AeroSafety WORLD

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CRIMINALIZATION
FIGHTING THE URGE TO PROSECUTE

THE JOURNAL OF FLIGHT SAFETY FOUNDATION

MARCH 2008

Cockpit Smoke Solution

According to Air Safety Week, at least once a day somewhere in North America a plane has to make an unscheduled or emergency landing because of a smoke and in-flight fire event.

Statistics from FAA Service Difficulty Reports clearly show that in-flight fires, smoke or fumes are one of the most significant causes of unscheduled or emergency landings and account for 3 precautionary landings per day based on 1,089 events during a 10 month period in 1999.

A pilot encountering smoke in the cockpit so thick that the instruments cannot be seen can utilize a relatively simple device, which provides a clear view.

The Emergency Vision Assurance System (EVAS) provides a clear space of air through which a pilot can see flight instruments and out the front windshield for landing. The pilot still relies on the oxygen mask for breathing, smoke goggles for eye protection and employs approved procedures for clearing smoke from the aircraft. When smoke evacuation procedures are not sufficient, EVAS provides emergency backup allowing the pilot to see and fly the aircraft to a safe landing.

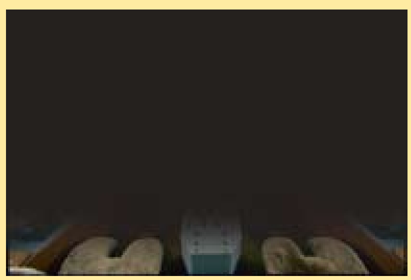
EVAS measures 3 x 8.5 x 10 inches when stowed, the approximate space of a Jeppessen navigation manual. When needed, the pilot removes the IVU (Inflatable Vision Unit) from the EVAS case and pulls a tab to activate the system. The IVU inflates with one lobe above and one below the glareshield. According to EVASWorldwide, the manufacturer, the whole process takes 15-20 seconds. The pilot leans forward, placing his smoke goggles in contact with the EVAS clear window, giving him an unimpaired view of both vital instruments and the outside world.

After it is activated, EVAS is continually pressurized with filtered cockpit air to maintain volume, and preserve a clear view. The device is independent of aircraft power, relying on a self-contained battery-power supply, pump and filters in each storage case. EVAS systems are designed to run for at least two hours, and filter down to .01 microns. The system requires virtually no installation.

While FAA regulations require smoke detectors, fire extinguishers, smoke goggles and oxygen masks, pilots point out that these safeguards and all other systems and equipment for flight safety are useless if the pilots cannot see to control and land the aircraft.

EVASWorldwide uses a fleet of mobile cockpit demonstration units to show potential customers the benefits of the system. EVAS demonstrations use a fog generator to reduce cockpit vision so the pilot cannot see his hand in front of his face. Smoke goggles offer no vision improvement, though they do protect the eyes. After EVAS is deployed, the pilot can clearly see both the vital instruments and out through the windshield. It is truly an amazing experience. Most pilots are sold on the benefits of EVAS on the spot.

Normal cockpit visibility



Uncontrolled smoke in the cockpit –No visibility

Uncontrolled smoke in the cockpit –Visibility with EVAS

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CURRENTLY SEEKING LAUNCH AIRLINE CUSTOMER

KEEPING IT Credible

Advocating safety in this remarkably safe industry isn't easy, as the people who read this magazine know. It is tough to stand up every day and suggest fixes for problems that haven't happened yet. It is even worse if you have to convince someone to spend money on a "risk" that doesn't seem real to them.

To do that job well, you have to do your homework and have a lot of conversations with yourself, asking if the risk you are attacking is real, or are you overstating the case? Just one overblown claim can compromise the credibility that is essential to our job.

Over the past year and a half, I have been working hard to make the case that all is not well in our aviation world. There are, in fact, big risks out there. That was a pretty easy position to justify when all the indicators were pointing toward record-setting growth that was overtaking the people and infrastructure that are essential to safety.

But what about now? Global financial markets have taken a pounding, and all the signs in the United States point toward recession. Do we still have a problem?

I am not an economist, but when I do my homework and ask the hard questions, this is where I come out: The world is definitely going to notice a U.S. downturn, but not the way it used to. Many areas around the world experiencing rapid growth have either a lot of oil or a lot of people. Oil dollars will continue to fuel expansion in places like the Middle East, Russia, West Africa and Indonesia.

In India and China, growth of the middle class has been driving transportation demand, and it is not going away. Growth may slow a bit, but the change will be from overwhelming to robust. China already has been trying to slow the nation's overheated aviation growth because of the safety threat; a downturn will ease the Chinese task.

India has not controlled growth, and today it faces a serious shortfall in skilled aviation professionals and supporting infrastructure. Even a substantial slowdown will not relieve India's need to catch up; six months ago the situation looked impossible, six months from now it may improve to really difficult.

I have been asking airline and manufacturing executives what they think. They are not seeing a slowdown yet. Europe looks solid, and even the U.S., as of February, is not seeing a big traffic dropoff. Manufacturers have all achieved record-setting backlogs and those numbers are holding. However, air freight, a reliable leading indicator, is showing some softness.

So my conclusion is simple. We may catch a little bit of a break, but it will be brief and slight. History has shown that aviation growth rebounds quickly from economic setbacks. We need to use this time to build the base of people and infrastructure that can support that expansion. It is a tougher sell today, but it is still the right message. Look at the numbers yourself and make up your own mind. During the coming difficult times we must keep the message credible and focused.

William R. Voss
President and CEO
Flight Safety Foundation

AeroSafetyWORLD

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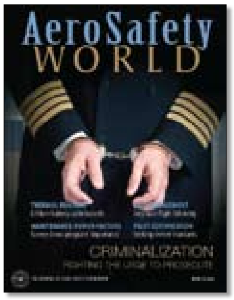

About the Cover
Learning from accident investigations is threatened by criminal prosecutions.
Photo Illustration: © Chris Sorensen Photography

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

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LINGERING Pain

Self-inflicted injuries always seem to hurt more, the pain exacerbated by the frustration that once again you've failed to maintain control and let things get so far out of whack that injury was the result. The subsequent healing process becomes a succession of reminders of your mistake.

Perhaps that's why the recent kerfuffle over data from the National Aviation Operational Monitoring Service (NAOMS), put together to develop new methods for aviation system safety analysis by the U.S. National Aeronautics and Space Administration (NASA), is so grating.

From birth, the study's basic concept had credibility problems. That good, quantifiable data would come from 25,000 telephone interviews with pilots is a premise that many in the business of serious research question.

If two pilots report a runway incursion incident, were there two incidents or are they both reporting the same event? If a pilot's union is engaged in wrangling with management over flight and duty time limits, might the pilot be just a little more likely to identify fatigue in the cockpit as a major safety risk? And even if he does exaggerate, he still might be right in his assertion; it's just that there is no supporting data other than his individual war story.

And that is what many feared NAOMS would become — just a massive collection of unverified war stories that might or might not be skewed by each pilot's personal reference framework. We just don't know, and that is the baseline fact. And while all data have problems, this bunch seems too burdened with unknowable variables for researchers to bother trying to adjust the data to get a clear picture of an environment already fairly well described through other methods.

But another error was made. The researchers promised those who participated in the study that their contributions would remain anonymous. It makes perfect sense to do so; the Aviation Safety Reporting System that collects volunteered incident reports grants anonymity to its participants. Although the program is serviced by NASA, it is a Federal Aviation Administration (FAA) program, and Congress has granted FAA the right to shield that sort of information against disclosure due to a request based on the Freedom of Information Act (FOIA), a right that NASA regrettably lacks.

Several years after the project was mercifully laid to rest, a news organization got to wondering what happened with NAOMS and filed an FOIA request, and NASA's problem became clear.

The situation was made worse when NASA, trying to explain its decision not to do more with the data, sounded like it was purposefully hiding bad news. This had the effect of throwing gasoline on a fire.

Trying to do the right thing for its study subjects, and remembering the very bad experience of several years ago when Dutch researchers had to divulge identifications it had pledged to protect, NASA on New Year's Eve released a package of data that went the extra mile to protect the participants.

Sadly, this is an election year in the United States, and members of Congress are getting attention by continuing to beat on the issue. Last month, the chairman of the U.S. House Committee on Science and Technology, Bart Gordon (D-Tenn.), joined with some committee members to request that the Government Accountability Office, an arm of Congress, take over the original data and analyze it. Looks like this self-inflicted wound will take a while to heal.

J.A. Donoghue

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

MARCH 5–7 ➤ Airport Wildlife Management Seminar. Embry-Riddle Aeronautical University. Dallas/Fort Worth International Airport. Allen R. Newman, <newmana@erau.edu>, <www.erau.edu/ec/soctapd/wildlife-management.html>, +1 866.574.9125.

MARCH 5–6 ➤ Avionics 2008 Conference: Operating in Future Airspace. ASD-Network. Amsterdam. <www.asdevents.com/event.asp?ID=107>.

MARCH 10–12 ➤ 20th annual European Aviation Safety Seminar (EASS). Flight Safety Foundation and European Regions Airline Association. Bucharest, Romania. Namratha Apparao, <apparao@flightsafety.org>, <www.flightsafety.org/seminars.html#eass>, +1 703.739.6700, ext. 101.

MARCH 10–13 ➤ 35th Annual International Operators Conference. National Business Aviation Association. San Antonio, Texas, U.S. <web.nbaa.org/public/cs/ioc/2008/index.php>, <registrations@nbaa.org>, +1 202.478.7770.

MARCH 11–13 ➤ ATC Global Exhibition and Conference (formerly ATC Maastricht). Civil Air Navigation Services Organisation and Eurocontrol. Amsterdam. <www.atcevents.com/atc08/show_link1.asp>, +44 (0)871 2000 315.

MARCH 13–15 ➤ ARSA 2008 Annual Repair Symposium. Aeronautical Repair Station Association. Washington, D.C. <arsa@arsa.org>, <www.arsa.org/node/400>, +1 703.739.9543.

MARCH 14 ➤ Introduction to Safety Management Systems. Aviation Consulting Group. Myrtle Beach, South Carolina, U.S. Bob Baron, <tacg@sccoast.net>, <www.tacgworldwide.com>, 800.294.0872, +1 954.803.5807.

MARCH 18–20 ➤ 2nd Civil Aviation Week India–Airport and Airline 2008 Expo. Airports Authority of India, Council of EU Chambers of Commerce in India, Business Aviation Association for India, et al. New Delhi. <www.civilaviationweek. com>.

MARCH 18–20 ➤ Aviation Industry Expo. National Air Transportation Association. Dallas. Jill Ryan, <jill.ryan@cygnusexpos.com>, <aviationindustryexpo.com/as3gse/index.po>, 800.827.8009, ext. 3349.

MARCH 18–20 ➤ Search and Rescue 2008 Conference and Exhibition. The Shephard Group. Bournemouth, England. <SC@shephard.co.uk>, <www.shephard.co.uk/SAR>, +44 1628 606 979.

MARCH 25 ➤ Aerospace Medicine: Survival Following Aircraft Incidents. Royal Aeronautical Society and IET. London. <conference@raes.org.uk>, <www.raes.org.uk/conference/indexconf.html>, +44 (0)20 7670 4345.

MARCH 28 ➤ IS-BAO Implementation Workshop. International Business Aviation Council. San Antonio, Texas, U.S. Katherine Perfetti, <kathyhp@comcast.net>, <www.ibac.org>, +1 540.785.6415.

MARCH 31–APRIL 2 ➤ Safety and Quality Summit: Practical Tools to Build a Safety Culture: Leveraging Your Safety Management System to Reduce Human Error. CHC. Vancouver, British Columbia, Canada. <www.chcsafetyqualitysummit.com>, <summit@chc.ca>, +1 604.232.7302.

MARCH 31–APRIL 2 ➤ 15th Annual SAFE (Europe) Symposium. SAFE (Europe). Geneva, Switzerland. <safe.distribution@virgin.net>, <www.safeeurope.co.uk>, +44 (0)7824 303 199.

APRIL 2 ➤ IATA Food Safety Forum. International Air Transport Association. Miami. <inflight@iata.org>, <www.iata.org/events/fsf08/index.htm>.

APRIL 14–17 ➤ 59th Annual Avionics Maintenance Conference. ARINC. Tulsa, Oklahoma, U.S. Samuel Buckwalter, <Samuel.Buckwalter@arinc.com>, <www.aviation-ia.com/amc/upcoming/index.html>, +1 410.266.2008.

APRIL 15–17 ➤ Maintenance Management Conference. National Business Aviation Association. Daytona Beach, Florida, U.S. Dina Green, <dgreen@nbaa.org>, <web.nbaa.org/public/cs/mmc/200804/index.php>, +1 202.783.9357.

APRIL 18–22 ➤ IFALPA 2008: 63rd Conference. International Federation of Air Line Pilots' Associations. Mexico City. <ifalpa@ifalpa.org>, <www.ifalpa.org/conference/index.htm>, +44 1932 571711.

APRIL 22–24 ➤ World Aviation Training Conference and Tradeshow. Halldale. Orlando, Florida, U.S. Chris Lehman, <chris@halldale.com>, <www.halldale.com/wats>.

APRIL 23–26 ➤ AEA Convention and Trade Show. Aircraft Electronics Association. Washington, D.C. <info@aea.net>, <www.aea.net/Convention/FutureConventions.asp?Category=6>, +1 816.373.6565.

APRIL 29–MAY 1 ➤ 53rd annual Corporate Aviation Safety Seminar (CASS). Flight Safety Foundation and National Business Aviation Association. Palm Harbor, Florida, U.S. Namratha Apparao, <apparao@flightsafety.org>, <www.flightsafety.org/seminars.html#cass>, +1 703.739.6700, ext. 101.

MAY 5–7 ➤ Airport Fire-Rescue USA: 5th International Aircraft Rescue Fire Fighting Conference and Exhibits. *Aviation Fire Journal*. Myrtle Beach, South Carolina, U.S. <www.aviationfirejournal.com>, +1 914.962.5185.

MAY 5–8 ➤ RAA Annual Convention. Regional Airline Association. Indianapolis, Indiana, U.S. Scott Gordon, <gordon@raa.org>, <www.raa.org>, +1 202.367.1170.

MAY 11–15 ➤ 79th Annual Scientific Meeting. Aerospace Medical Association. Boston. Russell Rayman, <rrayman@asma.org>, <www.asma.org/meeting/index.php>, +1 703.739.2240, ext. 103.

MAY 12–14 ➤ IATA Ground Operations Symposium and IGHC 2008. International Air Transport Association Ground Handling Council. Kuala Lumpur, Malaysia. <www.iata.org/events/ighs/index.htm>.

MAY 20–22 ➤ European Business Aviation Convention and Exhibition (EBACE). National Business Aviation Association and European Business Aviation Association. Geneva. <info-eu@ebace.aero>, <www.ebaa.org/content/dsp_page/pagec/ev_ebace>, +32-2-766-0073 (Europe), +1 202.783.9000 (United States and Canada).

MAY 30–JUNE 1 ➤ Australian and New Zealand Societies of Air Safety Investigators Conference. Adelaide, South Australia. <www.asasi.org/anzsasi.htm>.

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

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

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

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 1,170 individuals and member organizations in 142 countries.

MemberGuide

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Safety News

Outdated Instrumentation?

The primary cockpit instrumentation in many aircraft is outdated and inadequate for the required navigation performance (RNP) environment, which requires a high degree of accuracy in navigation, the International Federation of Air Line Pilots' Associations (IFALPA) says.

IFALPA criticized the design of the primary flight display (PFD) and navigation display (ND), which are based on analog "clocks and dials" used in earlier navigation instruments.

"In the days of straight courses, airways, approach and departure procedures, all with relatively large safety margins, these indicators, together with flight director (FD) guidance technology, [were] sufficient to enable pilots to safely monitor the progress of a flight as well as to keep flight technical errors within required margins when flying manually," IFALPA said in a position statement.

However, the depiction scale on today's NDs does not provide the resolution required for RNP flight, and information required to monitor system performance for flight procedures is scattered throughout the flight deck, IFALPA said. In addition, the PFD does not provide position information — or situation information — and as a result, the crew's situational awareness is inadequate, IFALPA said.

This integrated primary flight display gives pilots situational awareness of the flight path, terrain and navigational environment.

Flight crews today require information displays with "an accurate and intuitive presentation, without the need to use more than one display to access the relevant data," IFALPA said.

"There is an immediate need to update the capabilities of the avionics displays in order that they become equal to the task," IFALPA said.

The organization suggested that "development of a [three-dimensional] path in the sky, combined with a flight path predictor, may be the best way to optimize the display of all the requirements for safe and accurate flight in the RNP environment, thus allowing crews the facility to manually operate (or hand fly) the aircraft through complex approach, departure and missed approach procedures or during non-normal operations."

Runway Warning Lights

New runway light systems being tested at two U.S. airports for their effectiveness in averting runway incursions have proved effective and should be installed at airports nationwide, according to a report by the U.S. Department of Transportation Office of the Inspector General.

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Runway status lights (RWSL), which are being tested at airports in the Dallas–Fort Worth area and in San Diego, are automated "surveillance-driven" lights that are installed at runway and taxiway intersections and at runway departure points; they illuminate to indicate it is unsafe to cross or depart from a runway.

"RWSL is a viable and important technology for reducing runway incursions," the report said. "Pilots, pilot union officials, air traffic management and the airport operator at [Dallas–Fort Worth International Airport] all agreed that RWSL works as intended and has no known negative impact on capacity, communication or safety."

In addition, the report said that the U.S. National Transportation Safety Board (NTSB) considers RWSL a promising technology for addressing an NTSB recommendation that pilots receive direct warnings of potential runway conflicts.

The U.S. Federal Aviation Administration said, in a response included in the report, that it agreed with several report recommendations, including one that called for the accelerated deployment of RWSL.

VLJ Integration


© Spectrum Aeronautical

Eurocontrol has established a new forum to seek recommendations for integrating very light jets (VLJs) into the European air traffic system.

The European VLJs Integration Platform is intended to ensure the safe, efficient increase in the number of VLJs in European skies. That number is expected to total about 700 by 2015; of these, most are expected to be used in air taxi operations, resulting in an increase of 200 to 300 flights per day, Eurocontrol said.

"The growth in VLJs adds a significant extra dimension to the complexity of air traffic in Europe," said Alex Hendriks, Eurocontrol deputy director of air traffic management strategies. "VLJs have very different speeds and cruising levels from current commercial jet aircraft, so we need to conduct an impact assessment to see how they will affect the network as a whole."

Eurocontrol said that the assessment would examine the likely impact of VLJs on air traffic control services during takeoff and en route portions of flight, as well as the technical requirements of VLJ on-board systems because of the possibility of "difficulties in adapting some of the fully integrated avionics systems currently employed in certain VLJs to particular navigation requirements."

Special Regulations for MU-2Bs

The U.S. Federal Aviation Administration (FAA) says it will require additional training, experience and operating requirements to improve operational safety for the Mitsubishi MU-2B (*ASW*, 1/07, p. 32).

The FAA has finalized a special federal aviation regulation (SFAR) that mandates a comprehensive standardized pilot training program. The SFAR also requires pilots to use a standardized checklist and the current airplane flight manual and, in most cases, to have a working autopilot installed in the airplane.

"The FAA studies enormous amounts of data looking for trends," said Nick Sabatini, FAA associate administrator for aviation safety. "When we saw the rising accident rate for the MU-2B, we decided to take appropriate actions to bring the plane up to an acceptable level of safety."

The increase in accidents and incidents was recorded in 2004 and 2005, the FAA said, and a subsequent evaluation of the airplane concluded that changes were required in training and operating requirements.

MU-2B operators must comply with the SFAR within one year of its publication.


© Mitsubishi Heavy Industries

Aid to Indonesia

Officials from Australia and Indonesia have signed a three-year cooperative agreement to improve transport safety in Indonesia, including training for up to 40 Indonesian airworthiness inspectors each year.

The agreement, signed late in January, also calls for Australia to provide mentoring and training for personnel in Indonesian air traffic management services, as well as guidance in the conduct of transport safety investigations. These measures were among several that were identified by the Indonesian government as key safety priorities.

Australian Transport Minister Anthony Albanese said that the agreement calls for expansion of the existing cooperative relationship between the two countries.

"It is essential the traveling public of both countries [has] confidence that transport safety is a priority and that lessons from previous transport accidents are being acted upon," Albanese said. "Australia's assistance will complement the substantial efforts that the government of the Republic of Indonesia has already taken to improve the safety of their transport services."

Runway Safety Goals


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The U.S. aviation industry has taken significant short-term actions to improve airport safety, but additional steps must be taken to reduce risks of runway incursions and wrong-runway departures, the U.S. Federal Aviation Administration (FAA) says.

Acting FAA Administrator Robert A. Sturgell said that 53 of the nation's 75 busiest airports have upgraded airport markings, 20 large airports have completed runway safety reviews, and 385 of the nation's 569 certificated airports now require annual recurrent training for airport employees with access to movement areas.

In addition, all 112 active air carriers have told the FAA that they have complied with directives to include ground scenarios in pilots' simulator training and to review cockpit procedures to address matters that distract pilots during taxi, the FAA said. The FAA is developing a DVD for distribution to the air carriers for use in training non-pilot employees who operate vehicles or aircraft at airports and also has agreed to work with the National Air Traffic Controllers Association to develop an aviation safety action program (ASAP) — or voluntary, nonpunitive safety reporting system — for air traffic controllers.

In Other News …

A cost-benefit analysis is being conducted for the **Australian Civil Aviation Safety Authority** to evaluate instrument approaches with vertical guidance. Among the approaches being studied are the Japanese multi-function transport satellite-based augmentation system (MSAS) and the U.S. wide area augmentation system (WAAS). … The **U.S. National Transportation Safety Board** (NTSB) has issued a safety alert to warn general aviation pilots of the increased risks of controlled flight into terrain (CFIT) during night visual meteorological conditions, caution them against complacency, and urge increased altitude and position awareness and better preflight planning. The NTSB cited six general aviation CFIT accidents in a recent three-year period in which the aircraft struck terrain either soon after takeoff or during descent while preparing to land. … The **U.S. Federal Aviation Administration** (FAA) has issued a safety alert for operators warning of the hazards of an air conditioning (A/C) cart pressurizing an airplane cabin if the cart is used while airplane doors are closed. The FAA cited a 2005 accident in which a flight attendant on a Bombardier CRJ200 suffered serious injuries after opening the galley door while an A/C cart was connected to the airplane and being ejected from the galley service door (*ASW*, 1/08, p. 10).

Caution on Corrosion

Operators of older small aircraft — and the maintenance personnel who work on them — should add corrosion detection to their maintenance plans, the Australian Civil Aviation Safety Authority (CASA) says.

"Corrosion is a real problem, and … all corrosion, regardless of severity, requires rectification," a CASA airworthiness bulletin says. "Several reports have been received by CASA indicating that severe corrosion has been detected in several models and types of older small aircraft. In some instances, this has led to major repairs and has resulted in a few aircraft being beyond economic repair."

The airworthiness bulletin said that the problem has arisen, in part, because many small aircraft have remained in service longer than their manufacturers had expected.

"In many instances, the manufacturers did not consider the problems associated with older aircraft fleets," CASA said. "Some are only now considering corrosion detection and prevention programs and aging aircraft maintenance requirements."

CASA recommended that all registered operators of small aircraft incorporate corrosion detection, rectification and prevention into their maintenance plans and ensure that all corrosion is rectified as soon as possible after detection.


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Compiled and edited by Linda Werfelman.


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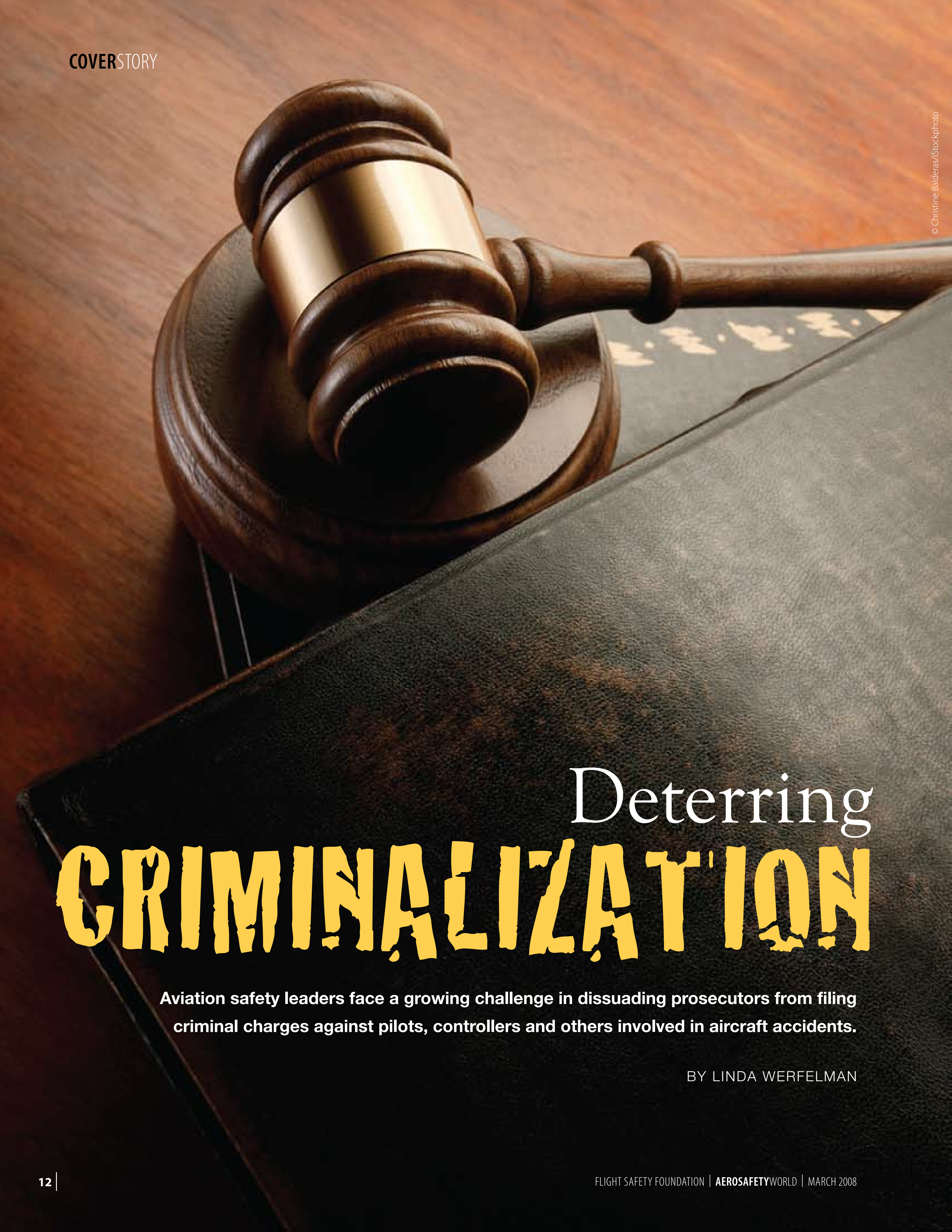

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Deterring CRIMINALIZATION

Aviation safety leaders face a growing challenge in dissuading prosecutors from filing criminal charges against pilots, controllers and others involved in aircraft accidents.

BY LINDA WERFELMAN

Criminal prosecutors are becoming increasingly eager to press charges against pilots, air traffic controllers and other aviation professionals involved in aircraft accidents, and that eagerness is a growing threat to flight safety, says Flight Safety Foundation President and CEO William R. Voss.

"The safety of the traveling public depends on encouraging a climate of openness and cooperation following accidents," Voss said. "Overzealous prosecutions threaten to dry up vital sources of information and jeopardize safety."

In addition to major cases that have generated worldwide attention — for example, the Air France Concorde that crashed into a hotel after takeoff from Charles de Gaulle Airport in Paris in

Photo Illustration © Chris Sorensen Photography

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"On one hand, we've got to be vigorous about protecting safety information, but on the other hand, we can't put ourselves ahead of justice."

2000 and the Gol Linhas Aéreas Boeing 737-800 that crashed in the Amazon after a midair collision with a business jet in 2006 (see "Cases of Criminalization") — dozens of lesser known cases also have been developed in jurisdictions around the world, he said.

"Every time you ask, there are two or three more cases," Voss said.

The most recent high-profile case involves the arrest in early February of the captain of a Garuda Indonesia 737 that overran the runway on landing in Yogyakarta and burned on March 7, 2007, killing 21 of the 140 people in the airplane and leaving 12 others with serious injuries (*ASW*, 1/08, p. 42). The Indonesian National Transportation Safety Committee (NTSC), in its final report on the accident, said that the causes were ineffective flight crew communication and coordination, the crew's failure to reject the unstabilized approach, the captain's failure to act on both his copilot's calls for a go-around and repeated alerts from the airplane's ground-proximity warning system (GPWS), the copilot's failure to take control of the airplane, and the absence of pilot training by the airline on required responses to GPWS alerts and warnings.

The captain could be sentenced to up to seven years in prison if he is convicted of the charges against him, including manslaughter and violating aviation law. His arrest was denounced by the Garuda pilots association as "unlawful."[1,2]

The Garuda pilots group, along with the International Federation of Air Line Pilots' Associations (IFALPA), said that, although the NTSC had issued what it called a final report, the report was incomplete and that further investigation is required to identify all factors that contributed to the accident.

"Unless this is done, there is little possibility that aviation safety in the area of crew performance can be improved by the lessons of this accident," IFALPA said. "Clearly, a criminal prosecution at this time may well foreclose further investigation for safety purposes."

Published reports have said that Indonesian police have been conducting a criminal investigation that has not relied on the findings of the NTSC report, issued late in 2007. The reports said that, when the case goes to trial, NTSC officials could be called to testify as expert witnesses but that the accident report cannot be used in court.[3]

Voss said that proponents of aviation safety "can't say, just because it's aviation, that the justice department doesn't have the right to pursue an independent investigation, as long as it doesn't compromise safety processes or critical safety information.

"On one hand, we've got to be vigorous about protecting safety information, but on

Cases of Criminalization

The following are examples of dozens of cases in which pilots, air traffic controllers, civil aviation regulators and officials of aviation companies have been accused or convicted of criminal activity in connection with an aviation accident:

Jan. 20, 1992 — An Air Inter Airbus A320 was being flown on a VOR/DME (VHF omnidirectional radio/distance measuring equipment) instrument approach to Strasbourg, France, in night instrument meteorological conditions when it struck a snow-covered mountain ridge.[1] The impact was just below the top of the ridge and on the extended runway centerline. There was no indication of any problem before the crash, and the flight crew had complied with standard procedures until the airplane began descending at 3,300 fpm — instead of 700 fpm — to the Strasbourg VORTAC, 2 nm (4 km) from the airport.

In 2006, one air traffic controller and five current and retired aviation officials of Airbus, the French civil aviation authority and Air Inter — a subsidiary of Air France that since has been incorporated into the airline — were tried in criminal court on charges of involuntary manslaughter and acquitted. Airbus and Air France were found liable for the pain and suffering of the victims' families, but the court did not determine how much the two companies should pay, leaving that decision to a subsequent trial.[2]

May 11, 1996 — A ValuJet Douglas DC-9 crashed in Florida's Everglades about 10 minutes after takeoff from Miami International Airport, killing all 110 people in the airplane. The U.S. National Transportation Safety Board said that the accident resulted from a cargo compartment fire that began with the actuation of oxygen generators that were improperly carried as non-revenue cargo. Probable causes were the failure of a contract maintenance firm to properly package and identify the oxygen generators, ValuJet's failure to properly oversee its contract maintenance program for compliance with hazardous materials practices and the U.S. Federal Aviation Administration's failure to require smoke detectors and fire suppression systems in Class D cargo compartments.[3]

Two months after the accident, SabreTech, the contract maintenance firm that had handled the oxygen generators, and three of its employees were indicted on criminal charges. A jury acquitted the three mechanics; SabreTech was convicted and ordered to pay US$2.9 million in fines and restitution. An appeals court overturned the convictions in 2005.[4]

July 25, 2000 — An Air France Concorde burst into flames during takeoff from Charles de Gaulle Airport in Paris and crashed into a nearby hotel, killing all 109 passengers and crew and four people on the ground. The French Bureau d'Enquêtes et d'Analyses (BEA) said that the probable causes of the crash were the passage of a Concorde tire over a part lost by an aircraft that had departed earlier, the "ripping out" of a large piece of the fuel tank and the ignition of the leaking fuel.[5]

In 2006, France's highest court refused to dismiss criminal charges against a former official of the French civil aviation authority and two former officials of Aerospatiale, the company that built the Concorde. Aerospatiale was one of three companies that merged in 2000 to form the European Aeronautic Defence and Space Co. (EADS). Continental Airlines, the operator of the DC-10 that investigators said dropped a titanium metal strip on the runway, also has been placed under investigation in the matter.[6] A trial is not expected before 2009.

Sept. 29, 2006 — A Gol Linhas Aéreas Boeing 737-800 crashed into the Amazon after a midair collision with an ExcelAire Embraer Legacy 600 business jet.[7]

All 154 people in the 737 were killed, and the airplane was destroyed. The Legacy's crew maintained control of their damaged airplane and conducted an emergency landing at a Brazilian air base; none of the seven people in the business jet was injured. A Brazilian military investigation of the accident was continuing, but preliminary findings indicated that the two airplanes had been assigned to the same flight level and that air traffic control (ATC) stopped receiving signals from the Legacy's transponder nearly an hour before the collision. Radio communications between the Legacy and ATC had been interrupted until about four minutes before the accident, when the crew heard an ATC call telling them to change radio frequencies but received no response to their request for clarification.

The Legacy pilots were detained in Brazil for two months after the accident. In June 2007, the pilots and four air traffic controllers were ordered to stand trial for "exposing an aircraft to danger."[8] At press time, the trial had not begun. A subsequent report by the military investigators said that five military controllers were among those responsible for the crash and that "crimes were committed" that could result in the controllers' imprisonment, suspension or discharge. The report also criticized the Legacy pilots for "contributing to the accident by action or omission."[9]

— LW

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the other hand, we can't put ourselves ahead of justice."

Capt. Stephanus Geraldus, president of the Garuda pilots association, agreed, adding, "We are not against holding pilots accountable if there is a case to answer. But we want everything to follow international standards." That is "not the case here," he said.[4]

Standards set forth by the International Civil Aviation Organization (ICAO) say that discipline or punishment for people involved in an aviation accident or incident is appropriate only if evidence shows that the occurrence "was caused by an act considered, in accordance with the law, to be conduct with intent to cause damage, or conduct with knowledge that damage would probably result, equivalent to reckless conduct, gross negligence or willful misconduct."[5]

ICAO also says that the only objective of an accident or incident investigation should be to prevent future accidents and incidents, not to determine blame or liability of anyone involved in the occurrence — and, international aviation leaders say, not to supply data to criminal prosecutors.

"In situations of gross negligence or malfeasance, the judicial authorities need to pursue their own, separate investigation," Voss said. "The lives of future passengers depend on the vital safety information that is gathered during an accident investigation. If there is fear of prosecution, then the parties involved will be less inclined to be open during this investigation process."

The same sentiments were expressed in an October 2006 resolution approved by Flight Safety Foundation, the Royal Aeronautical Society, the Académie Nationale de l'Air et de l'Espace and the Civil Air Navigation Services Organisation.

The resolution said, "The paramount consideration in an aviation accident investigation should be to determine the probable cause of and contributing factors in the accident, not to punish criminally flight crews, maintenance employees, airline or manufacturer executives, regulatory officials or air traffic controllers. By identifying the 'what' and the 'why' of an accident, aviation safety professionals will be better equipped to address accident prevention for the future. Criminal investigations can and do hinder the critical information-gathering portions of an accident investigation, and subsequently interfere with successful prevention of future aviation industry accidents."[6]

In the months since approval of the resolution, prosecutors generally have become less likely to file charges against "people on the line," Voss said. Instead, the emphasis appears to have shifted to managers who were accountable for failed systems, he said.

"This is more consistent with what we talk about in good safety practices — the concept of accountable executives," he said. "However, it does still have a little bit of a chilling effect because it makes people in executive positions uncomfortable. … It's a thing that's hard to celebrate, but you also have to acknowledge that it probably reflects an emerging understanding of safety issues on the part of prosecutors."

In addition, he noted that the government agencies that investigate accidents have become increasingly likely in recent years to cite weak safety practices or safety cultures within aviation organizations among the causes, or contributing factors, of accidents.

Capt. Paul McCarthy, IFALPA's representative to ICAO, said that in cases in which aviation personnel have been prosecuted for negligence, judges and juries often have been reluctant to convict.

"There is recognition that it is fundamentally wrong to convict someone criminally for trying to do their job," McCarthy said. "We have several examples where pilots have been acquitted.

In each case, the pilot was attempting to respond to either a malfunction or highly unusual circumstance and got it wrong. Where there have been convictions, the circumstances have been far more political than legal."

Nevertheless, prosecutors often respond to the public's calls for retribution after an accident, he said.

Voss theorized that this trend may be associated with the public's increased desire for accountability in many areas of industry — not just in aviation.

"The whole issue of corporate accountability, both in the United States and in Europe, has become very large in the public psyche, and I think that's partially feeding some of this," Voss said.

For example, a Swiss court in September 2007 convicted four middle-level managers of Skyguide, the Swiss air navigation services provider, of negligent homicide in the midair collision of a Bashkirian Airlines Tupolev Tu-154M and a DHL Boeing 757 on July 1, 2002, near Überlingen, Germany. The same court acquitted four others, including air traffic controllers and technicians.[7,8]

After the verdict, the International Federation of Air Traffic Controllers (IFATCA) said that, although it was encouraged that the court had recognized that accountability was expected at all organizational levels, it nevertheless was "troubled … by criminalization of so-called human errors, whomever these errors may be attributed to. …

"IFATCA believes that all personnel should be held accountable for their decisions and actions in a safety-critical system. However, experience has shown that criminal prosecution makes no contribution to improving system safety."

In the future, McCarthy said in a presentation to a 2007 ICAO regional seminar, the public likely will continue to demand punishment of aviation professionals who are involved in accidents and incidents. Nevertheless, the public sentiment cannot be permitted to override "the fundamental principle that punishment does not improve safety" because the threat of punishment — which may deter intentional acts — has no effect on unintentional errors that lead to accidents, he said.

Actions that *do* improve safety include accident investigations, mandatory safety reporting schemes, voluntary reporting schemes, and flight operational quality assurance (FOQA) programs and similar data analysis programs, all predicated on a "just culture" — defined by ICAO as a culture that recognizes that personnel should freely share critical safety information without fear of punishment while also accepting that, in some instances, there may be a need for punitive action.

"If this standard is met for these [reporting] programs, it is almost certain that the prosecutorial standards will be limited to intentional acts," McCarthy said.

Emphasis on establishing a just culture within aviation organizations, in addition to avoiding the criminalization of accidents, is paramount, Voss agreed.

He said that, "for the sake of safety and a just culture, safety investigators, plus those who are being investigated, must have complete confidence in the integrity of the process."

Achieving that trust will be difficult, he said, noting that the public and government officials frequently favor prosecution of those involved in accidents.

"We need to be realistic," Voss said. "We're not going to get major changes in regulations, and we're not going to change any constitutions. We need to just talk to prosecutors so that they can do a better job of balancing the rights of individuals that are compromised as a result of an accident versus the needs of the public." ●

Notes

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8. After the collision, crews of both the Bashkirian Tu-154M and the DHL 757 lost control and the airplanes crashed, killing all 71 people aboard. Fifty seconds before the collision, the traffic-alert and collision avoidance system (TCAS) in each airplane warned of traffic. As ATC told the Tu-154 crew to descend, on-board TCAS resolution advisories (RAs) told the Tu-154 crew to climb and the 757 crew to descend. Both crews descended. At the time of the accident, a single Skyguide controller was on duty. Twenty months after the accident, the controller was stabbed to death at his home by the father of two children who had been passengers on the Tu-154.

   The German Federal Bureau of Aircraft Accidents Investigation, in its final report on the accident (AX001-1-2/02), said that the immediate causes were that the "imminent separation infringement" was not noticed in time by ATC and that the Tu-154 crew followed ATC instructions to descend "even after TCAS advised them to climb … contrary to the generated TCAS RA."

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Real Time Risk Management

A major opportunity to improve safety.

BY PETER V. AGUR JR.

Most of the time, two heads are better than one. Sometimes, however, two heads are not enough. When trip conditions are changing rapidly or the situation is far outside the norm, additional information and ideas that are timely and digestible can make the difference in effective risk management.

About a year ago, a corporate flight crew departed from Detroit for White Plains, New York, U.S., in their large-cabin aircraft. They had a team of their company's top executives aboard. Because neither Detroit nor White Plains was their home base, the crew did what most corporate aviation crews do every day — they self-dispatched.

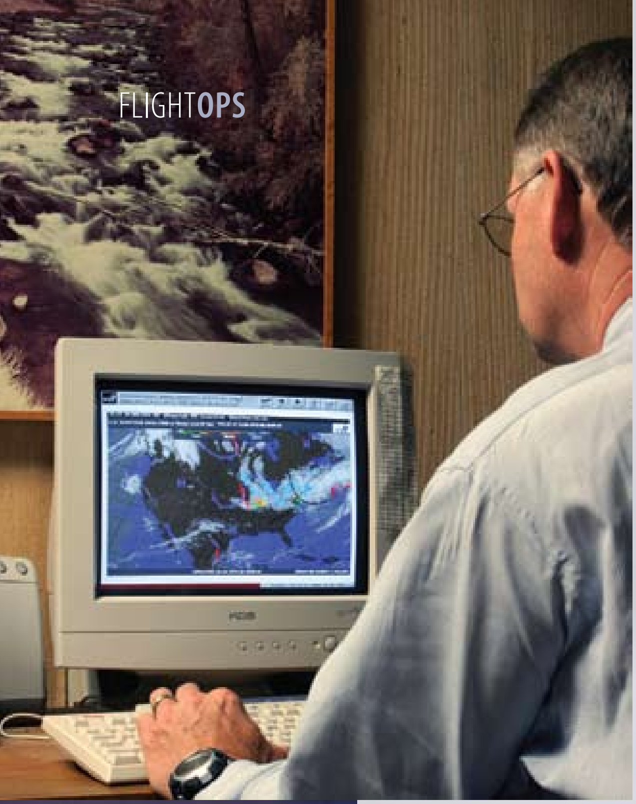
Their aviation department was certified as meeting the International Standard for Business Aircraft Operations (IS-BAO). As was their custom, the flight crew followed the format of the department's safety management system (SMS). They conducted a preflight analysis that included identification and assessment of risks for the trip, and development of risk-mitigation strategies and tactics.

Dominating their risk assessment that day was a dry, high-energy cold front that would pass through the White Plains area during their arrival window. They agreed to pay particular attention to the automatic terminal information system (ATIS) for White Plains and pull in other weather reports as they neared the New York area.

Unknown to the pilots, while they were en route, at least six commercial and corporate flight crews aborted takeoffs or landings at the Newark and Teterboro airports in nearby New Jersey due to extreme winds, wind shear conditions and strong low-level turbulence.

As the pilots neared the White Plains airport, the ATIS was reporting that the surface winds were gusty but less than 20 kt from about 60 degrees off runway heading. During their entry onto final approach, they noted that the winds at the outer marker were nearly 50 kt. At the middle marker, they asked for a wind check. The wind conditions reported by the tower controller were the same as the ATIS broadcast.

As they flared for touchdown, severe turbulence caused the aircraft to roll both left



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and right, requiring full aileron input to recover. Although it was a rough landing, no passengers were injured; they were all belted in, and their gear was properly stowed. However, during the postflight walk-around, the crew discovered that they had damaged a wing tip by ground contact during the landing.

The pilots considered themselves lucky that their surprise last-minute encounter with severe turbulence had not had more dire consequences. But, if their department had been using a *real time risk management* program, the crew likely would have been advised of the severe turbulence — and they might not have needed any luck at all.

Professional dispatchers constantly track weather and other critical variables that can adversely affect their flights.

Borrowing a Page

Real time risk management programs have been used for decades by the airlines. Professional dispatchers constantly track weather and other critical variables that can adversely affect their flights. When conditions warrant, the dispatchers contact the flight crews to alert them to what is happening, describe the potential risks and suggest mitigating options.

Many business aviation pilots take pride in the fact that they are not coddled like their airline counterparts. They aren't handed a briefing and a flight plan that tell them what to do and how to do it. Most business aviation pilots consider themselves problem solvers and jacks-of-all-trades.

Indeed, the vast majority of business aviation flight crews are on their own. They do their own preflight planning and preparation. They might even believe that they are ready for whatever comes their way. That sense of superiority and independence sounds like the gist of concerns that led to the emergence in the 1970s of crew resource management (CRM).

A few business aviation departments have discovered the power of additional support in their risk-mitigation and trip-management processes. Cox Enterprises in Atlanta is one of them. During a visit to their facilities last spring, I had the opportunity to see firsthand how they do it. One of their Hawkers was returning home from the Washington area. It was mid-morning, and lines of convective weather associated with a moist cold front were developing rapidly over the aircraft's route. Their licensed dispatcher, Dave Small, was tracking the flight and the weather on his high-definition display. He called the crew to recommend a routing change that would take the Hawker around the trailing edge of the weather.

The crew readily accepted the suggestion. It wasn't long before the original route became a mess, with other crews asking to divert due to severe turbulence and heavy precipitation. The Hawker crew reported that they completed the trip without a ripple. The Cox team had effectively identified a significant risk and mitigated it, in real time.

Home-Based Help

Following my observations of the Cox Enterprises processes, I talked with numerous members of other aviation departments about the use of home-based staff to support trip risk identification and mitigation. In general, two camps emerged: Those who wholeheartedly endorsed immediate implementation of the concept, and those who made excuses as to why it could not work in their departments because of the lack of staff.

Certainly, not every aviation department has a scheduler or a dispatcher. And many schedulers are not trained to interpret weather data effectively. But most departments have pilots who are.

For example, there is a department in Naples, Florida, that operates a single long-range aircraft without the services of a scheduler or dispatcher. But, for years, George Adams, the department's director of aviation, has acted as a resource to his crew when they are in the air. He routinely monitors weather, air traffic control (ATC) routing patterns, crew duty and workload issues, as well as anything else that may affect the safety or service of a trip. He communicates with the crew via voice and digital messaging to let them know what to expect, as well as to give them options to consider.

When the crew is making a return trip from Europe, for instance, Adams confirms that customs and quick-turn fuel arrangements are in place at the technical stop site. He assesses the crew's duty times, previous rest cycle and trip operating conditions to help them decide whether they should continue toward their maximum allowable duty day limits or to call it quits early. Based on their collaborative decision, he then further reduces the flight crew's workload by filing their flight plan for the next leg.

Best or Better

George Adams, Dave Small and several others have recognized that blending CRM and SMS has a very positive impact on trip outcomes. As the director of aviation, Adams did not have much difficulty implementing his program. He had the authority to do it. Small, a senior dispatcher, did not.

In 1999, Cox's department decided to elevate their operating standards to "best practices or better." Since then, they have implemented a number of changes, including improving the capabilities of their people through a variety of training and education initiatives. For instance, their schedulers are licensed dispatchers. They also have upgraded their office information systems to include real time flight tracking, digital weather displays and ground-to-air voice and digital communication links.

The impetus for Cox's decision to provide dispatcher support of trip crews was the ATC system shutdown in the aftermath of 9/11. It gave Small a heightened awareness of how the home-based Cox aviation team could be a powerful tool in support of crews during trips. Although Small clearly understood the opportunity right away, in the beginning, some of the department's captains did not. Nevertheless, with the endorsement of the director of aviation, he began to warn crews about the projected arrival of thunderstorms at their locations or destinations, ATC routing patterns and other factors that could impact trips and their planning.

Today, it is normal for Small to contact a crew en route to alert them about conditions they will encounter. They have come to value their dispatchers' information and suggested alternatives. Nevertheless, is very clear to the entire Cox team that the ultimate responsibility for the flight's decisions remains with the crew.

The real time risk management programs that Adams and Small implemented are rarely used by business aviation departments, but they have resulted in improved safety, service and efficiency. Implementing the programs required modest investments in hardware and software. And, like all things related to safety, the biggest challenges they faced were people-related.

Pilots have come to value their dispatchers' information and suggested alternatives.


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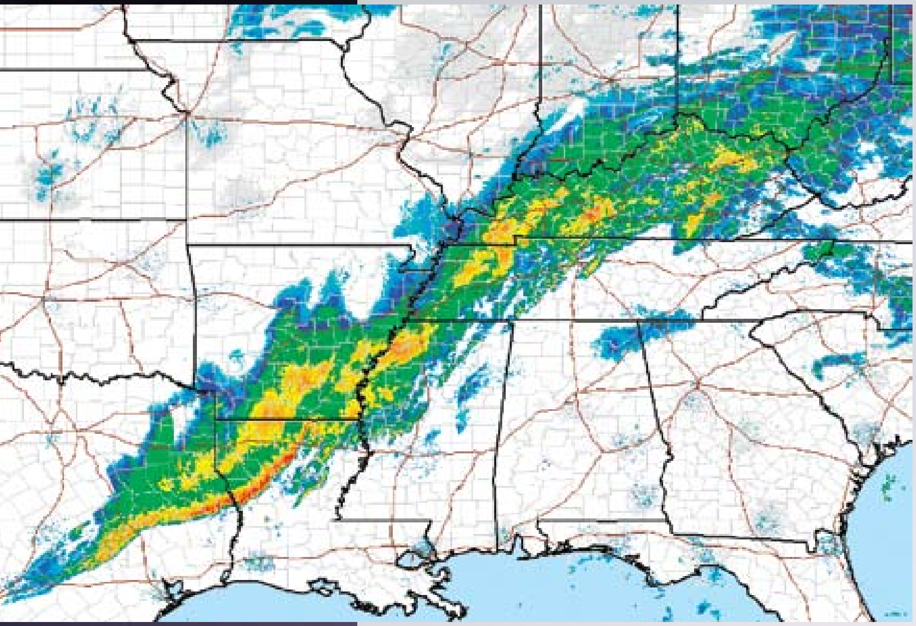
Small admits that his enthusiasm for supporting trips under way was not shared by all in the department. Some "old school" captains politely declined his offers of service in the beginning. But, over time, even the most independent souls were won over.

Safety Investment

During conversations with leaders and managers of aviation departments about the concept and practice of real time risk management, I have found a substantial number to be less than enthusiastic. The most often stated barrier was: "We don't have the people."

But, if you have a scheduler/dispatcher, you *do* have the people. If you have a pilot who is not directly involved with a trip, you *do* have the people. If you don't have a scheduler or a non-trip pilot, then you need even stronger on-board technology, such as an XM satellite weather uplink, to get every edge you can.



U.S. National Oceanic and Atmospheric Administration

You can arrange to have a certified meteorologist come to your department and provide a half day or more of introductory training on weather depiction.

And if you do have the bodies, you need to make certain that their heads and hearts are in the right places. Many schedulers are hired to be the customer's link with the department. They may not need any in-depth aeronautical knowledge and expertise when hired. But, if you have attended a National Business Aviation Association (NBAA) Schedulers and Dispatchers Conference, you know that these aviation professionals typically are bright, enthusiastic people on a quest to find ways to help their departments and their customers succeed. Real time risk management is right up their alley.

If you use a non-trip pilot as your risk identifier and solution adviser, you have a different set of opportunities. Is he or she appropriately trained and experienced to assess developing weather patterns? If not, you can arrange to have a certified meteorologist come to your department and provide a half day or more of introductory training on weather depiction technology and suggested sources of up-to-date information.

Some of the questions and concerns about real time risk management that I have heard are more administrative than substantive: "How are you going to get a pilot to do this on his day off?" "Won't we be interfering with the off-duty crewmember's rest cycle?"

The answer to the first question is relatively easy. Certainly, additional duties must be assigned equitably. As to the second question, quality of work/life does deserve strong consideration. The hierarchy of benefits to the department and its customers must be considered when establishing administrative processes that assure crew work/life balance. According to Adams, this is relatively simple in a smaller department operating one aircraft because there is only one trip at a time. Using his laptop computer and BlackBerry, he finds it easy to track the progress of a trip and to communicate with the crew while they are on the ground or in the air. Adams says that these tasks do not take much away from work or personal time.

Real time risk management improves the quality of operational safety and service. The biggest investment for most business aviation departments — whether managed or internal — is time. Those involved in business aviation should take a hard look at how real time risk management can be implemented in their department. When it comes to safety, there is no better time than now. ●

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

Quality Control *for* Pilots

An independent organization aims to set high, industrywide standards for new pilots.

BY CONSTANCE BOVIER

By now, virtually the entire aviation industry has heard the International Air Transport Association's estimate that the global demand for new commercial pilots will average 17,000 per year for the next 20 years. This figure far exceeds the current annual number of pilots who earn a commercial license with an instrument rating, the minimum credentials required to fly for hire. As Flight Safety Foundation President and CEO William R. Voss noted in his article about the Foundation's realigned priorities (*ASW*, 12/07, p. 16), the growing shortage of qualified personnel is emerging as a significant risk to the safety of the aviation system.

As the industry wrestles with this dilemma, the Professional Aviation Board of Certification (PABC; see sidebar) is proposing that pilot preparedness be tackled head-on by creating a globally accepted standard for training entry-level professional pilots.[1] PABC Executive Director Peter Wolfe explains that to be effective, such an international standard must be consistent with the new multi-crew pilot license (MPL) requirements (*ASW*, 12/07, p. 38) and be adaptable for use by the current extensive network of training programs that will continue to supply the industry for the foreseeable future.

Six different training paths now deliver pilots into commercial and business aviation cockpits (Figure 1, p. 26):

- The military;
- U.S. Federal Aviation Administration (FAA)/Industry Training Standards (FITS);
- Traditional;
- Bridge;
- Ab initio; and,
- MPL.

The MPL is the most recent, comprehensive, entry-level professional pilot training standard, created and approved by a large cross-section of international industry stakeholders. The other five training paths share no common standard, resulting in graduates whose knowledge, skills and competencies range from excellent to unacceptable.

Until the 1970s, most civilian-trained pilots followed the traditional path — especially in the United States, Canada and Australia — which enabled them to earn their private and commercial licenses, with instrument and multi-engine ratings, so they would be competitive when applying for the entry-level flying jobs of that era. Upon graduation, these new aviators typically added a flight instructor certificate to their résumés and flew any and all equipment to help build hours in their logbooks and accelerate their climb up the career ladder. Over time, however, a gap developed between the four licenses and ratings of the traditional track and the evolving needs of the industry. Recognition of this gap spurred development of other training paths, all of which, except MPL, are derivatives of the original traditional model.

Ab initio — a Latin term meaning “from the beginning” — was the first training method to include airline practices and procedures from the earliest stages. Ab initio courses introduce a wide range of air carrier operations while students earn commercial, instrument and multi-engine pilot qualifications. In most cases, these courses offer carrier- and type-specific training in support of a particular airline.

Bridge programs emerged in the mid-1980s to meet the increasing demand for pilots created by regional airlines. At first, bridge programs filled the gap between licensing — commercial, instrument and multi-engine certificates — and the needs of the industry by introducing supplementary training, consisting of a broad array of previously unaddressed subjects and skills needed to fly commercial and business aircraft. Today, a number of bridge programs introduce aspects of commercial and business aviation *during* the licensing phases. Generally — certainly in the United States — pilots are self-funded from the beginning of licensing courses through the completion of bridge programs, which increase candidate appeal to prospective employers and improve their ability to succeed in employers’ demanding new-hire training.

FITS and Starts

The FITS program, launched by the FAA in 2002, is the newest U.S. training path by which pilots can fulfill basic certification requirements. Like MPL, FITS encourages trainers to use the most advanced educational methods to turn out graduates who are highly competent in required flying skills and in general airmanship. Although FITS is in the early stages of development, it appears capable of delivering well-prepared applicants to the ranks of professional pilots, when training is augmented by courses addressing jet aircraft and commercial/business operations.

Military services around the world produce well-trained, experienced aviators who often transition into civilian flying careers. In the United States, military pilots receive FAA commercial and instrument certificates when they pass a written competence examination.

Figure 1 shows how most military, FITS, bridge and ab initio paths now offer supplementary courses to diminish the training gap and better meet industry needs.

Employers want pilot candidates who can begin classes already able to aviate, navigate and communicate, with a firm grasp of weather, the air traffic system, jet aircraft, high altitude and commercial flight operations, critical thinking skills, crew resource management, and threat and error management. Given the absence of stakeholder-defined and -approved standards, most training providers have been left to rely on their own judgment in selecting topics and determining their relative importance when designing courses.

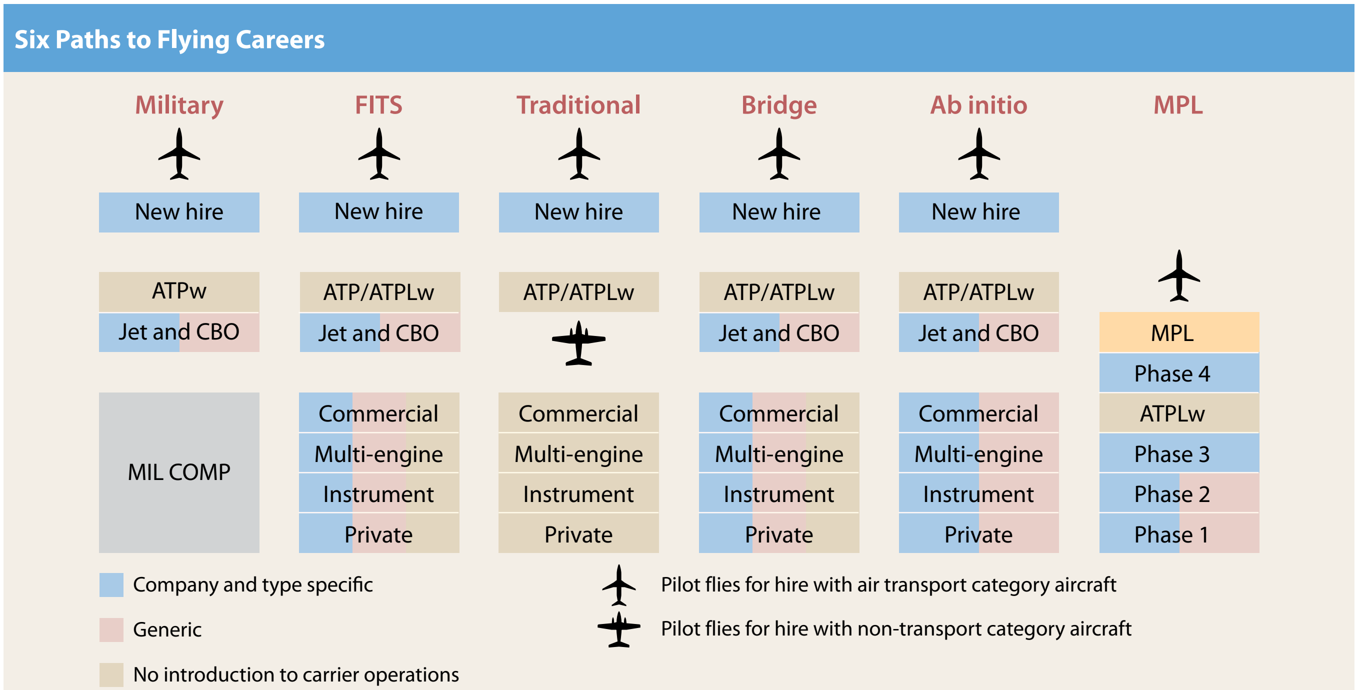
The irresistible attraction of the latest flight deck avionics for today’s computer-gaming youth explains why many vendors have emphasized this

Professional Aviation Board of Certification

The Professional Aviation Board of Certification (PABC) is a nonprofit U.S.-based corporation created to ensure the preparedness of pilots seeking professional careers in commercial and business aviation. This concept, rooted in discussions held in the mid-1990s by the Air Transport Association’s Operations Council, has been developed as an independent initiative without formal affiliation with any commercial or regulatory body. This frees PABC to address the overall interests of the aviation industry as its primary concern.

PABC Executive Director Peter Wolfe is a retired commercial and U.S. Air Force pilot and former airline executive and pilot trainer. The PABC board of directors and advisory council include representatives from seven stakeholder groups: employers, educators, pilots, government agencies, insurers, manufacturers and service providers, and the public. The board and council are currently expanding to reflect PABC’s international perspective.

— CB



New hire = aircraft and line qualification training provided by employer
ATP/ATPLw = successful completion of written tests required by the U.S. Federal Aviation Administration (FAA) for issuance of its airline transport pilot certificate and/or by International Civil Aviation Organization (ICAO) contracting states for issuance of their airline transport pilot licenses
Jet and CBO = jet aircraft and commercial and business flight operations course
MPL = multi-crew pilot license
Commercial = commercial pilot license
Multi-engine = multi-engine rating
Instrument = instrument rating
Private = private pilot license
MIL COMP = military competency: an FAA exam to earn commercial certificate and instrument rating
FITS = U.S. Federal Aviation Administration Industry Training Standards

Source: Professional Aviation Board of Certification

Figure 1

aspect of training in their curricula and marketing strategies. Employers, however, report an unbalanced result, with new hires often over-trained in advanced avionics yet lacking basic airmanship and instrument flying skills.

"We must confront these issues by creating a global training standard that is common among *all* training paths," says Wolfe. "PABC also believes that developing and maintaining such a standard should be a collaborative effort by government agencies and industry stakeholders."

Wolfe says that numerous aviation experts share this outlook, including executives, staff and members of the International Civil Aviation Organization (ICAO), the International Air Transport Association, the International Federation of Air Line Pilots' Associations, Transport Canada, the FAA, Airbus, Boeing, Alteon, CAE, Flight Safety Foundation, FlightSafety International, the Royal Aeronautical Society, airlines and collegiate aviation programs.

Failure Rate Up

Training managers from several U.S. organizations — who will speak only off the record, concerned that their remarks will erode customer confidence or alarm the public about the regional airline sector — say that the failure rate among new hires has risen as the flight experience of new hires has been reduced. Over the years, the failure rate hovered around 5 to 10 percent, but today the rate at some regional airlines has topped 20 percent.

Yet looking at failures shows only part of the story, because candidates with a great attitude who struggle because of shortfalls in their pre-employment preparation are often given extra training rather than being washed out. Extra training, like washouts, is costly to employers.

Because airlines have not established an industry-defined specification

Continued on p. 28

for pre-employment training courses, distributed such a standard to training vendors, or created any sort of quality control mechanism, the range of course quality is wide. Some so-called bridge courses simply "teach the test" — how to pass an employer's interview and flight check — while some others are poorly designed, taught or managed. The creation of a new baseline training standard will enable vendors, employers and students to compare cost and quality of course offerings against the performance of graduates.

MPL represents the most extensive update of pre-employment pilot training standards in over 40 years. MPL students do not earn private, instrument, multi-engine and commercial credentials. Instead, graduates must successfully complete a series of performance checks using various training devices and simulators, and must pass the airline transport pilot license written exam (ATPLw) or an equivalent test approved by the national aviation authority issuing the MPL license.

Until MPL programs are written, approved and implemented worldwide, the industry remains heavily dependent on the other five pilot career paths to fill work force requirements. Voss and Wolfe see an excellent opportunity for synergy during this transition, because both MPL and PABC support outcome standards for measuring the performance of pilot candidates.

The traditional metric for pilot evaluation, the flight logbook, while useful, is a poor measure of actual preparedness. "To be realistic, we'll always have to look at flight hours, because experience plays an important role in this, but we have to pay attention to what really matters — the competencies that we're trying to measure," Voss says. "I think we're much better now at developing the strategies to measure competencies than we were in the past, and we should go straight after that."

Peter Wolfe, PABC executive director (left), with FSF president and CEO William R. Voss.

J.A. Donoghue

As one part of such a system, PABC proposes that the ICAO standards and recommended practices (SARPs) be revised to encourage graduates of non-MPL training programs to take a common written exam to verify competence in prescribed subject areas.

Entry-Level Certificate

PABC's first goal is to create a global training standard consistent with the outcomes prescribed for MPL graduates. As the pool of pilot applicants continues to be fed by hundreds of training vendors, an independent certification exam for graduates becomes critical to attaining and supporting a predictable, quantifiable performance standard.

PABC envisions a common credentialing exam by which pilots prove that they have attained the entry-level standards for knowledge and competency that are defined by industry stakeholders. The exam's scope and depth are expected to be greater than many of today's licensing tests, and it will be upgraded regularly to keep up with changes in the industry. It will involve solving a number of scenario-based problems to assess the candidates' ability to apply their knowledge in practical situations. The resulting credential will also help employers screen applicants, while the underlying performance standards will support the design of new-hire training curricula for non-MPL pilots.

"The pilot shortage doesn't necessarily create a safety problem by itself unless we allow the shortage to compromise the level of competency that we require to operate an aircraft," says Voss. "We must proactively oversee the industry to make sure that pilot demand is not forcing standards below a safe level. There is no reason that industry can't come together to deliver a proposal to ICAO."

Such cooperative efforts, Wolfe and Voss believe, could greatly shorten the time to bring about essential changes needed to ensure the quality of the pilot work force for global air transport of the future. ●

Constance Bovier is a longtime aviation writer with special interests in pilot training and career development.

Note

1. The organization's Web site address is <www.pabc.aero>.

InSight is a forum for expressing personal opinions about issues of importance to aviation safety and for stimulating constructive discussion, pro and con, about the expressed opinions. Send your comments to J.A. Donoghue, director of publications, Flight Safety Foundation, 601 Madison St., Suite 300, Alexandria VA 22314-1756 USA or donoghue@flightsafety.org.

Close Call in Khartoum

BY MARK LACAGNINA

Confusion reigned when an A321 was flown below minimums in a sandstorm.

A navigation fix that was not where the flight crew thought it was, omission of standard callouts and a mix-up in communication about sighting the approach lights were among the factors involved in an unstabilized approach that was continued below the minimum descent altitude (MDA) in nighttime instrument meteorological conditions (IMC) at Khartoum, Sudan, on March 11, 2005.

The Airbus A321 "came hazardously close to the ground" before the crew realized their mistake and initiated a go-around, said the U.K. Air Accidents Investigation Branch (AAIB) in its final report on the serious incident. A few seconds later, when the aircraft was 125 ft above ground level (AGL), the terrain awareness and warning system (TAWS) generated a "TERRAIN, PULL UP" warning.

The report said that if the go-around had been initiated six seconds later, the aircraft likely would have struck the ground 1.5 nm (2.8 km) from the runway threshold. The TAWS warning occurred between 3.4 and 5.1 seconds after the go-around was initiated.

"Given that procedural triggers to go around had not been effective, it is of concern that the warning system may not have provided sufficient alert time to prevent an impact with the ground," the report said.

The TAWS was found to have functioned according to applicable design and installation standards. The system received position information from the A321's flight management and guidance system (FMGS) based on multi-sensor area navigation calculations.[1] The report said that position information received directly from

© Erich Ball

an on-board global positioning system (GPS) receiver is more accurate and results in more timely warnings.

Without a direct GPS feed, TAWS sensitivity is reduced when the aircraft is near the runway to prevent nuisance warnings that might be caused by less accurate position information. If the system in the incident aircraft had received position information directly from the on-board GPS and incorporated the latest software changes, a "TOO LOW, TERRAIN" warning likely would have been generated when the aircraft was at 240 ft AGL.

"CFIT protection technology has improved, but the required minimum TAWS standards have not."

"The current TAWS standards undoubtedly were appropriate at the time of implementation, and statistics show that they have significantly reduced the CFIT [controlled flight into terrain] risks, most likely saving many lives," the report said. "However, operational experience of indirect GPS installations that do not directly feed GPS quality data to the TAWS … has highlighted problems that have been addressed by the TAWS manufacturers but that are not required to be implemented.

"In essence, the CFIT protection technology has improved, but the required minimum TAWS standards have not. Thus, significant improvements in aviation safety in this area are available but not mandated."

Among recommendations based on the incident investigation, AAIB urged the European Aviation Safety Agency to work with industry on a review of TAWS design and installation standards "with particular emphasis on the timeliness of alerting when close to the runway." AAIB said, "Revisions to these standards arising from this review should apply [retroactively] to all aircraft currently covered by the TAWS mandate."

Airbus A321-200

© Adrian Pingstone/wikipedia.org

The A321 is a stretched version of the A320. The A321-200 has more fuel capacity, a higher takeoff weight and greater range than the -100. The incident airplane is an A321-231 that was built in 2002; it has International Aero Engines V2533-A5s rated at 146.8 kN (33,000 lb thrust), a maximum takeoff weight of 89,000 kg (196,209 lb) and a maximum landing weight of 79,000 kg (174,163 lb).

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

Sandstorm

The British Mediterranean Airways flight had originated in Amman, Jordan, at 2130 coordinated universal time (UTC; 2330 local time) with 19 passengers and eight crewmembers.[2] The commander, 46, had 7,400 flight hours, including 3,700 flight hours in type. The copilot, 39, had 4,700 flight hours, including 3,200 flight hours in type.

"The weather forecast for Khartoum, obtained before departure, had reported gusting northerly winds and reduced visibility in blowing sand," the report said. "During the cruise, and once they were in Sudanese airspace, the copilot asked ATC [air traffic control] for the latest weather report for Khartoum." The controller said that the surface winds were from the north at 20 kt and visibility was 1,000 m (5/8 mi) in blowing sand.

Runway 36 was in use. A notice to airmen advised that the instrument landing system (ILS) was not in service. The commander decided to conduct the VHF omnidirectional radio/distance measuring equipment (VOR/DME) approach. The Khartoum VOR/DME (KTM) is 0.6 nm (1.1 km) south of the Runway 36 approach threshold.

"Neither pilot had previously operated in blowing sand, and both were concerned about the possible implications," the report said. The pilots found no information about blowing sand in the airline's operations manual and used information about volcanic ash for guidance.

"As a result, the pilots discussed various possible actions, and the commander chose to select continuous ignition on both engines for the approach," the report said.

Although reported as blowing sand, the meteorological condition at Khartoum had the characteristics of a sandstorm. "Blowing sand is associated with strong winds which raise the particles above ground level but no higher than 2 m [7 ft]," the report said. "Sandstorms are usually associated with strong or turbulent winds that raise particles much higher." The operations manual recommended that pilots avoid flying in a sandstorm whenever possible.

Managed Approach

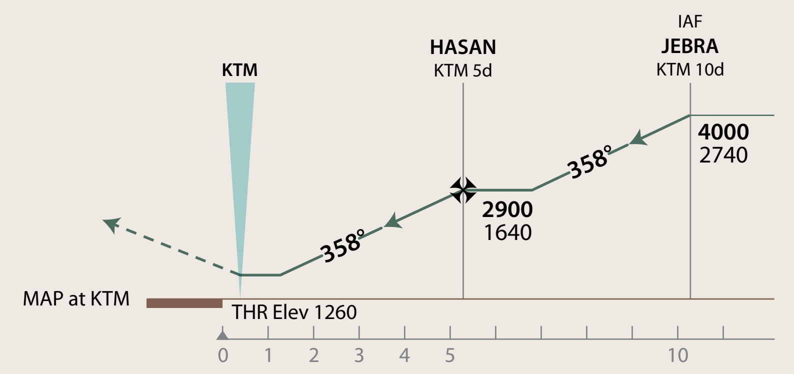
Another check with ATC on weather conditions at the airport indicated that visibility had improved to 3,000 m (2 mi). The commander decided to conduct a managed nonprecision approach (MNPA) to Runway 36. "This type of approach requires the autopilot to follow an approach path defined by parameters stored in the aircraft's commercially supplied [FMGS] navigation database," the report said.

At the time, however, the airline was in the process of developing MNPA procedures and had received authorization from a U.K. Civil Aviation Authority (CAA) flight operations inspector to conduct managed approaches only in visual meteorological conditions.

The commander had conducted managed approaches while flying for another airline. "Therefore, [he] did not consider it would be a problem, despite the fact that the reported visibility was below VFR [visual flight rules] limits," the report said. "The copilot's acceptance of this decision illustrates that neither pilot [realized] that not all the necessary safeguards were in place to conduct such approaches safely in IMC."

While setting up for the approach, the crew revised the MDA programmed in the FMGS database to 1,650 ft because the airline's standard operating procedures for a nonprecision approach required 50 ft to be added to the published MDA.

Charted Approach Profile



KTM = Khartoum VOR/DME (VHF omnidirectional radio/distance measuring equipment); d = DME distance (nm) from KTM; IAF = initial approach fix; THR Elev = Runway 36 approach threshold elevation; MAP = missed approach point

Source: U.K. Air Accidents Investigation Branch

Figure 1

The pilots were not aware that a discrepancy existed between the location of the final approach fix (FAF) depicted on their approach chart and the location programmed in the FMGS database. Approach charts and FMGS database updates were provided by different commercial vendors. The chart depicted the FAF, called HASAN, at "KTM 5d" — that is, 5.0 nm DME from KTM (Figure 1). The report said that this location resulted from the 2002 Sudanese *Aeronautical Information Publication* (*AIP*), which placed the FAF 5.0 nm from both the runway threshold and KTM. "By interpolating the depicted final approach gradient, the [chart vendor] determined that HASAN was actually 5.6 nm from the runway threshold," the report said. "This coincided with the KTM 5 DME position."

The FMGS database included a 2004 amendment to the *AIP* that placed the FAF 5.0 nm from the runway threshold and 4.4 nm DME from KTM.

"The pilots were unaware of [the] significant discrepancy between the approach parameters on the approach chart and those within the navigation database because they had not compared the two data sets before commencing the approach," the report said, noting that this omission was partly the result of the absence

The pilots were not aware that a discrepancy existed between their approach chart and the FMGS database.

of a formal U.K. CAA policy and clear guidance by the airline on how to conduct managed approaches.

'Late' Descent

The report said, "The pilots commenced the approach with the autopilot engaged in managed modes — that is, the approach profile being determined by the FMGS instead of pilot selections."

At 0025 UTC (0325 local time), the aircraft crossed the initial approach fix, JEBRA, at 4,000 ft, and then completed the procedure turn to the final approach course. During this time, the crew asked ATC for the current visibility and were told that it was between 1,000 m and 1,200 m (3/4 mi).

The crew said that the A321 was fully configured for landing and stabilized at the appropriate airspeed when it crossed the 5.0 DME location for HASAN depicted on the approach chart at 2,900 ft, the published minimum altitude for crossing the FAF.

The commander's input caused the autopilot to command a descent rate of 300 fpm, rather than a 3.0-degree flight path angle.

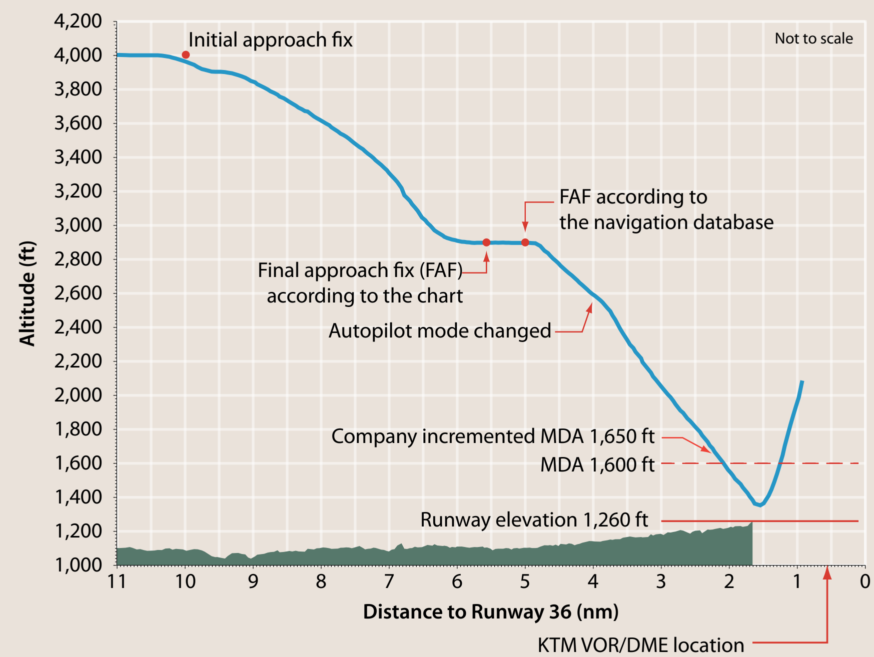
The managed approach was being conducted correctly by the autopilot based on the FMGS data. Thus, the aircraft did not begin the final descent at 5.0 DME, as the pilots expected (Figure 2). "The aircraft began its final descent 0.6 nm later than the pilots were expecting," the report said. "Believing the aircraft was high on the approach, the handling pilot [the commander] changed the autopilot mode in order to select an increased rate of descent."

The commander intended to establish the A321 on a 3.0-degree vertical flight path angle, which was equivalent to a descent rate of about 800 fpm at the selected airspeed. He mistakenly believed that the autopilot was in the track/flight path angle mode. The autopilot actually was in the heading/vertical speed mode, and the commander's input caused the autopilot to command a descent rate of 300 fpm, rather than a 3.0-degree flight path angle.

As the aircraft descended on final approach, it entered the sandstorm, and the crew's forward visibility decreased rapidly. "The commander described the effect of the sand as like watching iron filings flying past the windscreen," the report said. He also noted that the visual effect of the landing light reflecting off the sand was disorienting.

The copilot conducted a distance/altitude check at 4.0 DME and found that the aircraft was about 200 ft above the descent profile shown on the approach chart. "The commander stated that as the aircraft approached 3.0 DME, it became apparent that it was

A321 Flight Path



KTM = Khartoum VOR/DME (VHF omnidirectional radio/distance measuring equipment); MDA = minimum descent altitude

Source: U.K. Air Accidents Investigation Branch

Figure 2

not closing with the vertical profile, and so he increased the rate of descent to about 2,000 fpm," the report said. A few seconds later, he reduced the selected rate of descent to 1,200 fpm. "The pilot's selections resulted in a varying flight path angle that averaged about 4.5 degrees," the report said.

Lights in Sight?

The cockpit voice recorder (CVR) recording of the verbal communication between the pilots during the approach subsequently was overwritten. "It has not been possible to establish exactly what was said between the pilots at this time," the report said. "However, it is apparent that at some stage late in the approach, the commander asked the copilot if he could see the approach lights. The copilot mistook this question to be the commander stating that he could see the lights. As a result, the copilot informed ATC that they could see the approach lights and requested confirmation that they were cleared to land. The commander, hearing the copilot's transmission, took this to mean that the copilot had got the approach lights in sight."

Standard callouts were omitted, and neither pilot had the required visual references in sight as the A321 descended below 1,650 ft — about 390 ft AGL. "Had appropriate calls been made at the critical moments, they would have almost certainly prevented the confusion that allowed the aircraft to continue below MDA without the required visual references," the report said.

The commander looked up and saw lights at the one o'clock position but realized that they were not the approach lights. A note on the approach chart cautions pilots against "confusing local street and bridge lighting with approach and runway lights."

The misidentified lights and the disorienting effect of the blowing sand prompted the commander to initiate the go-around at about 180 ft AGL — 210 ft below the MDA. He advanced the throttles to the takeoff/go-around power setting, which automatically engaged the autopilot go-around mode. During this process, the aircraft sank to 125 ft AGL, where the TAWS "TERRAIN, PULL UP" warning was generated. "The commander reported that he noted the aircraft's attitude was 5 degrees nose-up, so he pulled back on his sidestick with sufficient force to disengage the autopilot and increase the pitch attitude to between 17 degrees and 20 degrees nose-up," the report said.

The commander pulled the sidestick about halfway back, instead of all the way back, as required by the emergency procedure for responding to the TAWS warning. He told investigators that he believed he already was "overpitching the aircraft." Nevertheless, the report said, "By nature, any [TAWS] terrain warning requires prompt and decisive action, and the protections built into the aircraft's flight control system allow for the application and maintenance of full back sidestick until the warning ceases."

Two More Tries

During the missed approach, the commander briefed the copilot for another approach. He decided not to conduct another managed approach but to use raw data and selected autopilot modes. "The pilots also decided to leave the landing lights off for this second approach to prevent the disorienting effect of light scattering off the sand," the report said.

During the second approach, the pilots did not have the approach lights in sight at the missed approach point, KTM, and another missed approach was conducted at 0049 UTC. "While carrying out the go-around, the commander could make out the running strobe lights below and stated that the aircraft passed slightly to the right of them," the report said.

The pilots told investigators they became aware that the crew of another aircraft had conducted the ILS approach and landed on Runway 36. However, when they tuned the ILS frequency, they found that a test code was being transmitted, indicating that the ILS must not be used for an approach. The crew decided to conduct another VOR/DME approach.

"While maneuvering, they heard the pilots of another inbound aircraft ask Khartoum Tower to confirm that the visibility was now 200 m [1/8 mi]," the report said. "When this reported visibility was confirmed, the copilot immediately questioned the tower controller about the current visibility at Khartoum. The initial reply from the controller was that the visibility was 900 m [between 1/2 and 5/8 mi], followed quickly by a correction to 800 m [1/2 mi] and then a further correction by the controller to 200 m."

The commander broke off the approach at 4,000 ft and diverted to Port Sudan, where the aircraft was landed without further incident at 0214 UTC (0514 local time). ●

This article is based on U.K. AAIB Aircraft Incident Report No. 5/2007 (EW/C2005/03/02).

Notes

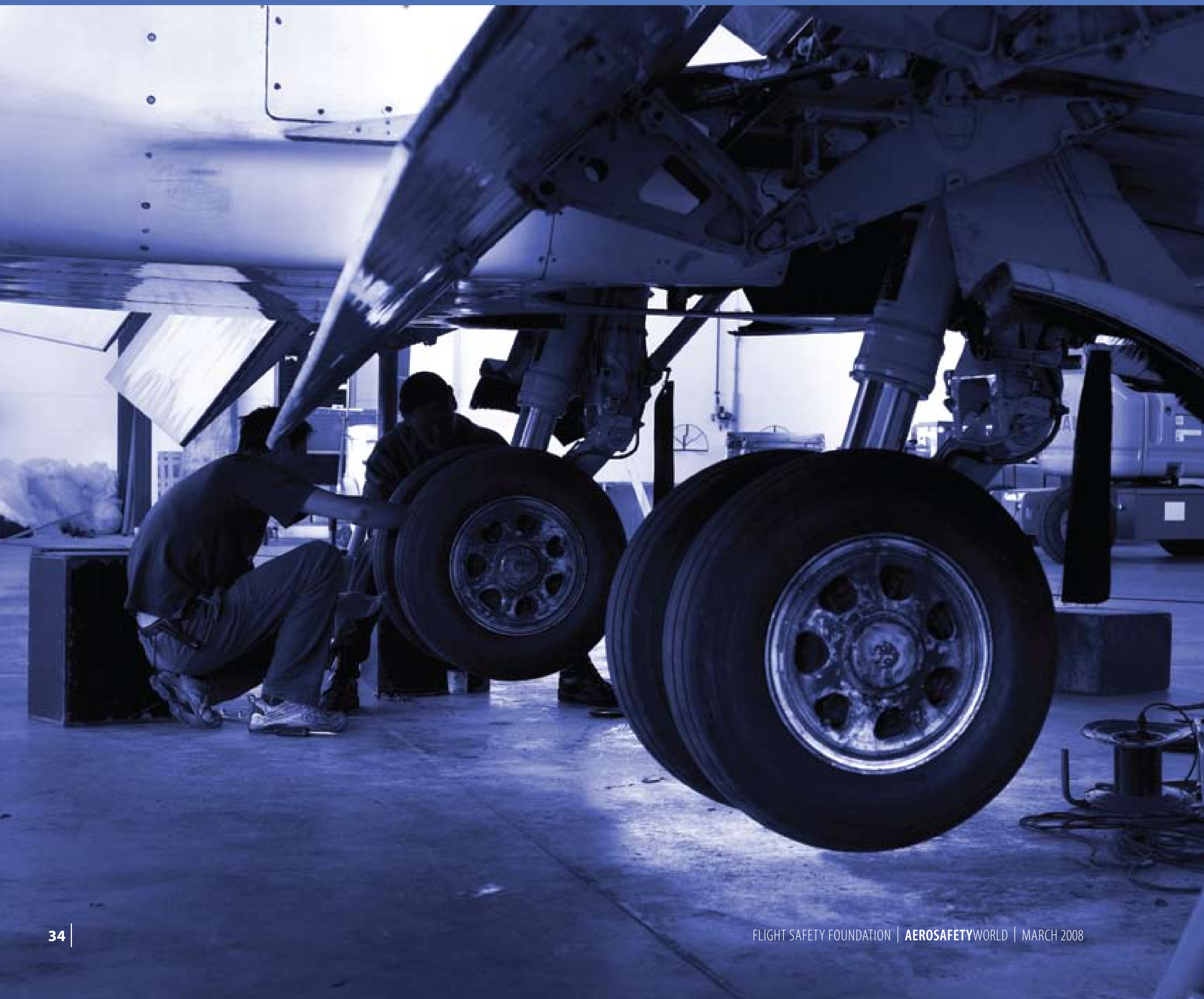
1. FMGS is an Airbus term. Flight management system (FMS) is another term used to describe the equipment.
2. British Mediterranean Airways was founded in 1994 and operated as a British Airways franchise until 2007, when it was acquired by the U.K. airline bmi.

Human Factors in MAINTENANCE

Surveys reveal the importance of regulations mandating human factors programs.

BY WILLIAM B. JOHNSON AND CARLA HACKWORTH

Despite the existence of human factors programs in aviation maintenance since the late 1980s, such programs are not required throughout the world, and those that do exist are far from standardized. In 2006 and 2007, the U.S. Federal Aviation Administration (FAA) conducted two large-scale surveys that gave the international maintenance community and FAA aviation safety inspectors (ASIs) an opportunity to report progress and identify



> **Continental Airlines in 1989 became the first to expand CRM and human factors principles to maintenance and engineering.**

© Tomas Bercic/iStockphoto

the human factors issues that need immediate attention. High response rates and frank answers to the surveys gave a clear view of the status and showed the direction future work should take.

During the 1980s, many flight organizations were enhancing safety by adopting cockpit resource management (CRM) programs. Flight crews were finding means to ensure and improve safety by focusing on teamwork, communication and developing operating procedures. The term evolved to become "crew" resource management and expanded to include a variety of human factors that affect performance and safety, such as fitness for duty, fatigue, nutrition and health, safety culture, and much more. There is no question that CRM has improved the safety of flight.

In 1988, the Aloha Boeing 737 fuselage-failure accident was the first of a number of significant events that focused attention on human factors in maintenance. That year, the U.S. Congress passed the Aviation Safety Act, which directed the FAA to conduct research on all aspects of human performance in aviation, including maintenance, launching the development of FAA's maintenance human factors research programs that continue today.

Continental Airlines in 1989 became the first to expand CRM and human factors principles to maintenance and engineering, introducing its Crew Coordination Concepts program. By the early 1990s, US Airways, with significant FAA research and development (R and D) participation, began its Maintenance Resource Management effort. Both programs continued for years, but without regulatory requirements to continue, they faded away when lean times arrived for the U.S. carriers.

By the mid-1990s, Transport Canada (TC), the U.K. Civil Aviation Authority and the FAA started an annual conference titled "Human Factors in Maintenance and Inspection." That conference provided excellent information exchange until 2002, when it took a hiatus until 2006. During that period, both TC and the Joint Aviation Authorities — now being replaced by the European Aviation Safety Agency (EASA) — enacted regulations requiring initial and continuing human factors training for all maintenance personnel. At the same time, the FAA continued its human factors R and D, publishing extensive human factors guidance materials for U.S. domestic and international applications. The FAA also initiated human factors training for all of its nearly 1,800 ASIs. An expanded version of that training continues today. Yet, in spite of the extensive R and D, guidance material and internal employee training, the FAA has not issued a regulation requiring the industry to provide training for human factors in maintenance.

Regulatory Differences

Meanwhile, TC, EASA, the Civil Aviation Safety Authority of Australia and other regulatory agencies have adopted regulations for maintenance human factors programs. That situation prompted the authors to assess the status of human factors programs in maintenance organizations and airlines throughout the world. In addition, the FAA wanted to understand maintenance human factors in the United States as viewed by its ASI work force.

Both surveys, developed in cooperation with the EASA's European Human Factors Working Group, were Web-based, and respondents' answers were anonymous.[1] The industry questionnaire contained 78 items; the FAA survey had 45 questions. For the most part the surveys used five-point rating scales and provided open-ended opportunities for comments. The surveys discussed here are more fully described separately.[2,3,4]

The goals of the industry survey were to assess the current status of human factors programs, including:

- Training;
- Fatigue management;
- Leadership commitment;
- Error report systems;
- Use of technical documentation; and,
- Program cost justification.

And, most importantly, the survey was designed to assess the differences between mandatory and voluntary programs.

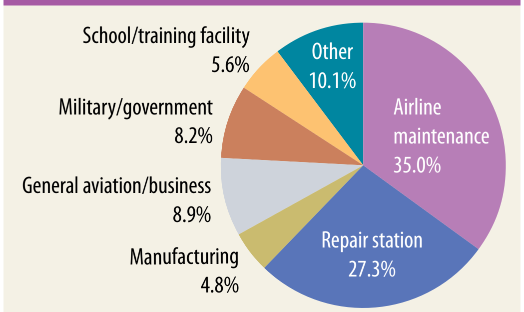
The international industry respondents had a lot to say. The invitation was sent to more than 600 valid e-mail addresses. Responses numbered 414, an unusually high 66 percent response rate, and included input from management, quality control, training and labor representatives in 54 countries. The highest percentage of respondents — 40 percent — worked within the United States. Some of the other countries included Canada, 9 percent; United Kingdom, 7 percent; and Australia, Norway and Singapore, all 3 percent.

The survey sample spanned the entire aircraft maintenance industry, with more than one-third from an airline maintenance department, 27 percent from repair stations, 9 percent in a general aviation/business operation, and 6 percent at a training facility or maintenance school. While specific respondent affiliation was secure and anonymous, it is estimated that approximately 200 organizations responded (Figure 1).

FAA-regulated maintenance operations were the most numerous, followed by those governed by EASA rules (Figure 2).

Regulations that require human factors programs make a difference, respondents said. To a question regarding the motivation for human factors programs, the two responses most frequently selected were flight safety and worker protection, followed by regulatory compliance and cost control.

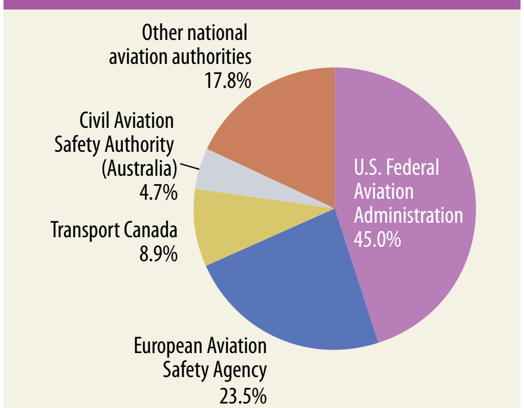
Employment of Respondents



Source: William B. Johnson and Carla Hackworth

Figure 1

Respondents' Primary Regulatory Authority



Source: William B. Johnson and Carla Hackworth

Figure 2

While these responses reflect positively on the industry, results from this question likely were skewed by the high percentage of FAA-regulated respondents, who are not required to have a program. However, answers to further questions showed that those who had to comply with regulations indicated their programs were more robust, provided better training for instructors and trained higher percentages of staff.

But human factors programs go beyond regulations. The survey inquired about many aspects of a total human factors program, including topics such as use of error management systems, fatigue management and training, cost justification of human factors programs and technical documentation systems.

Some 55 percent of the respondents reported that error data were stored in a database, and less than half of all those responding said their database was reviewed in a proactive manner. In this day of increased attention to safety management systems (SMS), a data-driven process, that number is not high enough. The response indicates that there is plenty of opportunity for improvement and reinforces the idea that the collection of data, while challenging, is easier than data analysis. The SMS challenge is to discover what the data are telling us.

Fatigue is a safety issue in maintenance, according to 82 percent of the respondents. However, only 25 percent had a fatigue management system, and just 36 percent covered fatigue in the training program. This discontinuity between recognizing the fatigue threat and establishing barriers is alarming, and it was repeated in the inspector survey.

Less than 10 percent of respondents reported that an effort had been made to show a return on investment in human factors programs even though 51 percent said such information was important. Clearly, the industry must improve methods to assess the financial return on human factors programs if such programs are to flourish and expand beyond minimum regulatory requirements. The lack of justifications helps explain why the apparently successful voluntary programs from the early 1990s became victims of hard financial times. Those programs "felt" good, but did not take the time to prove their financial worth.

More than 70 percent of respondents' companies had a formal or informal policy to apply human factors considerations to the development or modification of documentation.

Proper use of technical documentation remains a very high priority for the industry. Failure to follow procedures is the no. 1 cause of most negative events, and human factors issues are often a root cause of documentation events. When people do not use documents correctly, event investigations must drill down to discover the reasons, not just assign blame. Effective use of error reporting systems is a very good way to raise human factors-related attention to technical documentation and procedures.

The industry survey indicates that the following are the best opportunities for improving how human factors are handled in maintenance:

- Use of event reporting data, creation of a fatigue management program;
- Increased use of data to provide cost justification of human factors programs; and,
- Greater attention to the human factors aspects during the development and use of technical documentation and procedures.

Inspectors and Human Factors

The second survey, completed in 2007, focused on the FAA inspector work force. The FAA survey had these goals:

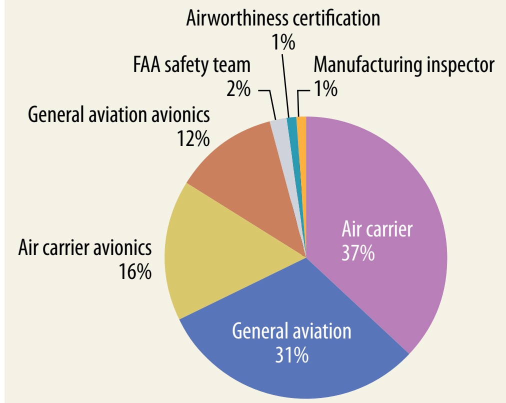
- To gather opinions regarding the perceived level of human factors knowledge among the ASI work force;
- To assess the level of human factors support for ASIs;
- To obtain an inspector's view of human factors programs in the industry; and,
- To identify workplace challenges both for the aviation maintenance industry and the FAA.

The inspectors capitalized on the opportunity, and the survey obtained approximately 180 open-ended comments.

As with the industry survey, there was a high response rate. The voluntary participation by more than 800 ASIs meant that nearly 45 percent of FAA's inspectors participated.

The inspectors generally were evenly divided between the airlines and general aviation, with the airline group slightly larger (Figure 3). More than 80 percent of the respondents performed surveillance as part of their job and had maintenance experience in excess of 20 years. Some 44 percent of the inspectors reported that the companies they oversee comply with EASA rules with respect to human factors. Thus, the FAA ASIs are seeing a lot of human factors programs, but not because of FAA regulations.

Aviation Safety Inspector Specialty Mix



Source: William B. Johnson and Carla Hackworth

Figure 3

A high percentage of FAA inspectors, 64 percent, said the human error investigations they see in the U.S. industry tend to be informal. In a separate item, 12 percent of the ASIs said their operators had implemented human factors practices to "a considerable extent" or "a great extent." The informality of the programs may be reasonable because good programs are not necessarily highly structured. Instead, they should be designed to fit the company culture and requirements derived from error reporting systems.

Failure to follow procedures is the no. 1 cause of most negative events, and human factors issues are often a root cause of documentation events.

The 12 most common causes of human error in maintenance, named the "Dirty Dozen" by Canadian safety specialist Gordon Dupont, were presented for inspectors to rank the challenges (Figure 4, p. 39). The top three for maintenance were pressure, complacency and the use of norms — that is, the use of unwritten practices. The combination of these top-rated causes of error can contribute to the failure to use technical

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Gordon Dupont's Dirty Dozen

The most common causes of human error:

- Lack of communication
- Lack of teamwork
- Norms
- Pressure
- Complacency
- Lack of knowledge
- Lack of awareness
- Lack of resources
- Distraction
- Assertiveness
- Fatigue
- Stress

Source: William B. Johnson

Figure 4

documentation, which surprisingly was rated only as the fifth on the inspectors' rating of challenges despite the fact that documentation issues are unarguably the leading contributor to maintenance error.

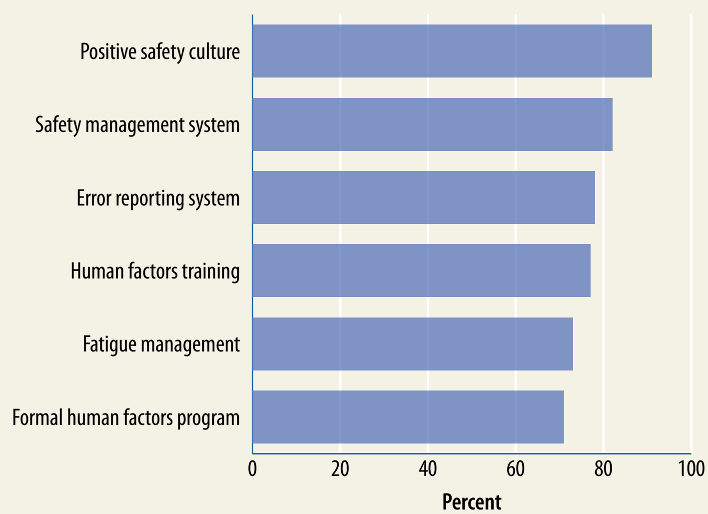
FAA inspectors rated the important attributes/programs for a quality maintenance organization and overwhelmingly identified a positive safety culture — 91 percent — and an SMS — 82 percent — as the most important (Figure 5). FAA management, especially from the Aviation Safety office (AVS), has been "walking the walk" with respect to safety culture and SMS, evidenced by the organization's recent ISO9000 certification and establishment of a new office dedicated to gathering, analyzing and sharing data.

Fatigue is a concern for the aviation industry.[5] Nearly 40 percent of ASIs responded that maintenance employee fatigue is a safety issue for the operators they oversee. Airline inspectors saw this as a greater issue — 43 percent — than did general aviation (GA) inspectors — 35 percent. Both categories of inspectors reported a need for regulations related to fatigue issues in maintenance, 91 percent for airline ASIs and 75 percent for GA inspectors. The FAA has ongoing research initiatives that are providing guidance and procedures to address fatigue in the maintenance workplace. This R and D involves a planned mix of approaches addressing issues including the science of fatigue and sleep, applications for nano-technology sensors, real-time human performance modeling, advanced technology scheduling practices, economics of maintenance worker compensation practices and accident investigation analysis related to fatigue.

The FAA's three-day employee course, "Human Factors in Aviation Maintenance," is now required training; half of all airworthiness ASIs attended the previous two-day class. Two-thirds of the respondents indicated that they want biennial recurrent training in human factors; EASA requires biennial recurrent training for its certificate holders.

During 2006 and 2007, FAA released two operator's manuals for human factors, one for maintenance that received the FAA Administrator's Plain Language Award for 2006, and the other a report for airport operations.[6] ASIs

Ranking Importance of Maintenance Safety Programs



Note: Results from survey of FAA safety inspectors

Source: William B. Johnson and Carla Hackworth

Figure 5

indicated a limited familiarity with the maintenance operator's manual, suggesting that the FAA must not only publish guidance materials but also promote them both internally and externally.

Inspectors used the "Dirty Dozen" to rate their own job challenges, and selected distraction, lack of resources and pressure as their greatest challenges. There were many comments providing positive suggestions to improve inspectors working efficiency. Inspectors recognized the emerging requirement for additional oversight of domestic and international repair stations and said they knew that inspectors face a workload that is growing faster than the work force.

Inspectors said that there should be an FAA regulation for human factors programs, with 80 percent of airline inspectors and 72 percent of GA inspectors backing the idea. Their positions were reinforced by numerous comments that generally said that airline maintenance organizations are driven by regulations and will invest resources to follow the rules. When there are human factors regulations, there will be compliance by all. Until then, human factors programs will exist only where there are EASA certificates and/or enlightened U.S. maintenance organizations.

Combining Survey Data

The high rate of response to both voluntary surveys was evidence of a high interest in maintenance human factors. Respondents had positive attitudes and reported what they believed were the best opportunities for improvement. FAA inspectors were generally positive in their rankings and candid in their responses about maintenance human factors. Their comments demonstrated an understanding of the impact of human factors programs in maintenance organizations. Many of the comments originated from the ASI's past employment in the airline maintenance industry.

There was general agreement between the two surveys that the no. 1 challenge is fatigue in maintenance. Throughout the world, the rules addressing fatigue are not strict. There are exceptions, usually due to national labor law. That leaves the responsibility of addressing fatigue challenges with companies, labor organizations and individuals.

A strict regulation regarding duty time may not be the best solution for everyone. The issue crosses a variety of domains, including but not limited to science, health, fitness for duty and safety, plus significant corporate and personal economic issues. One size does not fit all.

The industry must not wait for regulators to issue a mandate. Tools are available that organizations can use to assess the potential impact of their scheduling practices on fatigue and performance. Industry must step up to professional reviews of scheduling patterns, managing shifts and tracking duty time, plus beginning to recognize fatigue as a valid reason to miss or stop work.

Additional opportunities for improvement, depending on company and country, may include the following: increased use of error reporting system data; application of systems and data to cost-justify human factors programs; improved training for human factors trainers; improved systems for technical documentation; and more. The international movement toward a formal SMS environment is a step in the right direction. It is critical that SMS never lose focus on the most important link in the safety chain, the human. ●

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Notes

1. Nearly 1,500 safety professionals worldwide contributed to these surveys. The research was a joint effort of the FAA Civil Aerospace Medical Institute (CAMI) at the Mike Monroney Aeronautical Institute, Oklahoma City, Oklahoma, U.S., and the Maintenance Division of the Flight Standards Service, Washington, D.C. Flight Standards participants were John J. Hiles and David Cann. CAMI team participants were Kali Holcomb, Joy Banks, Melanie Dennis and David Schroeder.

2. Hackworth, C.; Holcomb, K.; Dennis, M.; Goldman, S.; Bates, C.; Schroeder, D.; Johnson, W. (2007a). "Survey of Maintenance Human Factors Programs Across the World." *The International Journal of Applied Aviation Studies*, Volume 7, Number 2, 212–31.

3. Hackworth, C.; Holcomb, K.; Dennis, M.; Goldman, S.; Bates, C.; Schroeder, D.; Johnson, W. (2007b). *An International Survey of Maintenance Human Factors Programs* (Report No. 07/25). Oklahoma City, Oklahoma: FAA CAMI.

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5. U.S. National Transportation Safety Board (2006). *Most Wanted Transportation Safety Improvements, Federal Issues. Aviation: Reduce Accidents and Incidents Caused by Human Fatigue.* <www.ntsb.gov/recs/mostwanted/aviation_reduce_acc_inc_humanfatig.htm>.

6. Human factors manuals are available at <www.hfskyway.com>.

THERMAL

BY WAYNE ROSENKRANS

New guidance for extinguishing lithium-battery fires is on the way.

The proliferation of portable electronic devices that passengers carry aboard airliners would increase the risk of in-flight fires, it was thought, but airline pilots and flight attendants in the United Kingdom since 2003 have been reassured that the extinguishing agents normally aboard their aircraft would be up to this firefighting task. However, recent experience and research seem to indicate that the "all's well" take of the underlying research report issued by U.K. Civil Aviation Authority (CAA) is not entirely justified.

The report said in part, "Based on the information, design knowledge and expertise provided by [the research contractor] regarding the in-built safety devices used in lithium-ion battery packs, together with past in-service experience, it is considered that the likelihood of an incident (i.e., smoke, fire or explosion) involving a portable electronic device with a lithium-ion battery pack is relatively low. However, [if there were such a fire,] the fire extinguishers available to the flight [crew] and cabin crew have been shown by test to be effective in extinguishing the fire."[1] Although lithium battery–specific firefighting techniques were not covered, this report built a foundation for the updated techniques expected later in 2008 from a joint effort by the CAA, U.S. Federal Aviation Administration (FAA) and three other civil aviation authorities.[2]

A few airline crewmembers have reported their need for such enhanced guidance. A Boeing 737 captain said in March 2007 — after conducting a diversion and landing without further incident — "My reason for this report is a needed change to the 'Cabin Smoke From An Unknown Source' checklist. We obviously isolated the situation [a lithium-ion battery in a laptop computer overheated during in-flight charging from an in-seat power supply port] by turning off the power ports as part of the checklist. My concern is that if a laptop [computer] is in the overhead bin and spontaneously combusts, we will never know [that the source of smoke/fire] is not the airplane. The flight attendants' [checklist] or our checklist should have a place to require all passengers with battery-powered devices of any kind to locate them and inspect them during an emergency of this type."[3]

Another airline pilot, traveling in June 2007 as a passenger, used a

U.S. Federal Aviation Administration

U.S. Federal Aviation Administration

magazine when asked to handle a nearby passenger's 9-volt battery, which the pilot believed to be an "alkaline battery … [with increasing] heat of an intensity which would blister skin," placed the battery in a cup of ice in the aft galley and notified the aircraft captain by interphone. The pilot-passenger later said, "Passengers carrying on batteries which have overheated have become a cabin safety issue. A large laptop [computer battery] overheating could present increased problems. Question: Is there adequate flight crew guidance available in pilot and flight attendant manuals on procedures to handle an overheating battery in the cabin? Is placing the battery in ice the proper procedure?"[4]

Despite no passenger airliner accident caused in the intervening years by a lithium-battery fire, the U.S. National Transportation Safety Board (NTSB) has reiterated concerns based on its investigation of the UPS Flight 1307 accident, in which the airplane was destroyed by fire after landing and three flight crewmembers received minor injuries during evacuation, and its awareness of incomplete and inconsistent aviation battery-incident data.[5]

U.S. Federal Aviation Administration

U.S. National Transportation Safety Board

RUNAWAY

NTSB's work since 2006 has torpedoed a few comfortable assumptions: that the probability of such fires is low because of the safety systems designed into most of these batteries; that passengers heed battery makers' safety warnings against battery misuse/abuse and comply with applicable regulations; that extinguishing agents can put out equally all types of lithium-battery fires; and that flight attendants can respond proficiently to a potential or actual thermal runaway — the characteristic of special concern in these fires.

"The issuance of the safety alerts and advisories [by the Pipeline and Hazardous Materials Safety Administration (PHMSA) of the U.S. Department of Transportation (DOT) and FAA] and the new, more stringent requirements [by PHMSA effective in January 2008] demonstrate the growing awareness and concern within the DOT and the airline industry over the air transportation of primary [nonrechargeable] and secondary [rechargeable] lithium batteries and electronic equipment containing such batteries," NTSB said in the final accident report (Table 1, p. 44).

Lithium Battery Basics

Lithium-ion battery refers to a rechargeable type that contains lithium as one element of chemical compounds but no metallic lithium in its elemental form. Lithium-ion batteries typically power consumer electronics such as laptop computers, mobile telephones, music/video players,

Left, overheated lithium-ion cell releases flaming electrolyte; six cells burned in a carry-on spare laptop battery. Above, a thermal runaway charred a JetBlue Airways overhead compartment; one of the laptops shipped on UPS Flight 1307.

A Growing Understanding of Lithium Battery Risks to Airliners

Date	Battery	Occurrence/Report	Significance
1976–1983	Lithium (unspecified)	After adopting approved battery designs first marketed in 1970, the U.S. Navy reported six injuries and one death.	Launched in 1982, the Navy's Lithium Battery Safety Program currently provides a technical manual of specifications and procedures, safety-performance testing requirements for cell/battery approval, safety-data packages and training.
May 1994	Lithium-metal	Loose button-size batteries in a box emitted smoke and showed fire damage during transport by truck.	The U.K. Civil Aviation Authority (CAA) noted that these batteries were destined for shipment as cargo on a passenger flight from London Heathrow Airport; the resulting safety focus was on the absence of protection against short-circuiting.
April 1999	Lithium-metal	A total 120,000 batteries on two cargo pallets burned after being removed from a passenger flight and then mishandled/dropped on the apron at Los Angeles International Airport.	Airline employees' initial attempts to extinguish the fires with portable fire extinguishers and a fire hose failed; flare-ups recurred each time the fire appeared to be extinguished. No external ignition source was found. The U.S. National Transportation Safety Board (NTSB) called for evaluation of lithium battery issues and appropriate measures to protect passengers and aircraft.
July 2003	Lithium-ion	U.K. researchers tested some of the most common battery packs used in portable electronic devices carried into aircraft cabins.	The report for U.K. CAA found "the likelihood of an incident (i.e., smoke, fire or explosion) … is relatively low." The test results "verified the effectiveness of existing fire-extinguishing agents in coping with a lithium-ion battery fire."
August 2004	Lithium-ion	Smelling smoke during loading, handlers repositioned a cargo container from a freighter to the ground; one of two 136-cell battery modules soon ignited.	NTSB said the probable cause was the failure of unapproved packaging, which was inadequate to protect the modules from short circuits during transportation. This 2005 report cited 16 other U.S. and non-U.S. events as relevant for regulatory review.
September 2006	Lithium-ion	The U.S. Federal Aviation Administration (FAA) released a study of fire-related characteristics of the most common type of cell used inside laptop computer batteries.	Individual cells and bulk-packed cells packaged for shipment on cargo and passenger aircraft were tested. FAA found in part that Halon 1301, the only FAA-certified fire-suppressant agent for systems permitted in cargo compartments of passenger aircraft, is effective for fires but not in sufficiently cooling overheated cells to prevent them from explosively releasing flaming liquid electrolyte seconds to minutes after its application.
January 2008	Lithium-metal	A final U.S. Department of Transportation (DOT) rule, effective on an interim basis in December 2004, prohibited cargo shipments of specified lithium-metal batteries on passenger aircraft.	Reasons included evidence from FAA research that heat from a smoldering cargo fire could ignite a lithium-metal battery fire, fire propagation between these batteries was likely, and burning batteries could not be extinguished by Halon 1301.
January 2008	Lithium-ion and lithium-metal	A DOT rule prohibited airline passengers from carrying loose batteries in checked luggage; monitoring of safety issues continued.	The rule allowed carrying batteries of specified sizes and quantities only if installed in portable electronic devices in checked luggage or carry-on bags, or packed as spares in carry-on luggage with protection against short-circuiting by enclosure in original packaging or other acceptable methods.
February 2008	Lithium-ion	NTSB released the final report on the UPS Flight 1307 accident in Philadelphia.	Although lithium-ion battery packs in laptop computers were among cargo burned in the early stages of the fire, the fire origin was undetermined. As part of this investigation, NTSB issued additional safety recommendations related to lithium-ion and lithium-metal batteries carried in cargo and passenger operations.

Sources: DOT, FAA, NTSB, U.S. Navy

Table 1

digital cameras and video camcorders. *Lithium-metal battery* refers to a nonrechargeable type that does contain lithium as a distinct element. Lithium-metal batteries typically power film cameras, high-intensity flashlights, remote control devices, toys and many other devices that take batteries of small standard sizes.

Distinguishing between these types is important because of different characteristic fire behavior and how cabin fire extinguishers perform. For example, the chemical components in lithium-metal batteries responsible for the batteries' superior energy density compared with conventional carbon-zinc or alkaline batteries can contribute to increased risk of fire and explosion if they are misused or abused. NTSB noted in a 2004 hazardous materials accident brief that "lithium is a combustible alkali metal that self-ignites in air at 352 degrees F [178 degrees C]. When exposed to water, lithium … releases hydrogen, creating a dangerous fire risk. Fires involving lithium are extremely difficult to extinguish. Extinguishers using water, gas or certain dry chemicals cannot control this type of fire."

Thermal runaway — essentially an internal chemical reaction unleashed by overheating a lithium-ion or lithium-metal battery — concerns aviation safety researchers. This reaction can be triggered by a short circuit, improper use, physical abuse, failure of protective systems, manufacturing defects or extreme external heat. Thermal runaways are startling and disorienting for unwary crewmembers and passengers, and fires would be especially hazardous if they spread to hidden areas of the aircraft. Flight attendants therefore have to be vigilant and anticipate the possibility of a fire involving a portable electronic device or spare battery on tray tables or in seatback pockets, overhead bins, closets or under seats.

In a draft video about laptop computer fire fighting, FAA has induced thermal runaways with one or more lithium-ion cells exploding unpredictably in seconds to minutes. The thermal runaway of each of six or nine cells in each laptop computer battery pack tested produced a brilliant flash, loud bang, jets of flaming liquid electrolyte, intense heat and thick smoke. Part of the implied challenge for the cabin crew in responding to thermal runaways then is determining when the process has ended so that the battery or device can be handled without anyone being burned by the device/battery itself or flying debris, or sustaining smoke/fume inhalation or an eye injury.[6]

To reduce the risk of a thermal runaway, PHMSA — the lead agency in the United States responsible for determining how to regulate lithium batteries and whether restrictions actually protect the traveling public — recommended these safety measures on its comprehensive Web site at <www.safetravel.org>: Keep batteries installed in portable electronic devices and carefully handle batteries when replacing a discharged battery with a spare during flight; pack spare batteries in carry-on luggage because fires are easier to detect in the cabin and flight attendants have access to fire extinguishers; keep spare batteries in original retail packaging; if retail packaging is unavailable, effectively insulate battery terminals, using insulating tape to further protect batteries that have protruding or sharp terminals and enclose them with a sturdy resealable plastic bag; use only batteries purchased from reputable sources and do not carry onto aircraft recalled, damaged or counterfeit batteries, including lithium-metal batteries charged contrary to safety warnings; and protect portable electronic devices containing batteries from inadvertent activation by using such devices as locks on switches or protective cases. One U.S. manufacturer of lithium–manganese dioxide cells and batteries [one subtype of lithium-metal battery], citing industry standards, also said that consumers immediately must discontinue using a battery that "emits an unusual smell, feels hot, changes color or shape or appears abnormal in any other way."[7]

PHMSA in March 2007 said, "Airline passengers who carry batteries or electrical devices in carry-on or checked baggage are responsible [under U.S. hazardous materials regulations] for ensuring appropriate steps are taken to protect against dangerous levels of heat that can be generated by inadvertent activation or short-circuiting of these devices while in transportation."[8]

Wayne Rosenkrans

Placing each spare lithium-ion battery pack in a sturdy resealable plastic bag can prevent short-circuits; spare lithium-metal batteries require comparable protection.

Airlines rely on aircraft occupants to obey regulations and heed warnings on use of lithium battery–powered devices such as high-intensity flashlights.

Wayne Rosenkrans

By January 2008, however, NTSB had issued two safety recommendations urging PHMSA, FAA and the airline and battery industries to take further steps to ensure passenger and crewmember awareness of the risks of improper use of lithium batteries inside aircraft cabins, and to measure and publish the results of communication campaigns.[9]

Scope of Problem Debated

Interpretation of the sparse U.S. data about lithium-battery fires on passenger flights has been a continuing point of contention (see "Crew Experiences"). According to a 2005 study by the U.S. Institute of Standards and Technology, "About five safety incidents involving notebook computers [including those in aviation] occurred in 2002. Cell production was in the range of 770 million units, of which roughly 40 percent (350 million) were for installation in [battery packs of] notebook computers. This translated into five incidents in 308 million, or slightly more than one [incident per] 61 million cells."[10]

Counting lithium battery incidents in aviation without categorizing them also has been contentious. From Feb. 1, 1996, through July 25, 2007, FAA's battery-incident database showed 14 incidents involving lithium-ion batteries — six involving checked baggage and carry-on items intended for passenger flights — and 13 involving lithium-metal batteries, according to an NTSB analysis. "Of the seven incidents involving passenger aircraft, two occurred in flight, one causing the flight crew to divert; three occurred on board before takeoff; and two occurred in the airports before boarding the aircraft," NTSB said.[11]

Lithium-metal batteries were involved in six incidents involving carry-on items intended for passenger flights, and two incidents involved packages shipped as cargo on passenger flights. "Of the eight incidents involving passenger flights, four occurred in flight, two causing the flight crew to divert or land; two occurred or were detected postflight, either during unloading or sorting operations; and two occurred before boarding the aircraft," NTSB said.

Another argument was advanced in a November 2007 presentation to the Dangerous Goods Panel of the International Civil Aviation Organization (ICAO) by the Portable Rechargeable Battery Association (PRBA), which said that some incidents cited from FAA's battery-incident database lack sufficient detail for useful safety analysis.[12]

"While there appear to be several reasons for these incidents, the majority of incidents were caused by non-compliance with the current regulations that govern the transport of lithium batteries and equipment powered by them, and passengers who failed to protect batteries from damage and short circuits," the association said. "Therefore, PRBA does not believe significant revisions to the current lithium battery dangerous goods regulations are necessary. … However, it is important to recognize that what is missing from this [FAA] list of incidents is any meaningful 'root cause' analysis of the purported incidents."

PRBA also said that some of the incidents in FAA's database involved batteries or devices that could have been subject to recall, damaged or counterfeited — yet such root causes could not be determined without failure analyses, which typically did not occur. In its comments on a letter to NTSB from the Air Line Pilots Association, International (ALPA) concerning the UPS Flight 1307 accident, PRBA also said, "There have been fewer than 50 incidents of [battery packs worldwide] overheating — fewer than 10 of which have involved flames — during a period in which over 5 billion lithium-ion cells have been produced. The [2006] Sony recall, which has received the most notoriety, has involved only a subset of this handful of incidents, even though apparently over 9 million battery packs were in service that may have contained cells from the same production runs."[13] Safety devices within each lithium-ion cell are designed to power off the cell if an internal cell short-circuit and spontaneous overheating occur because of contamination of parts of the cell by microscopic metal particles during manufacturing — which prompted, for example, the 2006 recall of Sony cells built into various laptop computer manufacturers' battery packs.

Crew Experiences

U.S. government investigations of cabin fires linked to a lithium-ion or lithium-metal battery typically find it difficult or impossible to obtain complete factual details and produce optimal analyses in the absence of standardized reporting, some aviation safety specialists say. The following summaries reflect issues that crewmembers have encountered in the relatively few situations in public records:

- Flight attendants preparing for the departure of a Boeing 767 smelled fumes, then saw smoke from a passenger's carry-on bag by opening an overhead bin. Removed to the airbridge, the bag contained scorched/melted clothing packed around an extremely hot video camcorder battery of unspecified type; a maintenance technician received a thermal injury to his hand while removing the battery.[1]
- The flight crew of a chartered 727 returned to the departure airport and landed without further incident after flight attendants and federal security agents extinguished a passenger-seat fire ignited after the explosion of a 9-volt lithium-ion video camera battery as it was being handled by a news media videographer.[2]
- During boarding and baggage loading, fire in a checked bag was discovered by a baggage handler who saw flames. Firefighters later told a crewmember of the Airbus aircraft that the fire had been ignited by a lithium-ion battery pack, designed for a handheld video game player, which had been packed loosely among wires and cables.[3]
- The flight crew diverted a 737 and landed without further incident after passengers and a flight attendant smelled electrical smoke, which at first seemed to have dissipated after completion of emergency-checklist items. Firefighters within 30 seconds of entry located smoke still being emitted by an extremely hot battery pack inside a passenger's laptop computer, which had been recharging from an in-seat power supply port.[4]
- A flight attendant notified the captain during an international flight that a battery of unknown type had exploded in the coach section of the widebody transport airplane. The crew continued to the destination after the captain determined that no injuries had occurred, smoke had dissipated without further indication of fire, one seat cushion had been damaged and only a few pieces of the battery could be found. No passenger would take responsibility for owning the battery.[5]
- During cruise, the flight crew of an A320 identified the source of a loud popping sound and acrid burning odor as an explosion involving the xenon lamp and lens in the captain's high-intensity flashlight, which had been used during the preflight inspection. After donning oxygen masks and clearing the odor from the cockpit, the crew found that this flashlight was hotter than normal and its lithium-metal batteries were charred.[6]

—WR

Notes

1. U.S. National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System (ASRS) report no. 440497, June 1999.
2. U.S. Federal Aviation Administration Accident/Incident Data System report no. 20041029028789c, Oct. 29, 2004.
3. NASA ASRS report no. 730630, March 2007.
4. NASA ASRS report no. 731104, March 2007.
5. NASA ASRS report no. 732079, March 2007.
6. NASA ASRS report no. 760318, November 2007.

Dramatic Video Demonstrations

Though not released as official guidance, the FAA's draft firefighting videos have been presented in public forums and posted to a Web site for industry comment. The draft video showing laptop computers, positioned as used on a cabin tray table, said that any installed battery pack may malfunction and overheat, often during the charging process, causing the pack to ignite. "A cell, in a thermal runaway, gets extremely hot, then overpressures, releasing flammable liquid electrolyte," FAA said. "Cells may explode."

This draft video shows scenarios of thermal runaways, induced during tests by external heating with either an electric hot plate or alcohol flame. Extinguishing options discussed include Halon 1211 fire extinguishers, water fire extinguishers, and bottles or pitchers of water, juice, soda, carbonated drinks and other nonalcoholic liquids typically found on a beverage service cart.

"The objective is to extinguish the fire and cool the battery pack, preventing additional cells from reaching thermal runaway," FAA said. "Water fire extinguishers are effective at extinguishing the fire and cooling the battery pack. Halon 1211 fire extinguisher followed by the available water source [was the second-best option in tests because] Halon 1211 extinguishes the fire and water cools the battery pack. [The third-best option was] using a Halon 1211 fire extinguisher alone, which extinguished the fire and prevented spread of fire as the battery cells consumed themselves [but] Halon 1211 did not prevent additional cells from reaching thermal runaway. Avoid using ice or smothering substances that act as an insulator; containing heat forced adjacent cells to explode."

As of February 2008, this draft video contained the following summary language for these scenarios:

- "Do not attempt to pick up and move the computer [because of the] extreme danger of bodily harm.
- "Relocate passengers away from the computer.
- "If a water [fire] extinguisher is available, utilize it to cool the computer and prevent additional cells from reaching thermal runaway.
- "Use Halon 1211 to extinguish the fire and prevent spread to adjacent flammable materials. Follow this [action] by dousing the laptop with water or other nonalcoholic liquids from the drink cart or any other source.
- "Avoid the use of ice or other covering materials [to cool or suffocate the fire]. These will insulate the laptop, making it more likely that more cells will reach thermal runaway."

In May 2007, ALPA suggested ways that airlines can supplement the guidance in FAA Advisory Circular 120-80, *In-Flight Fires* until the next revision. "Once ignited, a [lithium] battery fire may … have many characteristics that are not traditionally covered in firefighting training for crewmembers," ALPA said. "Once the fire appears to have been extinguished, consider moving the [portable electronic] device to an area without flammable material, such as a galley oven (if not adjacent to the cockpit); the device should not be moved if it is still on fire, or if it is too hot to be moved safely. … Remove power to the remaining passenger outlets [in-seat power supply ports] until the aircraft's system can be determined to be free from faults, if the device was previously plugged in [to a port]."

In the context of airlines enhancing guidance for cabin crews on lithium-battery fires, FAA said in August 2007, "Crewmembers should be aware of the content of the PHMSA guidance for the transport of batteries and battery-powered devices, and should continue to be vigilant as batteries become more powerful and battery-powered devices more numerous." ●

Notes

1. Lain, M.J.; Teagle, D.A.; Cullen, J.; Dass, V. "Dealing With In-Flight Lithium Battery Fires In Portable Electronic Devices." Safety Regulation Group, CAA. CAA Paper 2003/4. July 30, 2003.
2. Cabin Safety Research Technical Group (CSRTG). "Aircraft In-Flight Firefighting." October 2007. This draft video was posted for airline industry review and comment at <www.fire.tc.faa.gov/2007Conference/files/Training_Videos/ThursPM/Videos/BlakeFirefightingVideo1.wmv>. The CSRTG comprises representatives of Agência Nacional de Aviação Civil of Brazil, U.K. CAA, Direction Générale de l'Aviation Civile of France, the FAA and Transport Canada.
3. U.S. National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System (ASRS) report no. 731104, March 2007.
4. NASA ASRS report no. 740664, June 2007.
5. NTSB. "Inflight Cargo Fire, United Parcel Service Company Flight 1307, McDonnell Douglas DC-8-71F, N748UP, Philadelphia, Pennsylvania, February 7, 2006." Accident Report no. NTSB/AAR-07/07. Dec. 4, 2007.
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7. Ultralife Batteries. "Safety Precautions for Lithium–Manganese Dioxide (Li-MnO_2) Cells and Batteries." Jan. 14, 2004.
8. FAA. "PHMSA Guidance on the Carriage of Batteries and Battery-Powered Devices." Information for Operators, InFO no. 07016. Aug. 3, 2007.
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10. U.S. National Institute of Standards and Technology. "Why Are There No Volume Li-ion Battery Manufacturers in the United States?" Working Paper no. 05-01. Aug. 4, 2005.
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13. Kerchner, George A. Letter to NTSB Member Deborah Hersman. Oct. 26, 2006.

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Kiwi Count

Quarterly data from New Zealand show decreased incident numbers for Part 121 operations.

BY RICK DARBY

The latest published data from the Civil Aviation Authority of New Zealand (CAA) show that in the third quarter, from July 1 to Sept. 30, 2007, the number of accidents involving large and medium-sized airplanes was unchanged from the equivalent period in 2006, namely, zero.[1] When there are no accidents to analyze, incidents — which can be thought of as potential accidents — serve as a proxy for assessing risk management.

The data show that numbers of incidents, airspace incidents and defect incidents for large airplanes decreased in the third quarter of 2007 compared with a year earlier. But the long-term incident rates, especially for large and medium airplanes, are not notably improving.

New Zealand Aircraft Incidents, Second and Third Quarters, 2006–2007

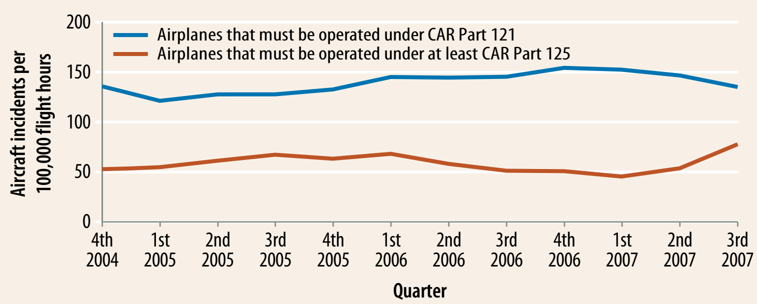
Aircraft Category	Second Quarter 2006	Second Quarter 2007	Change	Third Quarter 2006	Third Quarter 2007	Change
Airplanes that must be operated under CAR Part 121	111	85	–26	120	80	–40
Airplanes that must be operated under at least CAR Part 125	9	13	+4	9	23	+14
Other airplanes with a standard airworthiness certificate	28	30	+2	23	52	+29
Helicopters with a standard category airworthiness certificate	15	10	–5	13	9	–4

CAR = New Zealand Civil Aviation Rules

Source: Civil Aviation Authority of New Zealand

Table 1

New Zealand Aircraft Incidents, Large and Medium Airplanes



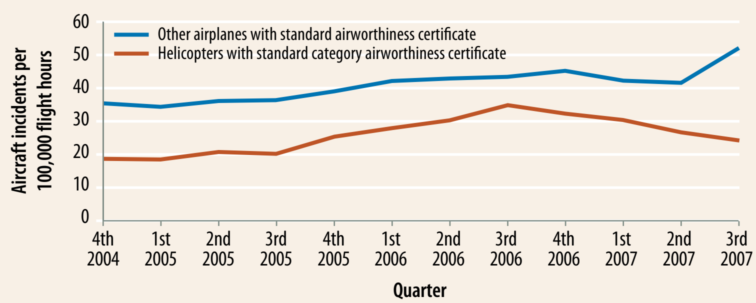
CAR = New Zealand Civil Aviation Rules

Note: Lines represent 12-month moving averages.

Source: Civil Aviation Authority of New Zealand

Figure 1

New Zealand Aircraft Incidents, Airplanes With Standard Airworthiness Certificate and Helicopters With Standard Airworthiness Certificate

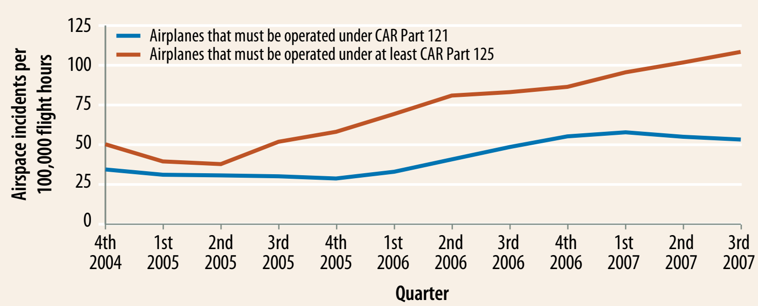


Note: Lines represent 12-month moving averages.

Source: Civil Aviation Authority of New Zealand

Figure 2

New Zealand Airspace Incidents, Large and Medium Airplanes



CAR = New Zealand Civil Aviation Rules

Note: Lines represent 12-month moving averages.

Source: Civil Aviation Authority of New Zealand

Figure 3

The number of air carrier incidents, involving large airplanes that must be operated under Civil Aviation Rules (CAR) Part 121, decreased to 80 in the quarter, from 120 (Table 1, p. 49).[2] That marked a drop of 33 percent, greater than the year-to-year 23 percent decrease in the second quarter.

The data were somewhat less encouraging in other categories. For medium-size airplanes in air transport that must be operated under at least CAR Part 125, the year-over-year incident totals were up in the second and third quarters.[3,4] For other airplanes with a standard airworthiness certificate — excluding airplanes used for agricultural operations or in sport — incidents increased 126 percent in third quarter of 2007 over the third quarter of 2006.

Part 121 airplanes had a higher incident rate since the fourth quarter of 2004 than those operated under at least Part 125. The incident rates, as 12-month moving averages, are shown in Figure 1. The incident rate for "other airplanes" has been gradually rising (Figure 2).

The CAA classifies incidents as critical, major and minor.[5] No incidents in the "airplanes that must be operated under Part 121" or "airplanes that must be operated under at least Part 125" categories were classified as critical in the second quarter or third quarter of either 2006 or 2007.

Rates of airspace incidents trended higher for both airplanes operated under at least Part 125 and those in Part 121 operations in the same period (Figure 3).[6] "Other airplanes" had a higher rate of airspace incidents than helicopters with a standard category airworthiness certificate (Figure 4).

Airspace incidents decreased year-over-year in the second and third quarters for Part 121 operations, but increased in the "other airplanes" category, with 51 percent more recorded in the third quarter comparison. The airspace incidents are shown for the second and third quarters of 2006 and 2007 in Table 2.

New Zealand Airspace Incidents, Second and Third Quarters, 2006–2007

Aircraft Category	Second Quarter 2006	Second Quarter 2007	Change	Third Quarter 2006	Third Quarter 2007	Change
Airplanes that must be operated under CAR Part 121	47	40	–7	47	39	–8
Airplanes that must be operated under at least CAR Part 125	19	18	–1	16	17	+1
Other airplanes with a standard airworthiness certificate	54	81	+27	45	68	+23
Helicopters with a standard category airworthiness certificate	7	13	+6	3	7	+4

CAR = New Zealand Civil Aviation Rules

Source: Civil Aviation Authority of New Zealand

Table 2

Defect incidents[7] occurred at a higher rate in Part 121 operations than for those involving airplanes operated under at least Part 125 from the 2004 fourth quarter to the 2007 third quarter (Figure 5).

Rates of defect incidents were similar in a side-by-side comparison of helicopters with a standard category airworthiness certificate and the "other airplanes" data category in this period (Figure 6, page 52).

The numbers of defect incidents declined year-over-year in the second and third quarters of 2006 and 2007 for all these airplanes.

Defect incidents involving Part 121 operations were down 36 percent from the second quarter of 2006 to the second quarter of 2007, and declined 10 percent for the respective third quarters. Table 3 (page 52) shows the numbers.

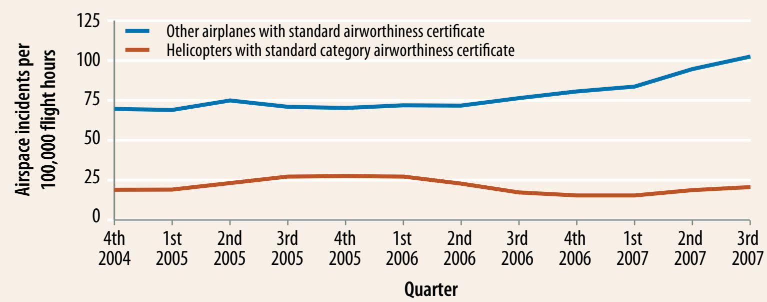
Bird hazard monitoring through March 31, 2007, indicated that eight of the 18 monitored airports had bird strike rates above the "trigger level" that calls for CAA action.

"One aerodrome exhibited a strike rate in the high-risk category of the CAA standard (above 10.0 bird strikes per 10,000 aircraft movements)," the report says. Six fell into the medium-risk category, and 11 were in the low-risk category. ●

Notes

1. CAA. *Aviation Safety Summary Report: 1 July to 30 September 2007*. Available via the Internet at <www.caa.govt.nz/safety_info/safety_reports.htm>.

New Zealand Airspace Incidents, Airplanes With Standard Airworthiness Certificate and Helicopters With Standard Airworthiness Certificate

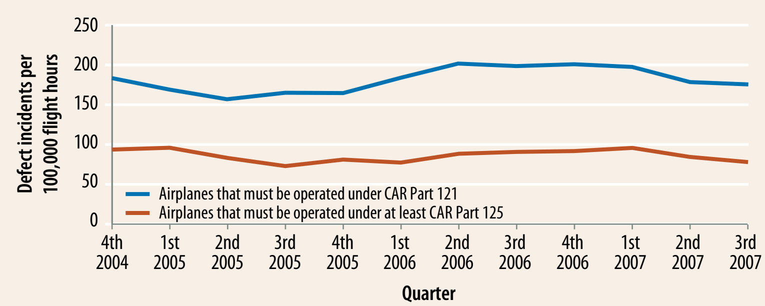


Note: Lines represent 12-month moving averages.

Source: Civil Aviation Authority of New Zealand

Figure 4

New Zealand Defect Incidents, Large and Medium Airplanes



CAR = New Zealand Civil Aviation Rules

Note: Lines represent 12-month moving averages.

Source: Civil Aviation Authority of New Zealand

Figure 5

New Zealand Defect Incidents, Second and Third Quarters, 2006–2007

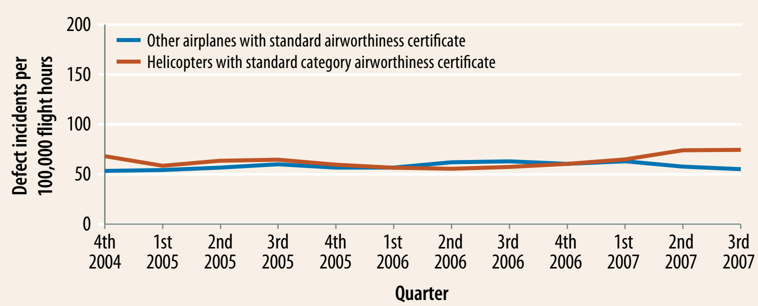
Aircraft Category	Second Quarter 2006	Second Quarter 2007	Change	Third Quarter 2006	Third Quarter 2007	Change
Airplanes that must be operated under CAR Part 121	176	113	–63	146	131	–15
Airplanes that must be operated under at least CAR Part 125	23	11	–12	20	13	–7
Other airplanes with a standard airworthiness certificate	55	41	–14	38	32	–6
Helicopters with a standard category airworthiness certificate	28	45	+17	28	29	+1

CAR = New Zealand Civil Aviation Rules

Source: Civil Aviation Authority of New Zealand

Table 3

New Zealand Defect Incidents, Airplanes With Standard Airworthiness Certificate and Helicopters With Standard Airworthiness Certificate



Note: Lines represent 12-month moving averages.

Source: Civil Aviation Authority of New Zealand

Figure 6

2. Part 121, *Air Operations — Large Aeroplanes*, applies to airplanes with more than 30 passenger seats or a payload capacity of more than 3,410 kg (7,518 lb).

3. Part 125, *Air Operations — Medium Aeroplanes*, applies to airplanes with 10 to 30 passenger seats, or a payload capacity of 3,410 kg or less and a maximum certificated takeoff weight greater than 5,700 kg (considered equivalent to 12,500 lb), or with a single engine and carrying passengers under instrument flight rules.

4. In response to a query by *AeroSafety World* about the meaning of the phrase "operated under at least CAR Part 125," the CAA said, "We take the view that an operator of an airplane that could be operated under Part 125 can operate that airplane to the higher specification of Part 121."

5. A *critical incident* causes, or on its own has the potential to cause, loss of life or limb.

   A *major incident* involves a major system that causes, or has the potential to cause, significant problems to the function or effectiveness of that system.

   A *minor incident* is an isolated occurrence or deficiency not indicative of a significant system problem.

6. An *airspace incident* involves deviation from, or falling short of, the procedures or rules for avoiding a collision between aircraft or avoiding a collision between aircraft and other obstacles when the aircraft is under air traffic control.

7. A *defect incident* involves failure or malfunction of an aircraft or aircraft component, whether found in flight or on the ground.

Traffic Jam

Europe is upgrading its air traffic management, but safety information flow within the system is held back by fears of legal repercussions.

BOOKS

European Air Traffic Management: Principles, Practice and Research

Cook, Andrew (editor). Aldershot, England, and Burlington, Vermont, U.S.: Ashgate, 2007. 277 pp. Figures, tables, appendix, bibliography, index.

"As part of the future air ATC/ATM [air traffic control/air traffic management] service for Europe, aircraft will be controlled accurately and with high integrity in four dimensions [latitude, longitude, altitude and time] with the aid of on-board and satellite navigation and communications technologies," says one contributor to this book, an across-the-board look at European ATM. "Each aircraft will negotiate and re-negotiate a 4D [four-dimensional] flight plan in real time with the ground-based ATM system. This will provide airborne autonomous separation to give conflict-free tracks between origin and destination in the form of 4D profiles to be accurately adhered to by aircraft."

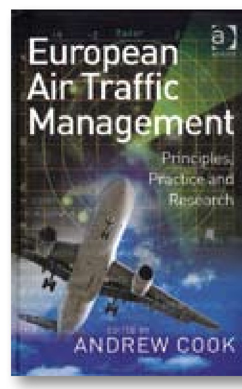
That will be then; this is now. Although ATC will arguably change more radically than any other part of the aviation system in the coming years, for the moment it remains largely in the hands of traditional controllers operating on the basis of radar coverage and voice or datalink radio communication.

European ATM must accommodate a growth in demand for air transport while maintaining or improving current safety levels. Technical innovations, such as reduced vertical separation minima, and administrative initiatives, such as the Single European Sky legislation adopted in 2004 to reorganize air navigation service providers into functional sectors independent of national boundaries, are helping to increase capacity, the book says.

In a chapter titled "ATM and Society — Demands and Expectations," contributor Nadine Pilon says that current forecasts predict a doubling of air traffic in Europe by 2025. "This predicted growth of flights may produce more incidents in absolute numbers, and increases the risk of collision," she says. "In order to maintain its adequate level of safety, the air transport industry, and in particular ATM, implements continuous reinforcements of safety assurances, but this has little repercussion on the *perception* of risk."

The development of land for housing and business in ever-growing areas around cities may also increase the perception of risk because of accidents during takeoff or approach. The two most dramatic accidents that resulted in people on the ground being killed were the El Al 747 accident in Amsterdam in 1992 and the Concorde accident at Roissy, near Paris Charles de Gaulle Airport, in 2000.

"It appears that society could be becoming more sensitive to, and more aware of, air transport safety risks and/or environmental impacts, and possibly becoming less tolerant of operational errors," Pilon says. "An illustration is the case of the Linate [Airport, Milan] accident where a runway incursion resulted in a collision, with fatalities, in 2001. Both the judicial investigation and the technical investigation were heavily reported in the press, in particular in the regional newspapers. The trial resulted in eight ATM personnel (from front-line operations to top management) being jailed. The way in which this, and a number of similar cases, were reported in the press and handled in the courts … identifies a lack of support by society for air traffic management. There remains a tendency for these cases to be addressed not only through



changes in the system but, additionally, by establishing culpability and punishment on the basis of personal liability. This poses the question of whether such cases point to a trend where, in modern societies, air transport is considered a mature industry in which failures of that system are less and less tolerated."

Concern about ATM-related accidents naturally leads to calls for measuring the system's safety. But European ATM, Pilon says, is "not providing at the European level a satisfactory indication of the level of safety it produces, as stated by the Performance Review Commission [of Eurocontrol in a 2006 report]."

Safety cannot easily be measured by the number of ATM-related accidents, which is quite low overall, so that a single major accident can cause a huge spike in the rate. "That is the reason why reporting on safety occurrences and incidents is required: In some cases, a safety occurrence may indicate that safety has been compromised and therefore lead to improvements," Pilon says. "However, this genuine demand for transparency may, in some cases, cause difficulties for air traffic management on account of the safety culture, confidentiality and even legal issues."

Pilon says that the flow of incident information can be limited for several reasons:

- "In organizations such as ATC, team issues play an important role, and a strong safety culture is crucial for safety. Efficient safety reporting is based on trust and therefore takes a long time to become fully embedded in the organization — and can soon be rejected. While in some operational units, implementing safety reporting can be seen as a catalyst for reinforcing the safety culture, it can also be detrimental in other instances where it seems to run counter to trust."
- "Individuals should voluntarily report their own errors and any other dysfunction of the ATM system, and such reports, rendered anonymous, should be made available for safety improvement. When considering the way safety analyses, investigations and improvement measures are carried out, some may see certain confidentiality clauses as being over-restrictive, however. A delicate issue to resolve."
- "In the case of a legal inquiry, any requested data or file will be released to the judicial authority, regardless of any confidentiality agreement. In certain countries in Europe, even when no accident has actually occurred, staff may still be prosecuted because of a safety incident."

To counteract inhibitions about reporting safety information, the ATM community and Eurocontrol, for example, through the SAFREP [Safety Data Reporting and Data Flow] task force, are promoting the idea of "just culture" in ATM. Eurocontrol says that "the SAFREP task force found that punishing air traffic controllers or pilots with fines or license suspension, as well as biased press reports, has led to a reduction in the reporting of incidents and sharing of safety information. It also recognized that the need for a culture that encourages honest reporting is not yet reconciled with the judicial system and legislators. It warns that the situation may get worse if no immediate action is taken."

REPORTS

An Overview of Spatial Disorientation as a Factor in Aviation Accidents and Incidents

Newman, David G. Australian Transport Safety Bureau (ATSB) Aviation Research and Analysis Report B2007/0063. Final report. December 2007. 42 pp. Figures, references. Available via the Internet at <www.atsb.gov.au/publications/2007/B20070063.aspx> or from ATSB.*

The prevalence of spatial disorientation (SD) as a factor in aviation incidents and accidents is hard to establish, the report says. In incidents, or when SD occurs with no accident or incident resulting, it may go unreported. And "many accidents where SD is cited [by investigators] as a likely factor are fatal," the report says.

"SD is defined as the inability of a pilot to correctly interpret aircraft attitude, altitude or airspeed in relation to the Earth or other points of reference," the report says. "It is a very common problem, and it has been estimated that the chance of a pilot experiencing SD during [his or her] career is in the order of 90 to 100 percent. The results of several international studies show that SD accounts for some 6 to 32 percent of major accidents, and some 15 percent to 26 percent of fatal accidents."

The report describes three types of SD:

- Unrecognized. "The pilot, unaware of the problem, continues to fly the aircraft as normal. This is particularly dangerous, as the pilot will not take any appropriate corrective action, since [he does] not perceive that there is in fact a problem. … This form of SD is clearly dangerous, and accounts for the majority of SD accidents and fatalities."
- Recognized. "The pilot becomes aware that there is a problem. While the pilot may or may not be aware that the problem is SD, in this form of disorientation [he is] aware that something is not quite right, that [his] sensory system is giving information that does not agree with the information available from the instruments, or that things just don't add up. … If this is successfully dealt with, an SD accident does not tend to result. The pilot may then have received a valuable lesson on SD and how to recover from it."
- Incapacitating. "The pilot may be aware of the disorientation, but is mentally and physically overwhelmed to the point where [he is] unable to successfully recover from the situation. The pilot may fight the aircraft all the way to ground impact, never once achieving controlled flight. Such forms of disorientation are a result of breakdowns in the normal cognitive processes, possibly due to the overwhelming nature of the situation, especially if other factors such as fatigue and high workload are also present."

The report describes various types of illusions: some known as vestibular, because they are caused by sensations in the vestibular system, or inner ear; others visual, which can occur even in visual meteorological conditions and are often based on expectations that override what the pilot actually sees.

Possible contributors to SD include pilot factors, such as flying while experiencing an illness that affects the vestibular system, or while taking medication with a similar effect; aircraft factors, for example, lack of an autopilot or the presence of a malfunctioning autopilot; operational factors, such as inadvertent entry into instrument meteorological conditions (IMC) by pilots without an instrument rating, or prolonged acceleration; and environmental factors, including the lack of visual cues, as when an approach is flown at night over water — prompting the "black hole" illusion that gives a false mental picture of altitude above terrain.

"The chances of an SD event occurring in flight can be reduced by a series of simple preventive measures, many of which can be attended to before flight," the report says. "These include flying when fit and well … , not flying under the influence of alcohol or medications, avoiding [flying under] visual flight rules into IMC, [and] increasing awareness of SD illusions and planning for their possible appearance at different stages of flight in the preflight planning process.

"It is vitally important that pilots are aware that SD happens to normal pilots. It can affect any pilot, any time, anywhere, in any aircraft, on any flight, depending on the prevailing circumstances. Furthermore, experience of SD does not mean it will not ever happen again. Awareness and preparedness are key elements in preventing an SD accident."

WEB SITES

Centers for Disease Control and Prevention, <wwwn.cdc.gov/travel/contenttravelindustryair.aspx>

The Centers for Disease Control and Prevention (CDC) is a component of the U.S. Department of Health and Human Services. The CDC says that its mission is "to promote health and quality of life by preventing and controlling disease, injury and disability." In support of this mission, the CDC Web site shares

information with the public.

Sections of the site focus on health and safety information of interest to flight and cabin crewmembers and the aviation industry. The CDC provides instructional and guidance documents and reporting forms at no cost for downloading or printing.

The following requirement is noted on the air travel pages: "Based on federal regulations (42 CFR Part 71), CDC DGMQ [Division of Global Migration and Quarantine] requires reporting from international conveyances destined for the U.S. of all on-board deaths and certain illnesses suggestive of a communicable disease."

To meet this requirement, the CDC has compiled documents for flight crews and cabin crews that describe specific medical conditions and symptoms, list information to be gathered from ill passengers or crewmembers, and define thresholds for reporting. Some of the information is repeated as single-page, quick reference cards.

The CDC also provides scripts for public health announcements to be delivered to passengers prior to landing. Scripts are matched to scenarios to assist crews in selecting the appropriate announcement for different communicable-illness situations.

There are health and safety guidance documents for ground and maintenance workers; interior and exterior cleaning workers; personnel interacting with passengers; and baggage and cargo handlers who have been exposed to airplanes arriving from areas affected by communicable diseases such as avian flu and SARS (severe acute respiratory syndrome) virus.

Some of the other topics of possible interest to flight and cabin crewmembers are tuberculosis and meningitis; risks from food and water (drinking and recreational exposure); protection from insects and arthropods, principally spiders; and health tips and vaccination requirements for global travelers.

Literature references and Web site links to related information appear within documents and on the CDC site.

Asociación Latinoamericana de Aeronáutica, <www.ala-internet.com>

The Latin American Aeronautical Association (ALA) gives "the Latin American aviation community an organizational link to the global aviation industry." It informs "the Latin American aeronautical community on aviation topics and … promote[s] aviation safety."

On its home page, visitors can select English, Spanish or Portuguese language pages. The Web site has a Spanish-English/English-Spanish aeronautical dictionary, an encyclopedia of aviation photography and an English/Spanish directory of companies providing products and services to the aviation industry. All three are free online.

According to the organization, the ALA magazine is "the only Spanish/Portuguese language aviation magazine." Excerpts from the current year's magazines are also free online. ●

Source

* Australian Transport Safety Bureau
P.O. Box 967, Civic Square ACT 2608
Australia
Internet: <www.atsb.gov.au>

— Rick Darby and Patricia Setze

Runway Deficit

The pilots saw vehicles ahead and realized something was amiss.

BY MARK LACAGNINA

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

JETS

Reduced Thrust Set for Takeoff

Boeing 777-300ER. No damage. No injuries.

The flight crew began the takeoff from Runway 05R at Auckland (New Zealand) International Airport the afternoon of March 22, 2007, believing that the full length — 3,230 m (10,598 ft) — was available. Flaps and engine thrust had been set accordingly. "During the takeoff, they saw work vehicles in the distance on the runway and, realizing something was amiss, immediately applied full engine thrust and got airborne," said the report by the New Zealand Transport Accident Investigation Commission (TAIC). The 777 passed 92 ft over the vehicles.

The aircraft had arrived in Auckland about two hours earlier on a flight from Sydney, Australia. Before departing from Sydney, the crew read a notice to airmen (NOTAM) advising that available takeoff and landing distance on Runway 05R had been reduced to 2,320 m (7,612 ft) due to work in progress on the eastern portion of the runway. The crew therefore planned to conduct a reduced-length landing at Auckland.

The NOTAM also said that, with 45 minutes' prior notice, the full length of the runway would be made available temporarily for long-haul international aircraft. As the 777 neared Auckland, the full length of the runway was made available for the departure of an aircraft bound for Singapore. "For traffic sequencing, the aerodrome controller held the Singapore-bound aircraft at the runway holding point and cleared the [777] pilots to land their aircraft first," the report said. "Because the full length of the runway was temporarily available, the aerodrome controller advised the pilots that the full length of the runway was available for their landing." The crew landed the 777 and taxied to the gate.

There were 357 passengers and 18 crewmembers aboard for the return flight to Sydney. The airport ground controller told the crew to taxi to Runway 05R and to hold on Taxiway A10 for departure. The crew did not request clearance to back-taxi on the western runway extension, which would have added 393 m (1,289 ft) to the available takeoff distance. To ensure that the crew knew about the reduced runway length, the controller said, "Confirm you will depart from alpha ten reduced length?" The crew confirmed that they would begin the takeoff from A10, believing that the full length of the runway was available and misunderstanding the controller's reference to "reduced length" as meaning the western runway extension that they were not planning to use.

"The first officer was the pilot flying, and the pilots set the thrust that they had determined was necessary for a reduced-thrust departure using the full length of the runway from intersection A10," the report said. An N_1 — fan speed — setting of 86.4 percent and a flaps 5 setting were used. The proper settings for the reduced takeoff distance were 94.6 percent N_1 and flaps 20.

The 777 was about halfway down the runway when the pilots saw the work vehicles, which included a rubber-removal truck and the airport safety officer's utility vehicle. The captain immediately applied takeoff/go-around thrust — 104.8 percent N_1. "The recorded airspeed at the time was 149 knots," the report said. "Within 4 seconds, the aircraft accelerated to the pilots' predetermined takeoff decision speed (V_1) of 161 knots. The first officer later said that immediately after reaching V_1, the captain called 'rotate' when the rotation speed (V_R) of 163 knots was achieved. The aircraft became airborne approximately 190 m [623 ft] before the end of the reduced runway and climbed away steeply." The crew landed the aircraft in Sydney about three hours later.

The pilots told investigators that because the full runway length was available for their landing, they believed that it also was available for takeoff. They said that this belief was reinforced by the words "active runway mode normal operations" at the beginning of the automatic terminal information service (ATIS) broadcasts they had received. The report said that these words meant only that the approach threshold of Runway 05R was not displaced. The pilots said that they had overlooked information provided later in the ATIS broadcasts about the reduced runway length.

The pilots told investigators that because the full runway length was available for their landing, they believed that it also was available for takeoff.

The report noted that the ATIS broadcasts for Auckland were twice the length recommended by the International Civil Aviation Organization (ICAO) and were cluttered with noncritical "permanent" information. Among recommendations based on the findings of the incident investigation, TAIC said that the New Zealand Civil Aviation Authority should "ensure that ATIS broadcasts … have clear word and sentence structures, are unambiguous, never imply that things are normal when they are not, contain no permanent information and conform as closely as possible to ICAO-recommended standards."

Undetected Damage Blamed for Rudder Loss

Airbus A310-300. Substantial damage. One minor injury.

Pre-existing damage within the rudder worsened after the aircraft departed from Varadero, Cuba, for a flight to Quebec City the morning of March 6, 2005, and eventually caused the rudder to separate in flight, said the Transportation Safety Board of Canada (TSB). There were 262 passengers and nine crewmembers aboard the aircraft.

The A310 was cruising at Flight Level (FL) 350 (approximately 35,000 ft) 90 nm (167 km) south of Miami when the flight crew heard a loud bang and felt a vibration. The aircraft then entered a Dutch roll. "Cabin crewmembers located in the back of the aircraft were thrown to the floor, and unsecured galley carts moved freely," the TSB report said. One cabin crewmember received a minor back injury.

The crew disengaged the no. 1 autopilot, believing that it was the source of the problem. However, when the no. 2 autopilot was engaged, the Dutch roll intensified. The autopilot was disengaged, and the captain hand-flew the aircraft. The crew requested and received clearance to descend, and they prepared to divert the flight to Fort Lauderdale, Florida, U.S.

"Throughout the event, there was no ECAM [electronic centralized aircraft monitor] message relating to the control problem … and there were no warning lights or cockpit indications of an aircraft malfunction," the report said. "Even with limited clues as to the cause of the Dutch roll, the crew knew that descending to a lower altitude might lessen or stop the Dutch roll motion."

The Dutch roll motion decreased during the descent and stopped at FL 280. The A310 was abeam Miami when the crew decided to return to Varadero. Their first indication that the rudder was the cause of the control problem came when they were unable to correct a slightly crabbed attitude with rudder inputs during final approach. Nevertheless, they landed the aircraft without further incident. "After shutdown, it was discovered that [only] small pieces of the rudder were still attached to the vertical stabilizer," the report said.

The accident aircraft first flew in 1991 and had accumulated 49,225 flight hours and 13,444 flight cycles. The rudder basically comprises carbon-fiber-reinforced plastic side panels bonded with resin to a composite honeycomb core. Investigators determined that some disbonding of a side panel or a core fracture likely existed when the A310 departed from Varadero and that the damage worsened to the point that it caused the rudder to flutter and fail during the flight.

"The manufacturer's recommended inspection program for the aircraft was not adequate to detect all rudder defects," the report said. "The damage may have been present for many flights before the occurrence flight." Based on this finding, the TSB recommended that the European Aviation Safety Agency work with the industry to "develop and implement an inspection program that will allow early and consistent detection of damage to [composite] rudder assemblies."

Switch Movement Cited in Shutdown

Boeing 717-200. No damage. No injuries.

The flight crew was beginning the descent from FL 330 during a flight from Perth, Western Australia, to Karratha on Sept. 6, 2006, when the right engine lost power soon after the autothrottle system commanded a thrust reduction. "During the completion of the relevant non-normal checklist items, the crew noticed that the main fuel switch for the right engine was selected to 'OFF,'" said the report by the Australian Transport Safety Bureau (ATSB). The crew restarted the engine as the aircraft descended through FL 160 and landed without further incident in Karratha.

ATSB determined from recorded flight data that the main fuel switch had been moved to the "OFF" position when the descent was begun. "The means for that switch movement could not be determined," the report said. A possibility was that the switch had not been locked in the "ON" position and had moved to the "OFF" position due to vibration or unintentional contact.

The 717's main fuel switches are on the center console, below the throttle levers. After the incident, the aircraft operator issued a safety alert to its 717 crews advising that the main fuel switches could be moved to the "ON" position without correctly engaging the locking detent. "That alert also warned flight crew of the possibility of inadvertent in-flight selection of the switches to 'OFF' by catching wristbands or long-sleeve shirt cuffs," the report said. "In addition, flight crew were advised to not pass technical manuals or other similar items across the throttle quadrant in the vicinity of the main fuel switches."

The main fuel switches could be moved to the "ON" position without correctly engaging the locking detent.

Ice Crystals Cause Dual Flameout

Raytheon Beechjet 400A. No damage. No injuries.

Soon after beginning a descent from FL 410 in instrument meteorological conditions (IMC) on July 12, 2004, the flight crew felt a jolt, heard a bang and noticed that cabin pressure was decreasing. The airplane, with nine people aboard, was over the Gulf of Mexico, about 100 nm (185 km) west of Sarasota, Florida, U.S., en route from Duncan, Oklahoma, to Fort Myers, Florida. There was convective activity in the area.

"The [pilots] donned their oxygen masks, declared an emergency and went through the emergency descent checklist," said the report by the U.S. National Transportation Safety Board (NTSB). "They noticed that every warning light in the cockpit was illuminated and that the engines were not operating. After several unsuccessful attempts to restart the engines, the pilots were able to get the right engine restarted as the airplane descended through 10,000 feet."

The crew diverted the flight to Sarasota and landed without further incident. Tests of the engines revealed no discrepancies. The fuel remaining in the Beechjet met Jet-A specifications, but the concentration of icing inhibitor, a fuel additive, was only 0.02 percent; concentrations of 0.10 to 0.15 percent are specified by the airplane flight manual.

NTSB determined that the probable cause of the incident was "high-altitude ice crystals that had accreted on the compressor vanes and were ingested into the high-pressure compressor when the pilots retarded the power levers [for the descent], causing compressor surges and flameouts of both engines." Contributing factors were "the lack of training on the hazards of high-altitude ice crystals to gas turbine engines and guidance to the pilots to activate the engine anti-ice system in conditions where high-altitude ice crystals may exist," the report said.

Trim Control Loss Traced to Condensation

Bombardier Challenger 604. No damage. No injuries.

About 4 1/2 hours after departing from Lagos, Nigeria, to fly to Farnborough, England, on Nov. 11, 2005, the autopilot pitch trim system failed. About 30 minutes later, both the primary and secondary manual pitch-trim systems failed. The manual systems are activated by switches on the control columns. The Challenger does not have a backup mechanical pitch-trim system, said the U.K. Air Accidents Investigation Branch (AAIB) report.

"The pilots elected to descend to a lower level, believing that 'cold soaking' of the aircraft in the very low temperatures at FL 400 could be a cause of the trim system faults," the report said. However, pitch trim ran to almost full nose-down despite manual application of nose-up trim commands.

"Consequently, although the commander remained the handling pilot, it was necessary for the copilot to assist him by applying aft pressure to the control column," the report said. "There is no indication that the crew attempted to disconnect the system through the stabilizer trim disconnect switches."

Although the checklist for landing with a stabilizer trim failure called for use of 20 degrees of flap, the commander decided to keep the flaps retracted, to avoid increasing the nose-down pitch. The runway at Farnborough was not long enough for a no-flap landing, so the crew requested and received clearance to divert to London Stansted Airport. The air traffic controller advised the crew that the Challenger was 65 nm (120 km) from Stansted, 25 nm (46 km) from Luton and 20 nm (37 km) from Heathrow. "Concerned with the physical effort required to fly the aircraft manually, the commander decided to divert to Heathrow," the report said.

A passenger, an off-duty employee of the company who held a pilot's license, assisted the crew by manipulating the throttles. The approach and landing at Heathrow were conducted without further incident.

The incident aircraft was manufactured in 2004 and had accumulated 202 flight hours. Initial examination revealed no pre-existing defects. The report cited several previous pitch-trim incidents that involved moisture contamination of the horizontal stabilizer trim control unit motherboards in Challengers and their regional jet derivatives. These incidents were believed to have been caused by water entering the control unit, which is located beneath the floor near the cabin door and galley. The response was to require protective tape to be installed on portions of the motherboard.

However, AAIB determined that the November 2005 incident likely was caused by condensation on the Challenger's motherboard. Laboratory tests showed that moisture contamination occurred during prolonged exposure to a hot and humid environment, followed by exposure to a cold environment. "Faults appeared after about five hours due to the cold external wiring cooling the motherboard and allowing condensate to build up, due to the humid air," the report said. The faults caused by the moisture contamination included multiple intermittent short circuits.

TURBOPROPS

Unfeathered Prop Causes Control Problems

Bombardier DHC-8/Q400. No damage. No injuries.

The aircraft was on a scheduled flight with four crewmembers and 69 passengers from Stockholm to Kalmar, Sweden, on April 6, 2006. During descent for the initial approach in visual meteorological conditions (VMC), an overspeed of the right propeller occurred. "According to the emergency checklist, a number of actions are to be taken, ending with feathering the faulty propeller and switching off the engine to reduce the air resistance (drag) of the propeller," said the report by the Swedish Accident Investigation Board.

The commander decided, however, not to feather the propeller and to keep the engine operating at flight idle. He increased power from the left engine from flight idle to 40 percent torque. The first officer asked whether she should secure the right engine. "The commander rejected this proposal, referring to the fact that the approach had now begun and that he understood that, in this situation, one should not start a shutdown sequence but continue the approach and land," the report said.

The commander increased left-engine power to 90 percent to level off at 2,000 ft. "The first officer once again asked the commander if she should secure the right engine but again received a negative answer," the report said. "At this stage, the autopilot automatically disconnected due to the increased asymmetric power, and the aircraft had to be flown manually. At the same time, the automatic 'up-trim' system in the engine increased the power from the left engine to 100 percent torque."

The Q400 began to sink rapidly. The terrain awareness and warning system (TAWS) generated a "TERRAIN, PULL UP" warning and several "SINK RATE" warnings when the aircraft was 1,200 ft above ground level (AGL), sinking at 3,700 fpm and in a right turn, away from the airport. The commander increased left-engine power to 125 percent, which is beyond the torque limit, and began a climbing left turn toward the final approach course.

The airport air traffic controller noticed on his radar screen that the aircraft was off course and 800 ft low. At the same time, the first officer reported that they had an engine problem. The controller asked if they needed assistance, and the first officer replied, "We don't need any assistance. It will be a normal landing."

"At this stage, the air traffic controller decided that the situation really was serious and set off the alarm," the report said. While calling emergency services, the controller saw the Q400 in level flight at a very low height — 200 to 300 ft AGL — about 1 nm (2 km) from the runway threshold. "The controller was convinced that there would be an accident and therefore said to the emergency services, 'Come out with all you've got. He's going to crash,'" the report said.

Recorded flight data showed that full rudder and aileron control were used during the approach. The aircraft passed 15–20 ft over the runway threshold and touched down about 20 m (66 ft) beyond the threshold. "Roll-out on the runway took place with no further problems," the report said. "The rescue vehicles followed the aircraft to its parking place on the apron."

The commander told investigators that he did not complete the propeller overspeed checklist, by feathering the propeller and shutting down the engine, because "he thought the Q400 had so much power that this was not necessary," the report said. "During the approach, he found that controlling the aircraft became more and more difficult … and found it difficult to understand why."

The 125 percent torque setting had been maintained for 1 minute and 15 seconds, and did not cause any damage to the left engine. The propeller overspeed was traced to contact between a sensor and a bus bar on the propeller hub that produced sparks and electromagnetic interference with the propeller electronic control unit.

In the two-year period preceding the incident, six propeller overspeeds had occurred during the airline's operations. "The QRH [quick reference handbook] emergency checklist was not followed in any of these cases," the report said. "Instead, the crews had either carried out only part of the list or not followed it at all. … Several explanations were given for not completing the checklist in these situations."

Among actions taken by the airline after the April 2006 incident were a revision of the emergency checklist to improve its clarity and implementation of propeller overspeed training during simulator checks.

"At the same time, the automatic 'up-trim' system in the engine increased the power from the left engine to 100 percent torque."

Airspeed, Turbulence Cited in Breakup

Aero Commander 690A. Destroyed. Four fatalities.

The airplane was about 1,038 lb (471 kg) over its maximum takeoff weight when it departed from Oklahoma City to fly to Orlando, Florida, U.S., the afternoon of Oct. 15, 2006. About 37 minutes later, while cruising at FL 230, the pilot was told by air traffic control (ATC) that radar showed the airplane entering an area of heavy precipitation, the NTSB report said. The pilot acknowledged the information.

The Aero Commander was being flown 15 to 20 kt above its turbulence-penetration speed when moderate turbulence was encountered. ATC radar indicated that the airplane made a 180-degree turn while descending at about 13,500 fpm. The wreckage was found the next day, scattered over a densely wooded area in Antlers, Oklahoma. "An examination of the airframe revealed that the airplane's design limits had been exceeded and that the examined fractures were due to overload failure," the report said.

Engine Fails During Flight Over Mountains

Cessna 208B. Destroyed. Three fatalities, five serious injuries.

The Caravan was over a designated mountainous area at 9,000 ft, during a flight from Tofino, British Columbia, Canada, to Vancouver, on Jan. 21, 2006, when the engine failed. "A compressor turbine blade failed as a result of the overstress extension of a fatigue-generated crack," the TSB report said. "The subsequent internal damage to the engine was immediate and catastrophic."

The pilot turned toward Port Alberni Regional Airport, about 17 nm (31 km) away. "The pilot was in VMC, but he would have to enter cloud during the descent," the report said. "The pilot then requested navigational information to help keep the aircraft clear of the mountains. … There is no capability for air traffic controllers to provide such navigational guidance." The aircraft did not have, and was not required to have, a TAWS.

ATC lost radio communication with the pilot when the aircraft descended through 7,000 ft. Pilots of other aircraft in the area heard the Caravan pilot declare an emergency and say that he was attempting a forced landing on a logging road. "The aircraft struck trees during a steep right-hand turn and crashed," the report said. The pilot and two passengers were killed.

PISTON AIRPLANES

Aileron Rigging Error Missed on Preflight

De Havilland DHC-2. Substantial damage. No injuries.

The pilot said that both he and the maintenance technician who had rebuilt the Beaver checked the engine and flight controls before attempting the first flight following the rebuild on April 17, 2007. Winds were from 150 degrees at 16 kt, gusting to 22 kt, when the airplane departed from Runway 14 at Ted Stevens Anchorage (Alaska, U.S.) International Airport. The Beaver was about 150 ft AGL on initial climb when it suddenly rolled right about 90 degrees, the NTSB report said.

"The pilot applied left aileron and left rudder control, but the airplane did not respond," the report said. "He retarded the engine power to idle and pushed forward on the control yoke to maintain airspeed." The right wing, then the left wing struck the runway, and the airplane touched down hard on the main landing gear, departed the runway and struck a ditch.

"A postaccident examination of the airplane and flight controls revealed that the chain control linkage within the control yoke was misrouted at the base of the control column, thereby reversing the aileron activation," the report said. NTSB said that the rigging error and the pilot's inadequate preflight inspection were the probable causes of the accident.

Fuel Injectors Blocked by Rust Particles

Piper Aztec. Destroyed. One fatality.

The aircraft had been stored outside at Bagby Airfield near Thirkelby Hall, England, with no engine runs conducted, for nearly five years before the pilot bought it in February 2006, the AAIB report said. Water was found in the fuel system during maintenance and inspections conducted before the sale; the system was flushed, and the fuel filters were cleaned.

The pilot flew the Aztec a little more than three hours before returning it to Bagby Airfield for an annual maintenance inspection. A fuel injector in the left engine was found blocked; all the fuel injectors were cleaned, and the fuel system again was flushed.

Winds were from 250 degrees at 5–8 kt when the pilot arrived at the airfield to pick up the airplane on June 29, 2006. Bagby is an unlicensed airfield with two grass runways. The main runway, 06/24, is 710 m (2,330 ft) long, and Runway 24 has a nearly 3-degree downslope.

Witnesses saw smoke emerging from both engines as the Aztec departed from Runway 24. The pilot radioed that the aircraft was not climbing properly and then flew a tight pattern to return for a landing on Runway 24. The aircraft touched down hard and bounced several times before the pilot conducted a go-around. The aircraft was observed climbing slowly before it banked steeply left, stalled and spun to the ground.

"The examination of the engines revealed that two different types of corrosion debris had affected many of the fuel injector nozzles," the report said. One of the fuel injectors on the left engine was totally blocked, and those on the right engine had flow rates reduced by 55 to 91 percent. The report said this indicated "that despite the cleaning and flushing of the fuel system, not all of the corrosion debris had been removed from the system."

HELICOPTERS

Water Contact During Go-Around

Sikorsky S-61N. Minor damage. No injuries.

The helicopter was returning with 12 passengers to Den Helder (Netherlands) Airport from a North Sea platform on Nov. 30, 2004. IMC prevailed at the airport, and visibility was deteriorating in fog. The first officer, the pilot flying, told the pilot-in-command (PIC) that he would conduct the instrument landing system (ILS) approach at 70 kt, rather than the standard 100 kt, to provide "ample time to observe everything," said the report by the Dutch Safety Board.

The PIC told the first officer to descend "and stay just a bit below" the glideslope. The report said that he likely expected that this would hasten their acquisition of the approach lights and reduce the possibility of a go-around.

The helicopter was about 250 ft over the Waddenzee when the PIC noticed that airspeed had decreased to 20 kt and the helicopter was descending rapidly. He applied full power and maximum aft collective. The descent was arrested, but the S-61 touched the water before it began to climb. It then was landed at the airport without further incident. The water contact had caused no damage, but the gearbox had been overloaded during the recovery and required replacement.

The report said that the failure of both pilots to promptly notice and correct the decreasing airspeed and increasing descent rate likely was caused by fatigue, neglect of standard operating procedures and checklists, preoccupation with an autopilot problem and lack of recent experience in the S-61.

Tail Rotor Control Lost During Landing

Bell 206L-3. Substantial damage. Two minor injuries.

The news helicopter was engaged in filming a rescue operation at 12,500 ft in mountainous terrain near Taos, New Mexico, U.S., on July 12, 2006. After circling an open landing area three times, the pilot attempted a run-on landing. The LongRanger began to yaw right about 30 ft AGL, and the pilot was not able to correct the yaw, the NTSB report said. The helicopter struck the ground and rolled onto its left side.

"The pilot reported that the wind was calm and the temperature was approximately 70 degrees F [21 degrees C]," the report said. "The pilot stated that he did not complete any performance calculations prior to the flight." NTSB said that the probable cause of the accident was loss of tail rotor effectiveness during the attempted landing in the high-density-altitude conditions.

"When operating at high altitudes and high gross weight, tail rotor thrust may not be sufficient to maintain directional control," the report said. "In these conditions, gross weight needs to be reduced and/or operations need to be limited to lower density altitudes." ●

Preliminary Reports

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Jan. 2, 2008	Tehran, Iran	Fokker 100	destroyed	59 none
Snow was falling when the Fokker skidded off the runway during takeoff.				
Jan. 2, 2008	Masbate, Philippines	NAMC YS-11A	substantial	47 NA
Winds were reported from 040 degrees at 10 kt, gusting to 14 kt, when the airplane overran Runway 21 on landing and struck a concrete fence.				
Jan. 3, 2008	Bahía Piña, Panama	Britten-Norman Islander	destroyed	2 serious
The flight crew reported an engine problem before the Islander stalled and crashed on approach.				
Jan. 3, 2008	Deauville, France	Boeing 737-400	minor	174 none
The 737 ran off the runway during landing.				
Jan. 3, 2008	Oklahoma City	Pilatus PC-12/45	none	1 fatal
The pilot was shutting down the engine after landing with seven passengers when a line technician walked into the propeller and was killed.				
Jan. 4, 2008	Los Roques, Venezuela	LET 410VP	destroyed	14 fatal
During descent, the pilot reported that both engines had failed. The airplane crashed while being ditched.				
Jan. 5, 2008	Kodiak, Alaska, U.S.	Piper Chieftain	substantial	6 fatal, 3 serious, 1 minor
A passenger said that the baggage door opened during takeoff. The pilot lost control while attempting to return to the airport, and the Chieftain crashed into the ocean.				
Jan. 7, 2008	Bangkok, Thailand	Boeing 747-400	none	334 none
All four generator control units failed about 30 minutes after the 747 departed from Bangkok. The crew returned to the airport using standby power and instruments.				
Jan. 9, 2008	Detroit	Airbus A319-100	substantial	73 none
The no. 2 engine fan cowling separated during approach and struck the horizontal stabilizer. Engine maintenance had been performed before the flight.				
Jan. 11, 2008	Windhoek, Namibia	Cessna 210M	destroyed	6 fatal
The airplane crashed in a residential area after losing power during takeoff for a charter flight.				
Jan. 14, 2008	Lihue, Hawaii, U.S.	Beech 1900C	destroyed	1 fatal
The airplane crashed in the ocean during a night cargo flight to Lihue from Honolulu.				
Jan. 15, 2008	Port Saïd, Egypt	Beech King Air C90B	destroyed	2 fatal
The King Air crashed on takeoff during a training flight.				
Jan. 16, 2008	Cleveland	Beech 58 Baron	substantial	1 fatal
The Baron crashed in Lake Erie during takeoff from Burke Lakefront Airport for a positioning flight.				
Jan. 16, 2008	Tulsa, Oklahoma, U.S.	Aero Commander 500B	substantial	1 fatal
The airplane was departing in night instrument meteorological conditions (IMC) for a cargo flight when the pilot reported gyro problems. The pilot lost control while attempting to return to the airport.				
Jan. 17, 2008	London	Boeing 777-200ER	substantial	2 minor, 191 none
Both engines lost power and did not respond to throttle inputs during final approach. The 777 touched down in a grassy area short of the runway.				
Jan. 19, 2008	Huambo, Angola	Beech Super King Air 200	destroyed	13 fatal
The King Air crashed into a mountain during an approach in night IMC.				
Jan. 22, 2008	Ochopee, Florida, U.S.	Robinson R44	substantial	2 fatal
The helicopter was seen maneuvering erratically before it crashed during a training flight.				
Jan. 23, 2008	Miroslawiec, Poland	CASA C-295M	destroyed	20 fatal
The Polish Air Force airplane crashed in a forest during final approach.				
Jan. 25, 2008	Pointe Noire, Congo	Antonov An-12	destroyed	2 serious
The Antonov struck a 727-200 after its brakes failed during taxi. Both airplanes reportedly were damaged beyond economic repair.				
Jan. 26, 2008	Malinau, Borneo	CASA 212-200	destroyed	3 fatal
The airplane crashed during a cargo flight from Tarakan to Long Apung, Indonesia.				
Jan. 26, 2008	Los Angeles	Robinson R44	destroyed	1 fatal
The helicopter struck power lines and crashed on a highway.				
Jan. 30, 2008	Sugapa, Indonesia	de Havilland Canada DHC-6	substantial	1 fatal, 2 serious, 18 none
The Twin Otter skidded off the runway while landing and struck several people, killing one and injuring two others.				
Jan. 31, 2008	West Palm Beach, Florida, U.S.	Boeing 757	none	NA
The crew declared an emergency because of smoke in the cockpit and cabin. After landing, six occupants were transported to a hospital with unknown injuries.				

NA = not available

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