harm to persons or property. If, as a result of a failure to act in this reasonably skillful way, harm/injury/damage is caused to a person or property, the person whose action caused the harm is negligent."

All that verbiage should nail it. In a courtroom it would serve its purpose — which is to say, it would give attorneys on both sides of the case plenty of room to debate whether the accused was negligent. But the point of just culture is to get away, insofar as possible, from legalistic judgments.

Dekker isn't buying the definition. "It does not capture the essential properties of 'negligence,' so that you can grab negligent behavior and put it on the unacceptable side of the line," he says. "Instead, the definition lays out a whole array of questions and judgments that we should make. Rather than this definition solving the problem of what is 'negligence' for you, you now have to solve a larger number of equally intractable problems instead:

- "What is 'normal standard'?
- "How far is 'below'?
- "What is 'reasonably skillful'?
- "What is 'reasonable care'?
- "What is 'prudent'?
- Was harm indeed 'caused by the negligent action'?"

Of course, any definition of an abstraction requires interpretation or judgment, as the author acknowledges. But he adds, "It is, however, important to remember that judgments are exactly what they are. They are not objective and not unarguable. … What matters are which processes and authorities we in society (or you in your organization) rely on to decide whether acts should be seen as negligent or not."

Although Dekker goes to great lengths to point out the ambiguities inherent in the idea of just culture, he supports the principle. The rest of the book is concerned with making it work — not perfectly, which is impossible, but as well as intelligence and goodwill allow.

Here are some of his suggestions:

- "A single account cannot do justice to the complexity of events. We need multiple layers of description, partially overlapping and always somehow contradictory, to have any hope of approximating a rendition of reality";

Although Dekker goes to great lengths to point out the ambiguities inherent in the idea of just culture, he supports the principle.

- "A just culture accepts nobody's account as 'true' or 'right' and others [as] wrong";
- "Disclosure matters. Not wanting to disclose can make a normal mistake look dishonest, with the result that it will be treated as such. … Disclosing is the practitioner's responsibility, or even duty";
- "Protecting those who disclose matters just as much. Creating a climate in which disclosure is possible and acceptable is the organization's responsibility"; and,
- "Proportionality and decency are crucial to a just culture. People will see responses to a mistake as unfair and indecent when they are clearly disproportionate."

When a Boeing 747 captain was found guilty of negligently endangering his aircraft and passengers by almost striking an airport hotel on the approach to London Heathrow Airport — he conducted a go-around and no one was injured — he was fined £1,500 by a court and reduced in rank to first officer by his airline. As Dekker tells the story, a pilot friend of the former captain asked what the captain had been found guilty of. "Endangering the passengers," he replied. The friend laughed and said, "I do that every day I fly. That's aviation."

'Not wanting to disclose can make a normal mistake look dishonest.'

Dekker urges organizations that are serious about instilling just culture to begin immediately with the following steps:

- "An incident must not be seen as a failure or a crisis, neither by management nor by colleagues. An incident is a free lesson, a great opportunity to focus attention and to learn collectively";
- "Abolish all financial and professional penalties in the wake of an occurrence. Suspending practitioners after an incident should be avoided at all cost. These measures serve absolutely no purpose other than making incidents into something shameful, something to be kept hidden";
- "Implement, or review the effectiveness of, any debriefing programs or critical incident/stress management programs to help practitioners after incidents. Such debriefings and support form a crucial ingredient in helping practitioners see that incidents are 'normal,' that they can help the organization get better, and that they can happen to everybody";
- "Build a staff safety department, not part of the line organization, that deals with incidents. The direct manager (supervisor) of the practitioner should not necessarily be the one who is first to deal with that practitioner in the wake of an incident";
- "Aim to decouple an incident from what may look like a performance review. Any retraining of the practitioner involved in the incident will quickly be seen as punishment (and its effects are often quite debatable), so this should be done with utmost care and only as a last resort"; and,
- "Be sure that practitioners know their rights and duties in relation to incidents. Make very clear what can and typically does happen in the wake of an incident. … Even in a climate of anxiety and uncertainty about the judiciary's position on occurrences, such information will give practitioners some anchor, some modicum of certainty about what may happen. At the very least, this will prevent them from withholding valuable incident information because of misguided fears or anxieties."

Landing Margin Disappears

Delayed deployment of speed brakes and thrust reversers led to a wet-runway overrun.

BY MARK LACAGNINA

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

JETS

Checklist Omitted

Boeing 737-700. Minor damage. No injuries.

The flight crew had completed a leg from Chicago to Denver the morning of April 26, 2011, and were returning early that afternoon to Chicago Midway International Airport. Nearing Midway, the crew was told by an approach controller to expect to hold due to delays caused by weather and traffic on the approaches to Midway and nearby O'Hare International Airport.

"Shortly afterward, the controller advised the crew that aircraft capable of conducting the required navigation performance (RNP) area navigation [RNAV] approach to Runway 13C would be accepted to [land at Midway]," said the U.S. National Transportation Safety Board (NTSB) report. The controller said that a 30-minute hold could be expected before being sequenced for the RNP approach, while an indefinite hold could be expected for all other approaches.

The crew told the controller that they were "RNP capable," but then mistakenly briefed and programmed the 737's flight management system (FMS) for the global positioning system (GPS) approach rather than the RNP RNAV approach to Runway 13C, the report said.

After entering the holding pattern, the crew received the latest weather information for Midway and used the on-board performance computer (OPC) to conduct a landing distance assessment for Runway 13C. They also reviewed their fuel status and options for diverting to an alternate airport.

A line of thunderstorms had passed over Midway about 10 minutes earlier. The automatic terminal information service (ATIS), based on an observation taken five minutes earlier, said in part that surface winds were from 190 degrees at 16 kt, gusting to 23 kt; visibility was 6 mi (10 km) in light rain and mist; and the clouds were scattered at 800 ft, broken at 1,400 ft and overcast at 2,200 ft.

The crew's landing distance assessment was based on OPC inputs that included an estimated landing weight of 126,000 lb (57,154 kg) and the use of speed brakes, reverse thrust and maximum autobraking to land on a wet runway with good braking action reported. The result was a calculated "stop margin" of 720 ft (219 m). "Stop margin is the distance remaining after the aircraft comes to a complete stop, measured from the nose gear to the end of the runway," said the report, noting that the calculation is based on certain assumptions, such as touching down 1,500 ft (457 m) beyond the approach end of the runway, and includes a 15 percent safety factor.

Runway 13C had an available landing distance of 6,059 ft (1,847 m). "The calculation results showed sufficient runway length for the landing, in accordance with the flight manual procedures," the report said.

After holding for about 27 minutes, the crew was cleared by air traffic control (ATC) to

Recorded flight data indicated that the speed brakes were not armed to deploy automatically on touchdown, as required by the checklist.

proceed to the Joliet VHF omnidirectional radio (VOR) and to intercept the initial approach course. Although they acknowledged the clearance, the crew was confused because the VOR was not on the GPS approach procedure that they had briefed and programmed into the FMS. The report said that the ensuing discussion between the pilots, their identification and briefing of the correct procedure, and their reprogramming of the FMS for the RNP approach were distracting and added to their workload.

Additional distractions during the approach included a flap-overspeed warning when the first officer attempted to set flaps 25 at an airspeed above the limit and a discussion of the direction of movement of a rain shower near the threshold of Runway 13C.

The crew also heard a radio transmission by a pilot in a preceding Cessna Citation that braking action while landing on the runway was "fair." Based on this report, the 737 crew again used the OPC for a landing distance assessment with fair braking action. This resulted in a calculated stop margin of 210 ft (64 m), which also met requirements.

The cockpit voice recording indicated that the crew did not conduct the "Before Landing" checklist or mention the speed brakes. Recorded flight data indicated that the speed brakes were not armed to deploy automatically on touchdown, as required by the checklist. "A lack of speed brake deployment results in severely degraded stopping ability," the report said. "According to the [airline's] flight operations manual, braking effectiveness is reduced by as much as 60 percent."

Shortly after the 737 touched down within 500 ft (152 m) of the runway threshold, the captain perceived that deceleration was inadequate and applied full manual braking, which disengaged the autobrakes. Neither pilot noticed that the speed brakes had not deployed.

"About 16 seconds after touchdown, thrust reversers were manually deployed, which also resulted in speed brake deployment per system design, when the airplane had about 1,500 ft [457 m] of runway remaining," the report said. "As the airplane neared the end of the runway, the captain attempted to turn onto the connecting taxiway but was unable. The airplane struck a taxiway light and rolled about 200 ft [61 m] into the grass."

The 737 came to a stop about 180 ft (55 m) from the runway threshold and to the left of the engineered materials arresting system. None of the 134 passengers or five crewmembers was injured. "The right engine sustained damage from ingesting a taxiway light, and the thrust reverser and inlet cowls were damaged," the report said. "Two fan blades of the left engine were bent. The left and right inboard aft flaps were damaged. The damage did not meet the [NTSB] definition of 'substantial.'" Thus, the event was categorized as an incident, rather than an accident.

The NTSB determined that the probable cause of the incident was "the flight crew's delayed deployment of the speed brakes and thrust reversers, resulting in insufficient runway remaining to bring the airplane to a stop."

Performance studies indicated that, under the existing conditions, the airplane likely would have stopped with about 900 ft (274 m) of runway remaining if the speed brakes had deployed automatically on touchdown, or with about 1,950 ft (594 m) of runway remaining if both the speed brakes and thrust reversers had deployed promptly.

Anomalies Traced to Generator

Airbus A321-231. No damage. No injuries.

The A321 began to experience electrical system anomalies while cruising in instrument meteorological conditions and light turbulence at Flight Level (FL) 360 (approximately 36,000 ft) over northern Sudan during a scheduled flight from Khartoum to Beirut, Lebanon, with 42 passengers and seven crewmembers the night of Aug. 24, 2010.

"The commander [the pilot flying] reported that, without warning, his primary flight display (PFD), navigation display (ND) and the ECAM [electronic centralized aircraft monitor] upper display unit (DU) began to flicker, grey out, show lines or crosses, and go blank," said the report by the U.K. Air Accidents Investigation Branch (AAIB). At the same time, the flight crew heard a "chattering" sound emanating from the circuit breaker panels behind their seats.

The anomalies initially lasted only briefly. The copilot checked the circuit breaker panels but found none of the circuit breakers open and no signs of overheating. "The commander reviewed the ECAM electrical system page, which showed no abnormalities," the report said.

Shortly thereafter, the anomalies affecting the commander's PFD and ND, and the upper ECAM DU resumed, and the cockpit lights began to flicker. The crew disengaged the autopilot, and the commander transferred flight control to the copilot, whose displays initially functioned normally but then began to flicker. The chattering sound from the circuit breaker panels also resumed.

Numerous ECAM messages and master warnings appeared, and the A321's digital electronic flight control system reverted to alternate law, which provides fewer automatic protections against exceeding specific flight envelope parameters.

In addition, "the aircraft rolled to the left and adopted an approximately 10-degree left-wing-low attitude, without any flight control input from the crew," the report said. "The flight crew reported that the aircraft did not seem to respond as expected to their control inputs and shuddered and jolted repeatedly. … The ECAM was only sometimes visible and did not identify the root cause of the problem. [The pilots] were not aware of any procedure applicable to the symptoms experienced."

The commander saw an "ELEC GEN 1 FAULT" message, and the associated checklist items appeared momentarily on the ECAM. He responded by disengaging the no. 1 integrated drive generator and activating the auxiliary power unit. "On doing so, the juddering motion ceased, the chattering noise stopped, and all displays reverted to normal operation, although the aircraft's left-wing-low attitude persisted," the report said.

Although the crew had made no trim changes, they noticed that the rudder trim display was several units left of neutral. "When the rudder trim was reset to neutral, the aircraft readopted a wings-level attitude," the report said. "The aircraft had deviated approximately 20 nm [37 km] to the left of the intended track during the incident."

The pilots hand flew the aircraft and landed in Beirut without further incident. The no. 1 integrated drive generator was replaced, and no similar anomalies occurred on subsequent flights. Although this indicates that the anomalies likely had resulted from a generator fault, the report said that "it was not possible to determine with any degree of certainty the cause of this incident."

The commander had verbally reported the incident to the airline and had filed an air safety report, but the airline had not informed the AAIB of the incident until several weeks later. By that time, flight data recorded during the incident had been overwritten. "The operator stated that it had since taken actions to improve its processes for the reporting and tracking of air safety incidents," the report said.

The no. 1 integrated drive generator was replaced, and no similar anomalies occurred on subsequent flights.

Early Flare Cited in Overrun

Boeing 737-400. Minor damage. No injuries.

The ATIS at Amsterdam (Netherlands) Schiphol Airport the night of Oct. 2, 2010, indicated that the surface winds were variable at 9 kt, visibility was 2,500 m (about 1 1/2 mi) in rain and there were a few clouds at 400 ft, scattered clouds at 700 ft and a broken ceiling at 1,100 ft.

Inbound from Dalaman, Turkey, on a scheduled flight with 167 passengers and six crewmembers, the flight crew had prepared for an approach to Schiphol's Runway 18R. "Due to the changing weather conditions, ATC changed the runway for landing to Runway 22" when the 737 was about 15 minutes from the airport, said the report by the Dutch Safety Board.

The report said that the crew had calculated a reference landing speed of 140 kt for Runway 18R and "did not change the reference landing speed for Runway 22," which, at 2,014 m (6,608 ft), is about 1,786 m (5,860 ft) shorter than Runway 18R.

The crew conducted a stabilized instrument landing system approach to Runway 22, but heavy rain reduced their visibility during the final stage of the approach, the report said. The captain disengaged the autopilot 200 ft above ground level (AGL) and began to flare the aircraft early, at a radio altitude of about 50 ft, rather than at the normal height of 20 ft.

"Because of this pitch manoeuvre, the aircraft's rate of descent decreased, and this resulted in a touchdown further down the runway," the report said. "It also gave the crew the feeling that the aircraft was floating over the runway."

Recorded flight data indicated that the wind was from 110 degrees at 6 kt, resulting in a slight tail wind as the 737 touched down about 860 m (2,822 ft) from the approach threshold of the runway.

The thrust reversers were deployed shortly after touchdown, and maximum brake pressure was applied. However, "the flight data showed that the speed brake handle did not reach full deflection and, as a consequence, the landing distance increased," the report said. "The partial deployment could not be explained with the information available."

The 737 came to a stop with the nose landing gear mired in soft ground about 9 m (30 ft) off the end of the runway. There were no injuries and only minor damage to the aircraft's nosewheel.

Jet Blast Topples Occupied Push Stairs

Boeing 737-800. No damage. One serious injury.

The flight crew was preparing the 737 for a flight from Brisbane, Queensland, Australia, to Denpasar, Indonesia, the morning of Oct. 14, 2011. The first officer calculated the fuel requirements for the flight and then began to exit the 737 via the rear left cabin door to give the calculation to the refueling supervisor on the apron.

Meanwhile, a 747-400 was holding on a taxiway perpendicular to the 737's gate area. The 737 first officer had stepped onto push stairs placed outside the rear left door when the 747 flight crew received instructions from ATC to continue taxiing and applied power to initiate forward movement, said the report by the Australian Transport Safety Bureau (ATSB).

The exhaust (jet blast) from the 747's engines toppled the push stairs. "The first officer standing on the stairs fell to the tarmac, sustaining serious injuries," the report said.

The tail of the 747 was about 71 m (233 ft) from the tail of the 737 when the accident occurred. The push stairs encountered a jet blast velocity of about 30 kt when the 747 crew applied breakaway thrust. "The stairs had been tested at manufacture and demonstrated stability at up to 50-kt wind speeds with locking pads applied," the report said. "The investigation was not able to establish if the locking pads on the stairs were correctly applied at the time of the accident."

TURBOPROPS

Undrained Water Disrupts Power

Beech King Air 200. Destroyed. Five fatalities, one serious injury.

Surface winds were from 200 degrees at 3 kt, visibility was 10 mi (16 km), and there was an overcast at 800 ft when the pilot initiated a departure from Runway 30 at Long Beach (California, U.S.) Airport for a business flight the morning of March 16, 2011. Witnesses told investigators that the King Air stopped climbing and yawed left shortly after liftoff. They heard noises similar to propeller-blade pitch changes and saw smoke trailing the airplane.

"A witness, who was an aviation mechanic with extensive experience working on airplanes of the same make and model as the accident airplane, reported hearing two loud 'pops' about the time the smoke appeared, which he believed were generated by one of the engines intermittently relighting and extinguishing," the NTSB report said.

The King Air entered a left skid with a bank angle between 45 and 90 degrees and then descended in a near-vertical attitude. "Just before impact, the airplane's bank angle and pitch began to flatten out," the report said. "The airplane had turned left about 100 degrees when it impacted the ground about 1,500 ft [457 m] from the midpoint of the 10,000-ft [3,048-m] runway. A fire then erupted, which consumed the fuselage." The pilot and four passengers were killed, and one passenger was seriously injured.

Examination of the wreckage revealed no pre-existing anomalies. The nacelle tanks, from which fuel is fed to the engines, had been breached on impact, and no fuel remained in them. Tests of fuel samples taken from the refueling truck showed no sign of contamination. However, investigators concluded that the left engine's momentary power disruptions during takeoff had been caused by water that had not been drained from the fuel tanks during the pilot's preflight preparations.

The King Air 200 operating manual states that fuel should be drained from the 12 sumps before every flight. "The investigation revealed that the pilot's previous employer [a U.S. Federal Aviation Regulations Part 135 charter operator], where he had acquired most of his King Air 200 flight experience, did not have its pilots drain the fuel tank sumps before every flight," the report said. "Instead, maintenance personnel drained the sumps at some unknown interval."

The pilot, 43, who had logged 1,113 of his 2,073 flight hours in multiengine airplanes, including 463 hours in type, had been employed as a contract pilot for the past 10 months. "He had been the only pilot of the [accident] airplane for its previous 40 flights," the report said. "Because the airplane was not on a Part 135 certificate or a continuous maintenance program, it is unlikely that a mechanic was routinely draining the airplane's fuel sumps."

NTSB concluded that the probable cause of the accident was "the pilot's failure to maintain directional control of the airplane during a momentary interruption of power from the left engine during the initial takeoff climb."

"Given that the airplane's airspeed was more than 40 kt above the minimum control speed of 86 kt when the left yaw began, the pilot should have been able to maintain directional control during the momentary power interruption," the report said, noting that this applied despite the airplane being about 650 lb (295 kg) over maximum takeoff weight when the accident occurred.

The pilot had completed a Part 135 pilot-in-command check flight in a King Air five months before the accident. "However, no documentation was found indicating that he had ever received training in a full-motion King Air simulator," the report said. "Although simulator training was not required, if the pilot had received this type of training, it is likely that he would have been better prepared to maintain directional control in response to the left yaw from asymmetrical power."

Split Seal Causes Depressurization

Bombardier Q400. Minor damage. No injuries.

En route from Manchester, England, with 49 passengers and four crewmembers, the aircraft was descending from FL 250 to FL 200, in preparation to land in Brussels, Belgium, the morning of Oct. 12, 2011, when the flight crew felt mild inner ear pain and saw indications of cabin depressurization. Cabin altitude was increasing in excess of 3,000 fpm.

"The cabin crew reported by interphone that a loud 'pop' had been heard from the rear of the aircraft, followed by the noise of air escaping from the rear left galley area," the AAIB report said.

The cabin pressure warning light illuminated, and both pilots donned their oxygen masks. The commander, the pilot flying, initiated an emergency descent, and the first officer declared an emergency with ATC.

The commander stopped the descent at FL 80. "After establishing with the cabin crew that the passengers were not in difficulty and observing that the cabin pressurisation system had stabilized the cabin altitude at 2,000 ft, the commander … decided to continue the fight to Brussels Airport, where the aircraft landed without further incident," the report said.

Maintenance personnel found that the inflatable seal on the aft baggage compartment door had split, causing the compartment to depressurize. "This had caused the 'blow-out' panels on the bulkhead dividing the aft baggage

The inflatable seal on the aft baggage compartment door had split, causing the compartment to depressurize.

compartment from the passenger cabin to open, causing the 'pop' noise, and the open blow-out panels then allowed the passenger cabin to depressurize," the report said.

'Inadequate Skill' Led to Overrun

Cessna 208B Caravan. Substantial damage. No injuries.

Inbound from Imphal, India, on a charter flight to Lengpui with nine passengers the morning of May 4, 2011, the pilot was told by ATC that visibility at the destination was 4,500 m (about 2 3/4 mi). The pilot requested and received a special visual flight rules clearance into Lengpui's airspace.

Visibility then decreased to 2,000 m (1 1/4 mi), and ATC approved the pilot's request to enter a holding pattern at 6,500 ft. "The pilot thereafter, without any communication with ATC, reported downwind for Runway 17 and subsequently reported for final," said the report by the Indian Directorate General of Civil Aviation (DGCA). "The controller, after sighting the aircraft, gave the landing clearance, with wind as calm and runway surface wet."

The report said that "it was impossible to stop the aircraft" after it touched down "well beyond" the threshold of the 2,500-m (8,203-ft) runway at high speed. The Caravan overran the runway and descended into a 60-ft (18-m) ravine.

Investigators found that the pilot, who had 1,983 flight hours, had not accumulated the 100 hours as pilot-in-command in type required to conduct single-pilot charter operations and did not meet requirements for operating at airports in mountainous terrain. The DGCA concluded that the cause of the accident was the "inadequate skill level of the pilot to execute a safe landing during marginal weather conditions."

PISTON AIRPLANES

Water Favored Over Airport

Piper Chieftain. Destroyed. No injuries.

The Chieftain was en route at 9,000 ft from Punta Cana, Dominican Republic, to Aguadilla, Puerto Rico, the afternoon of Oct. 27, 2010, when the pilot noticed high cylinder head and oil temperatures, and a partial loss of power from the right engine. The pilot received clearance from ATC to descend to 2,500 ft and to divert the flight to Borinquen Airport in Puerto Rico.

"Both engines were operating; however, the loss of rpm on the right engine made it hard to maintain altitude," the NTSB report said. "[The pilot] shut down the right engine before performing the troubleshooting items listed in the POH [pilot's operating handbook] and continued flying the airplane at 108 kt. He did not declare an emergency."

The Chieftain was at 2,500 ft and about 4 nm (7 km) from Borinquen Airport when the pilot told the tower controller that he was going to ditch the airplane in the ocean. "When asked why he elected to ditch the airplane instead of continuing to the airport, the pilot stated [that it was] because of poor single-engine performance and windy conditions," the report said, noting that the surface winds at the airport were from 060 degrees at 6 kt.

The pilot was rescued by a Coast Guard helicopter crew after he ditched the airplane about 3 nm (6 km) east of the airport. The Chieftain sank and was not recovered. NTSB concluded that the pilot's decision to ditch the airplane was "improper."

Power Loss Traced to O-Rings

Cessna 402B. Substantial damage. One fatality.

The 402 was on a positioning flight to Portland, Maine, U.S., the evening of April 10, 2011, when the pilot requested and received clearance from ATC to divert the flight to Biddeford, Maine. He gave no reason for the destination change, the NTSB report said.

Investigators determined that a partial loss of power from the right engine occurred on final approach, and the pilot intentionally reduced power from the left engine to prevent the airplane from rolling right. Minimum control speed with one engine inoperative is 82 kt; ATC radar data indicated that the airplane's groundspeed decreased to 69 kt. The Chieftain descended, struck several trees at 25 ft AGL and came to rest on the roof of a house about 1,500 ft (457 m) from the runway.

Investigators determined that the partial power loss had been caused by improper installation of two O-rings in the right engine's throttle-control assembly. When the O-rings were replaced, "the engine operated smoothly with no noted anomalies," the report said.

Control Lost on Circling Approach

Piper Aerostar 601P. Substantial damage. No injuries.

When the Aerostar reached the missed approach point during a GPS approach to Castroville (Texas, U.S.) Municipal Airport on March 24, 2012, the pilot had the runway in sight but determined that the airplane was not in position for a normal landing. "He then decided to circle to land with full flaps, while maintaining an airspeed of 140 mph," the NTSB report said.

The airplane entered a high sink rate during the turn to final. "The pilot added full power and leveled the wings, but the airplane continued to descend," the report said. "The airplane impacted the ground off the end of, and to the right of, the runway." The left wing spar was substantially damaged. The three people aboard the Aerostar were not injured.

HELICOPTERS

Blinded by Landing Light

Bell 47G. Substantial damage. One serious injury.

Visibility was 2 1/2 mi (4,000 m) in mist, and there was a 100-ft overcast when the pilot departed from Salinas (California, U.S.) Municipal Airport the morning of Sept. 3, 2010, on a positioning flight to a nearby work site. The helicopter entered fog when the pilot climbed from 50 ft to 80 ft AGL to avoid power lines.

"The pilot stated that after entering the fog, he turned on the landing light, which blinded him and caused him to become disoriented as he attempted to make a 180-degree turn back to the airport," the NTSB report said.

The pilot lost control, and the helicopter struck a guardrail and crashed inverted on the highway. "A truck driver who witnessed the accident reported that the forward visibility was about 250 ft [76 m]," the report said.

Water Causes Gearbox Corrosion

Robinson R44 Raven. Substantial damage. No injuries.

About 30 minutes after departing from Darwin for a charter flight to Bamurru Plains, both in Australia's Northern Territory, the afternoon of July 28, 2011, the helicopter was descending through 650 ft when the pilot felt a minor but persistent vibration. About 30 seconds later, the vibration increased, and the pilot heard a loud "bang" and saw the clutch warning light illuminate.

"The pilot immediately conducted an autorotative descent and landing, resulting in distortion of the skids and minor damage to the tail boom from contact with a main rotor blade," the ATSB report said. The four people aboard the R44 escaped injury.

Investigators determined that water had entered the main rotor gearbox gear carrier, causing it to corrode over time and fail from fatigue cracking during the accident flight. The gearbox failure caused the loss of main rotor drive.

Methane Chokes Engine

Bell 206L-3 LongRanger. Substantial damage. Three minor injuries.

Shortly after lifting off from a platform in the Gulf of Mexico the afternoon of March 24, 2011, the pilot heard a loud bang, lowered the helicopter's nose and entered an autorotation.

"As the helicopter descended, the pilot activated the helicopter's float system," the NTSB report said. "The floats inflated; however, the helicopter impacted the water and rolled inverted." The pilot and two passengers exited the helicopter and were rescued by a boat crew.

Examination of the engine revealed nothing that would have precluded normal operation, but recorded engine data indicated that a rapid and momentary increase in turbine outlet temperature and torque had occurred during the takeoff. Investigators determined that a compressor stall had occurred when the engine ingested methane that was being vented from the offshore platform.

Preliminary Reports, August 2012

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 2	Santiago de Compostela, Spain	Cessna Citation I	destroyed	2 fatal
Runway visual range varied between 450 and 1,700 m (about 1/4 and 1 mi) when the Citation struck trees and crashed 1.2 mi (1.9 km) from Runway 17 during an instrument landing system approach.				
Aug. 2	Hoonah, Alaska, U.S.	Piper Saratoga	substantial	1 fatal
The single-engine airplane struck terrain during a cargo flight under visual flight rules.				
Aug. 2	Houston, Texas, U.S.	Beech E55 Baron	substantial	none
The Baron struck an embankment during a rejected takeoff following a loss of power from the left engine.				
Aug. 5	Hilton Head, South Carolina, U.S.	Embraer 170-200	none	1 serious
Although the seat belt sign was on and an announcement had been made, a passenger left her seat to go to the lavatory. She was seriously injured when the aircraft encountered light to moderate turbulence.				
Aug. 6	Saint Gallen, Switzerland	Embraer Phenom 300	substantial	3 none
The business jet overran the runway while landing in heavy rain.				
Aug. 11	Taylorville, Illinois, U.S.	Beech G18S	substantial	1 fatal, 12 none
Five parachutists were hanging outside the Twin Beech and seven others were standing near the cabin door as the airplane neared the drop zone at 11,000 ft. All the parachutists jumped when the airplane stalled and rolled inverted. The G18 struck terrain in a near-vertical dive, killing the pilot.				
Aug. 18	San Juan, Puerto Rico	Bell 206B JetRanger	substantial	3 none
The helicopter was on a night police surveillance flight when the crew smelled fuel and decided to return to the airport. The engine then lost power, and the main rotor blades severed the tail boom during a hard autorotative landing.				
Aug. 19	Talodi, Sudan	Antonov 26-100	destroyed	32 fatal
The An-26 was carrying several members of the Sudanese government and military when it struck a mountain during an attempted go-around in a sandstorm.				
Aug. 22	Gorelovo, Russia	Cessna 421C	destroyed	2 fatal
The flight crew lost control of the 421 during a test flight. The airplane crashed into a kindergarten building; no one on the ground was hurt.				
Aug. 22	Ngerende, Kenya	Let 410UVP-E9	destroyed	4 fatal, 7 serious
Both pilots and two passengers were killed when the aircraft stalled on takeoff from a game preserve and crashed in a field.				
Aug. 24	Solemont, France	Pilatus PC-12/45	destroyed	4 fatal
The pilot reported an unspecified problem before the PC-12 crashed out of control in a wooded area. Witnesses said that the aircraft had been struck by lightning.				
Aug. 24	Bontang, Indonesia	Piper Chieftain	destroyed	4 fatal
The Chieftain struck a mountain at 1,300 ft under unknown circumstances during a night flight.				
Aug. 24	Abingdon, Virginia, U.S.	Bell 407	substantial	1 fatal
After disembarking passengers on shore, the pilot was making a night departure over a lake when the helicopter struck the water.				
Aug. 29	Canton, Iowa, U.S.	Piper Apache 150	substantial	2 fatal
A partial loss of power occurred before the Apache stuck trees and terrain during a forced landing.				
Aug. 29	Millville, New Jersey, U.S.	Beech A55 Baron	substantial	1 fatal, 1 serious
The student pilot was killed when the Baron veered off the runway on landing. The flight instructor had reported a simulated engine failure on approach.				
Aug. 30	Hualien, Taiwan	Britten-Norman Islander	destroyed	3 fatal
The Islander struck mountainous terrain at 5,250 ft during an aerial photography flight.				
Aug. 31	Lahore, Pakistan	ATR 42-500	substantial	46 none
The aircraft veered off the runway after the right main landing gear collapsed during a bounced landing.				
Aug. 31	Bath, New York, U.S.	Bell 407	substantial	1 minor
The police helicopter was cruising at 2,500 ft when it pitched nose-down and entered a right spin. The pilot apparently recovered from the spin and conducted an autorotative landing in a wooded area.				

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

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