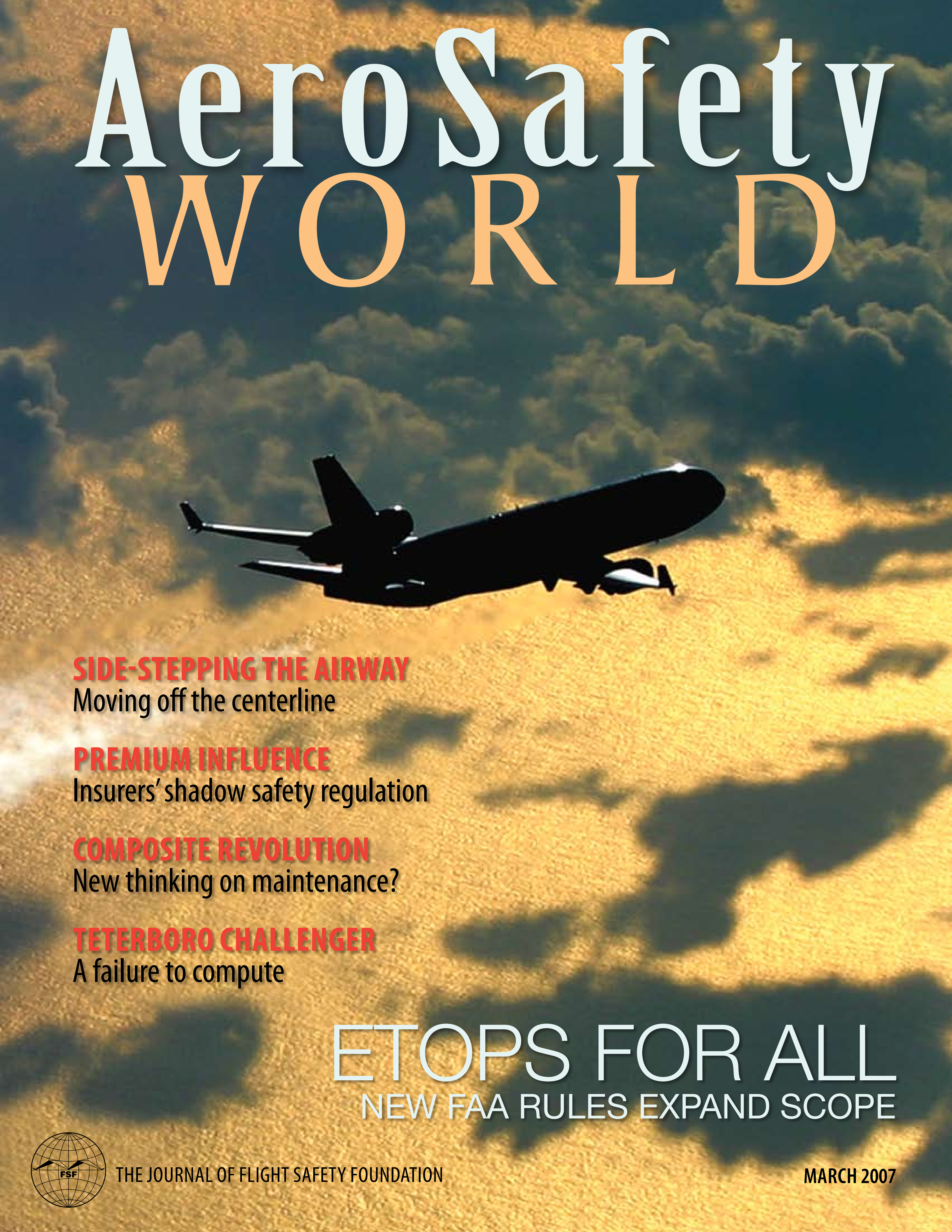

# AeroSafety WORLD

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Moving off the centerline

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Insurers' shadow safety regulation

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New thinking on maintenance?

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A failure to compute

## ETOPS FOR ALL
NEW FAA RULES EXPAND SCOPE

THE JOURNAL OF FLIGHT SAFETY FOUNDATION

MARCH 2007

# STARTING Down the Road

Over the past few months, I have made a big deal about establishing connections across the various components of our industry, breaking down old barriers to attain the next level of safety improvements. We have also made considerable mention of the *Global Aviation Safety Roadmap* in this column and elsewhere in this magazine. Well, as with most things, there comes a time when you have to stop talking and start doing. This month, I'd like to talk about the first few steps taken with the *Roadmap*.

As a reminder, the *Roadmap* is a strategic action plan that a diverse group of aviation industry representatives put together to help the International Civil Aviation Organization (ICAO) work with the industry to produce coordinated and integrated plans for improving safety around the world, region by region.

The Foundation joined with our friends from the Dutch Directorate General for Civil Aviation and Freight Transport (DGTL) and the secretariat of ICAO to host the first meeting on the first region where the *Roadmap* will actually be put to work — Africa. We called it a "think tank" to break the mold of preconceptions and invited a cross section of people representing African operators and regulators, manufacturers and various organizations that run support programs and safety initiatives on the continent.

We had only a couple of days, so the best we could hope for was to scratch the surface and agree on a way forward. One thing was clear: The regional planning process laid out in the *Roadmap* is a good one. Thanks to the process, and the quality of the participants at the table, we were able to get to the critical underlying issues. Everybody agreed that the priority had to be placed on programs that target deep-seated issues before other reforms could take hold. It was also very clear that changes to the African airline industry had to be driven by strong and capable regulators, and that those regulators had to be able to do their job without interference from politicians. That is a pretty touchy discussion topic for a bunch of people sitting in Washington, but the good news is that it was the same tough conclusion the African Union itself reached last year.

It is important that a disparate group of people used the *Roadmap* as a tool to get to conclusions together. And what is different in this instance is that the conclusions were not the destination, but the starting point.

After the big focus areas were identified, what remained was to figure out who takes the next step and starts building those vital plans. That is a tough question. It will take more focus and more resources than have been invested before. Over the next couple of months, the think-tank participants will develop proposals that should gain the support of the African Union and the African aviation industry.

Other regions are ready to start down the *Roadmap* path as well. Plans are coming together in the Middle East and South America. It is pretty clear that everyone will approach it a little differently, and different organizations will be taking the lead in different regions. As long as everybody agrees to the destination, it doesn't matter who drives or the route they take. They will all get there. That is the good thing about a roadmap.

William R Voss

*William R. Voss*
*President and CEO*
*Flight Safety Foundation*

AeroSafetyWORLD

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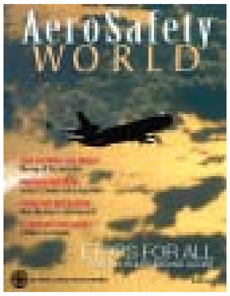


**About the Cover**
The new ETOPS covers more than twins.
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## AeroSafetyWORLD

**William R. Voss**, publisher,
FSF president and CEO
voss@flightsafety.org, ext. 108

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

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

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

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

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

**Karen K. Ehrlich**, web and print production coordinator
ehrlich@flightsafety.org, ext. 117

**Ann L. Mullikin**, production designer
mullikin@flightsafety.org, ext. 120

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

**Patricia Setze**, librarian
setze@flightsafety.org, ext. 103

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Flight Safety Foundation
601 Madison Street, Suite 300, Alexandria, VA, 22314-1756 USA
tel: +1 703.739.6700 fax: +1 703.739.6708
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# INCURSIONS, EXCURSIONS & Confusions

In an industry that produces volumes of data to assure the safety of flight, the absence of guidance for landing on slick runways stands out in sharp relief. During a two-day runway safety workshop in Amsterdam in early February, it became clear that pilots landing airplanes on runways that are anything but dry and clean have very little information for judging landing performance. When standing water is deep or snow and ice are on the runway, the landing becomes, in a very real sense, a "physics experiment," as one participant described it.

Runway surface condition information and runway friction criteria available to pilots range from little to none. The only consistent advice is to add 50 percent to stopping distances if the runway is wet. If it is snow- or ice-covered, good luck, you're on your own. The situation is so bad that National Air Traffic Services (NATS), the U.K. air traffic control provider, will relay only subjective reports from pilots whose own physics experiments turned out well, adding the type of aircraft and the time of the report. Should 10 minutes pass and the next airplane is significantly larger or smaller, we're back to "good luck." An effort to produce friction standards appears to be five years or more away from conclusion.

This lack of data was one of many issues discussed during the workshop.

The genesis for this meeting of regulators, air traffic service providers, pilots, airline groups and airport groups was an uncomfortable feeling, based on increasing incidents but only a few accidents, that a number of unresolved problems are lurking about. While "runway safety" was the theme of the meeting, the specific issues were runway incursions, runway excursions and runway confusions.

Incursions have been the subject of many regional and national efforts, driven by a rising rate, a number of scary near-collisions and, of course, the tragic MD-87/CJ2 collision in 2001 at Linate, Italy. However, these efforts' best result has been to halt the rise of the incursion rate.

Efforts to reduce the number of runway excursions during landing or takeoff are nearly nonexistent because the subject has not been addressed in a comprehensive manner. There aren't even any good data on the frequency of these events, many of which do not result in aircraft damage or personal injury; those that do often are shunted off into pilot error categories. Sketchy data on excursions say the frequency is increasing to the point of setting off alarms in our data-driven safety-alerting structure.

The poster case for runway confusion is last year's tragic Comair Bombardier CRJ-100 accident at Lexington, Kentucky, U.S., on a clear, quiet morning. Not too long ago, a Singapore Airlines Boeing 747 succumbed to a runway confusion accident: Both accidents were catastrophic.

What if, it was asked, controllers don't give a takeoff clearance until the aircraft is at the departure end of the correct runway, as is the practice in some places? And what if pilots emphasize the importance of checking the aircraft magnetic heading against the runway heading before starting to roll?

Questions such as these, and more, drove the workshop group to continue its work, with a follow-up meeting set for late May in Brussels. And a name for the effort emerged: Runway Safety Initiative.

## Clarifying the Position on SSRIs

In "Anxiety Suspected in Pilot Incapacitation" (*ASW*, 12/06, p. 9), the final paragraph implies that the Aerospace Medical Association (AsMA) is in agreement with the Civil Aviation Safety Authority of Australia on the issue of the use of a class of antidepressants known as selective serotonin reuptake inhibitors (SSRIs). This could be misinterpreted in that AsMA's public policy on this issue is a little more restrictive.

Our policy is well defined in a position paper published in the May 2004 *Aviation, Space, and Environmental Medicine* entitled "Aeromedical Regulation of Aviators Using Selective Serotonin Reuptake Inhibitors for Depressive Disorders."

In the paper, we proposed that exceptions might be made for *selected* cases of pilots who are depressed and are taking SSRIs as long as they are carefully monitored. At a later date, once there is more confidence in the use of these medications, a broader policy might be in order.

**Russell B. Rayman, M.D.**
Executive Director, Aerospace Medical Association

*Editorial note: Dr. Rayman is a member of the* AeroSafety World *Editorial Advisory Board.*

**MARCH 12–14 ➤ 19th annual European Aviation Safety Seminar (EASS): "Staying Safe in Times of Change."** Flight Safety Foundation and European Regions Airline Association. Amsterdam, Netherlands. Namratha Apparao, <apparao@flightsafety.org>, <www.flightsafety.org/seminars.html#eass>, +1 703.739.6700, ext. 101.

**APRIL 2–4 ➤ Maintenance Management Conference.** National Business Aviation Association. San Diego. Dina Green, <dgreen@nbaa.org>, <web.nbaa.org/public/cs>, +1 202.783.9357.

**APRIL 2–5 ➤ 58th Annual Avionics Maintenance Conference.** ARINC. Phoenix, Arizona, U.S. Roger S. Goldberg, +1 410.266.2915.

**APRIL 4–5 ➤ 8th Annual Airline Line Maintenance Conference.** Aviation Industry Conferences. Lisbon, Portugal. <amandap@aviation-industry.com>, <www.aviationindustrygroup.com>, +44 (0)207 931 7072.

**APRIL 15–18 ➤ FAA Tech Transfer Conference and Exposition.** American Association of Airport Executives, U.S. Federal Aviation Administration, et al. Atlantic City, New Jersey, U.S. Tom Zoeller, <tom.zoeller@aaae.org>, <www.aaae.org>, +1 703.824.0500.

**APRIL 16–17 ➤ ACI–NA Public Safety & Security Spring Conference.** Airports Council International–North America. Spokane, Washington, U.S. Amy Peters, <apeters@aci-na.aero>, <www.aci-na.org>, +1 202.293.8500.

**APRIL 17–19 ➤ MRO 2007 Conference & Exhibition.** *Aviation Week*. Atlanta. Lydia Janow, +1 212.904.3225, 800.240.7645.

**APRIL 18–19 ➤ ERA Regional Airline Conference.** European Regions Airline Association. Lisbon, Portugal. Paula Bangle, <paula.bangle@eraa.org>, <www.eraa.org/inside-era/RAC07.php>, +44 (0)1276 856495.

**APRIL 24–26 ➤ 9th Annual Canadian Airport Management Conference.** Airports Council International–North America and Canadian Airports Council. Ottawa. <meetings@aci-na.aero>, <www.aci-na.org>, +1 202.293.8500.

**APRIL 25–27 ➤ 2nd China International Conference & Exhibition on Avionics and Test Equipment (AvioniChina).** Grace Fair. Shanghai. Jasper Shi, <jasper@gracefair.com>, <www.gracefair.com/avi_home.htm>, +86 10 64390338, ext. 85.

**MAY 7–9 ➤ 4th International Aircraft Rescue Fire Fighting Conference.** *Aviation Fire Journal.* Las Vegas. <www.aviationfirejournal.com/vegas/contact.htm>, +1 914.962.5185.

**MAY 8–10 ➤ 52nd annual Corporate Aviation Safety Seminar: "Safety — The Foundation for Excellence."** Flight Safety Foundation and National Business Aviation Association. Tucson, Arizona, U.S. Namratha Apparao, <apparao@flightsafety.org>, <www.flightsafety.org/seminars.html#cass>, +1 703.739.6700, ext. 101.

**MAY 13–17 ➤ Aerospace Medical Association 78th Annual Scientific Meeting.** New Orleans. Dr. Russell B. Rayman, <rrayman@asma.org>, <www.asma.org/meeting/index.php>, +1 703.739.2240, ext. 103.

**MAY 15–17 ➤ Wildlife Hazard Management Workshop.** Embry-Riddle Aeronautical University, Center for Professional Education. Charlotte, North Carolina, U.S. Billy Floreal, <florealb@erau.edu>, <www.erau.edu/ec/soctapd/seminar_progs.html>, +1 386.947.5227.

**MAY 15–17 ➤ Fifth Anniversary RACCA Conference.** Regional Air Cargo Carriers Association. Scottsdale, Arizona, U.S. <stan@raccaonline.org>, <www.raccaonline.org/html/conference.html>, +1 508-747-1430.

**MAY 22–24 ➤ European Business Aviation Convention & Exhibition (EBACE 2007).** National Business Aviation Association and European Business Aviation Association. Geneva. Kathleen Blouin, <kblouin@nbaa.org>, <www.ebace.aero>, +1 202.783.9364.

**MAY 28–30 ➤ Airport Show Dubai.** Dubai, United Arab Emirates. <mail@theairportshow.com>, <www.theairportshow.com>, +9714 3329029.

**JUNE 3–5 ➤ 3rd Annual International Airfield Operations Area Expo & Conference.** Airport Business. Milwaukee. Carmen Seeber, <carmen.seeber@cygnuspub.com>, <www.aoaexpo.com>, 800.547.7377, ext. 1622, +1 920.563.6388, ext. 1622.

**JUNE 4–7 ➤ SimTecT 2007: Simulation Conference and Exhibition.** Simulation Industry Association of Australia. Brisbane. <simtect2007@consec.com.au>, <www.siaa.asn.au/simtect/2007/2007.htm>, +61 2 6251 0675.

**JUNE 5–6 ➤ 5th Annual Regional Airline Industry Flight Technology Conference.** Regional Airline Association. Washington, D.C. <www.raa.org>, +1 202.367.1170.

**JUNE 6–7 ➤ 13th Annual Asia Pacific Airline Engineering & Maintenance Conference.** Aviation Industry Conferences. Bangkok, Thailand. <ruthm@aviation-industry.com>, <www.aviationindustrygroup.com>, +44 (0)207 931 7072.

**JUNE 8–10 ➤ 2007 Regional Air Safety Seminar.** Australian and New Zealand Societies of Air Safety Investigators. Wellington, New Zealand. Peter Williams, <p.williams@taic.org.nz>, +64 4 473 3112.

**JUNE 10–13 ➤ 79th Annual AAAE Conference and Exposition.** American Association of Airport Executives. Washington. <AAAEmeetings@aaae.org>, <www.aaae.org>, +1 703.824.0500.

**JUNE 12–14 ➤ 2007 Flightscape Users Conference.** Flightscape. Ottawa. Christine Fernandes, <christine.fernandes@flightscape.com>, <www.flightscape.com/about/conferences.php>, +1 613.225.0070, ext. 231.

**JUNE 18–24 ➤ 47th International Paris Air Show.** Le Bourget, Paris. <exposants@salon-du-bourget.fr>, <www.paris-air-show.com/en/index.php>.

**OCT. 1–4 ➤ 60th annual International Air Safety Seminar.** Flight Safety Foundation, International Federation of Airworthiness, and International Air Transport Association. Seoul, Korea. Namratha Apparao, <apparao@flightsafety.org>, <www.flightsafety.org/seminars.html#iass>, +1 703.739.6700, ext. 101.

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

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

# Safety News

## Headset Warning

Pilots and other flight crewmembers who use noise-canceling headsets may have difficulty hearing audible alarms and other sounds, the U.S. Federal Aviation Administration (FAA) warned in a bulletin issued in January to operators.

"Noise-canceling headsets cancel noise through a combination of physical means and electronic means," the FAA said. "While this technology can have many beneficial effects, such as providing clearer communications, reduced pilot fatigue and added comfort, electronic attenuation of important environmental sounds and alarms may occur."

Ordinary, non-noise-canceling headsets do not present the same problem because they reduce ambient noise physically, by providing "acoustical quieting," the FAA said.

The FAA recommended that operators and pilots should evaluate their use of noise-canceling headsets, both on the ground and during flight, to determine whether audible alarms and other sounds can be heard. If these sounds are inaudible, "operators should elect to find other solutions to discern such alarms or sounds, or discontinue the use of noise-canceling headsets," the FAA said.

Lightspeed Aviation's 20XLc Headset

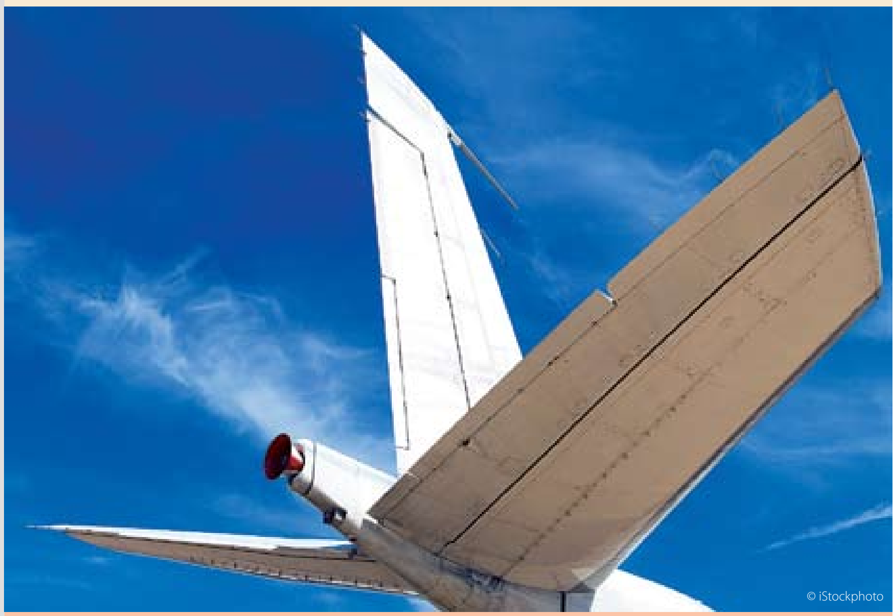
## Developing Safer Rudders

A vertical motion simulator is being used in a three-phase testing program aimed at revising rudder certification regulations in an effort to achieve safer handling characteristics for large transport airplanes.

The program is being conducted by the U.S. National Aeronautics and Space Administration (NASA) Ames Simulation Laboratories and the U.S. Federal Aviation Administration.

The first phase of the tests is designed to "determine the necessary lateral motion of a simulator for determining valid pilot response to aggressive rudder control," NASA said. Researchers also will identify the initial flight control criteria for rudder control system designs. These criteria include "various parameters limits, such as the force required to push rudder pedals at different airspeeds, travel of the rudder pedals, the cable stretch coefficient and force induced on the tail," NASA said.

Subsequent testing phases will develop tentative criteria for rudder flight control systems and validate the criteria by using more complex piloting tasks.



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## FAA Backs Later Retirement for Pilots

Administrator Marion C. Blakey of the U.S. Federal Aviation Administration (FAA) has proposed going along with an International Civil Aviation Organization (ICAO) standard to increase the mandatory retirement age to 65 from 60 (*ASW*, 2/07, p. 11).

Blakey said that the FAA would issue a formal notice of proposed rule making later this year and publish a final rule after a review of public comments.

ICAO's standard — which increases the upper age limit for pilots to 65, as long as another pilot in the flight crew is younger than 60 — took effect in November 2006. Since 1959, the FAA has required pilots of commercial airliners to retire at age 60.

"A pilot's experience counts — it's an added margin of safety," Blakey said. "Foreign airlines [which already have adopted the older retirement age] have demonstrated that experienced pilots in good health can fly beyond age 60 without compromising safety."

## Air Traffic Estimates Soar

The number of passengers passing through airports around the world each year is likely to double by 2025 — from the 4.2 billion who traveled in 2005 to more than 9 billion, according to projections by the Airports Council International (ACI).

Increases are expected to be largest in India, with a forecast increase of 10.4 percent, and China, with 8.1 percent growth, ACI said in its *ACI Global Traffic Forecast 2006–2025*, released in late January.

Cargo operations also are expected to increase, with average increases in tonnage carried expected to grow 5.4 percent a year over the next 20 years. The greatest growth is expected to occur in Asia, which likely will be the world's largest freight market by 2025, ACI said.

"Both the scale and speed of growth indicated by this latest forecast represent a daunting challenge for airports," said ACI Director General Robert J. Aaronson.

He praised the European Commission for recognizing air traffic congestion as a "crucial concern" and said that many airport development projects are "held up by regulation which distorts market forces or creates expensive, time-consuming bureaucratic hurdles to airport development."

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## ATSB Launches Confidential Reporting Scheme

The Australian Transport Safety Bureau (ATSB) has begun a confidential reporting program for aviation safety designed to identify safety issues that otherwise might not come to the ATSB's attention.

The new program — REPCON, which stands for Report Confidentially — complies with recommendations from the International Civil Aviation Organization to encourage confidential reporting of safety risks such as unsafe crew scheduling or noncompliance with rules or procedures.

"While Australia has the most comprehensive mandatory safety occurrence reporting legislation in the world, the Australian aviation industry has been keen to see a new confidential reporting scheme introduced with legislative coverage that will protect the identity of the reporter," said Mark Vaile, deputy prime minister and minister for transport and regional services.


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## GPS Approaches on the Horizon

The U.K. Civil Aviation Authority (CAA) says it expects to approve the use of global positioning system (GPS) nonprecision instrument approaches for general aviation aircraft by summer 2007.

CAA approval is expected to follow the analysis of more than 150 reports submitted by pilots who participated in a trial involving GPS approaches at six U.K. airports in 2006. The CAA said it will use data gathered during the trial to assess "the viability of the design, approval, management and use of such approaches."

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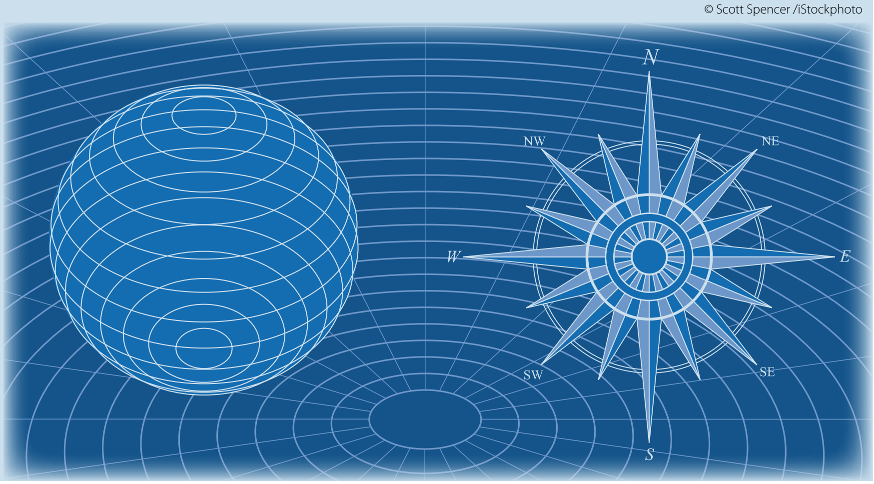


## High-Altitude Training

The U.S. National Transportation Safety Board (NTSB) has recommended changes in training for pilots who conduct high-altitude flights in regional jet airplanes.

The recommendations to the U.S. Federal Aviation Administration (FAA) include a call for enhanced training syllabuses that include methods of ensuring that pilots have a thorough understanding of regional jets' performance capabilities, limitations and high-altitude aerodynamics. The NTSB also recommended that air carriers ensure that their pilots have opportunities to practice high-altitude stall recovery techniques in a simulator.

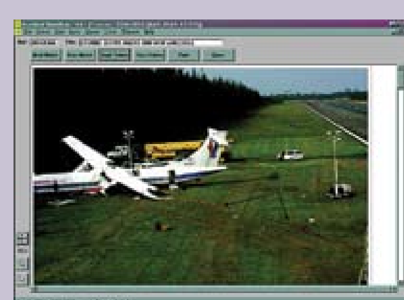
The NTSB action follows the investigation of the Oct. 14, 2004, crash of a Pinnacle Airlines Bombardier CL600-2B19 near Jefferson City, Missouri, U.S.; both crewmembers on the positioning flight were killed, and the airplane was destroyed.

The NTSB said that the probable causes of the accident were "the pilots' unprofessional behavior, deviation from standard operating procedures, and poor airmanship, which resulted in an in-flight emergency from which they were unable to recover, in part because of the pilots' inadequate training; the pilots' failure to prepare for an emergency landing in a timely manner, including communicating with air traffic controllers immediately after the emergency about the loss of both engines and the availability of landing sites; and the pilots' failure to achieve and maintain the target airspeed in the double engine failure checklist, which caused the engine cores to stop rotating and resulted in the core lock engine condition." Contributing factors were "the engine core lock condition, which prevented at least one engine from being restarted, and the airplane flight manuals that did not communicate to pilots the importance of maintaining a minimum airspeed to keep the engine cores rotating," the NTSB said (*ASW*, 7/06, p. 44).

© Bombardier

## In Other News …

An appeals court in **Japan** has upheld a lower court's finding that a former pilot for Japan Air Lines was not guilty in a June 8, 1997, accident in which a flight attendant was killed and 13 passengers and crewmembers were injured. The lower court held that the pilot had not known that releasing the autopilot would result in violent pitch changes. … Five years after the crash of a Raytheon Beech Super King Air 200 carrying members of the Oklahoma State University basketball team, U.S. National Transportation Safety Board Chairman Mark V. Rosenker is commending the **National Collegiate Athletic Association, American Council on Education** and the **National Association for Intercollegiate Athletics** for compiling a student-transportation safety manual. All 10 occupants were killed in the Jan. 27, 2001, crash in Strasburg, Colorado, U.S., and the airplane was destroyed. … Data from the **Aviation Safety Network**, a service of Flight Safety Foundation, have been added to an international safety database on aircraft fires and cabin safety. The database is maintained by the Cabin Safety Research Technical Group, whose members include civil aviation authorities worldwide.


**Cabin Safety Research Technical Group Database Screenshot**

*Compiled and edited by Linda Werfelman.*

© Michael Martoudis/airliners.net

# ETOPS Redefined

**A new name and sweeping new rules for 'extended operations.'**

BY PATRICK CHILES

After more than two decades of long-range flight operations governed by a series of advisory circulars, policy letters and draft policies, the U.S. Federal Aviation Administration (FAA), with much international input, has revised its regulations to provide definitive guidance to long-haul operators. ETOPS, an acronym previously describing *extended-range twin-engine operations*, has been redefined to mean *extended operations*, the name applied to this package of regulations for all commercial multi-engine airplanes.

The development of the new rules not only has been anticipated by U.S. commercial aircraft operators but also has been closely watched by other civil aviation authorities. Australia, Canada and New Zealand intend to publish similar rules this year. Europe's Joint Aviation Authorities is developing recommended requirements that will be harmonized with the FAA's. The International Civil Aviation Organization is crafting a proposal for member states that would consider these new rules.

The wide-ranging package of changes to U.S. Federal Aviation Regulations (FARs) Parts 1, 21, 25, 33, 121 and 135 is the product of a nearly seven-year rule-making process guided by recommendations of an FAA/industry aviation rule-making advisory committee (ARAC). The new ETOPS requirements, most of which took effect in February 2007, apply to a larger number of operators and to a greater range of operations.

The new rules have provisions to increase maximum allowable diversion times for air carriers that have been conducting ETOPS flights. The more significant changes affect three- and four-engine airplanes, and Part 135 on-demand operators, which previously were not under the ETOPS umbrella.

As of early 2007, commercial aircraft operators and manufacturers are still examining the final rule to determine its impact. There is much to digest, so we will attempt here to describe the implications for the operator, focusing on the issues of most concern for those previously not affected by ETOPS.

## Increased Diversion Times

The FAA first allowed operators to fly twin-engine airplanes on routes that did not remain within 60 minutes of an adequate alternate airport at single-engine speed in 1977, when it allowed a deviation time of up to 75 minutes for Caribbean operations.

Clearly, turbine engines and time-limited aircraft systems had become more reliable over decades of operation. In 1985, the FAA recognized this and issued Advisory Circular 120-42, detailing how airlines could get permission to operate routes with maximum diversion times up to 120 minutes, opening up the North Atlantic to twin-engine airplanes. A subsequent revision allowing for maximum diversion times up to 180 minutes — which eventually was further revised to allow special increases to 207 minutes — opened the door to Pacific routes.

Today, twin-engine airplanes largely have displaced three- and four-engine airplanes on North Atlantic routes and have claimed a healthy share of Pacific traffic. The 2007 rules retain many of the existing maximum diversion times while extending the maximum diversion time to 240 minutes and more in some situations.

While ETOPS became accepted practice, none of its provisions were codified as FARs. As extended operations became increasingly common, it became clear that formal rule making was needed to clarify the requirements. It also became generally accepted that the safety principles used in ETOPS had great merit for use in other types of remote operations. For example, interest in transpolar routes that became viable after the collapse of the Soviet Union prompted the FAA to issue a policy letter detailing rules applying to all airplanes for, among other things, systems endurance, alternate airports and protection for passengers in the event of a diversion in extreme climes.

The ARAC codified existing procedures and "industry best practices" into a proposed comprehensive operating standard that was released in November 2003. The proposal generated vigorous public comment, which was not surprising considering its scope. In particular, operators of three- and four-engine airplanes and those operating under Part 135 would now have to carefully consider maximum diversion times instead of just equal-time points (ETPs), at which the diversion times to designated en route alternates are equal.

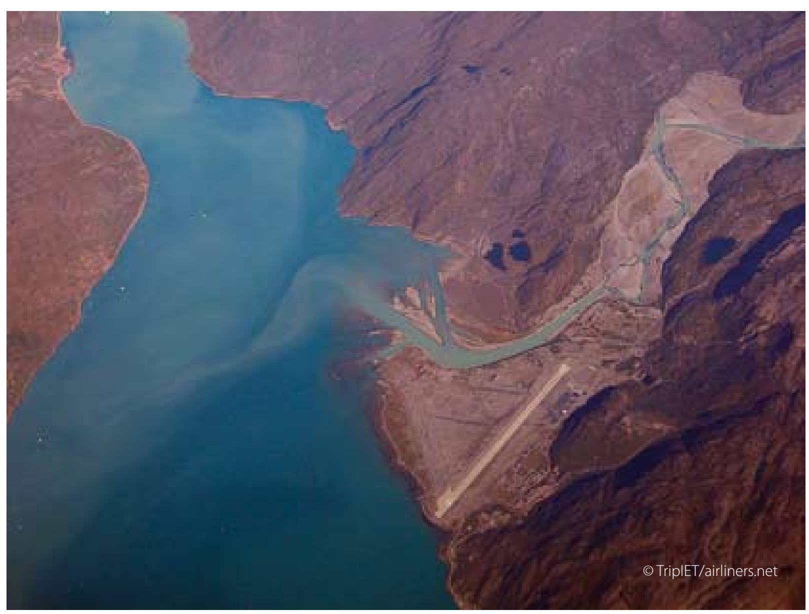
Aware of the many questions — especially by newly affected operators — about complying with the new rules, the FAA is working on a new advisory circular, anticipated by mid-year, as well as new handbook guidance for its operations and maintenance inspectors. The fundamental requirements are already familiar to U.S. air carriers.

## Gaining Approval

Initial approval generally requires a carrier to have at least one year of operating experience with a specific airplane to gain authority for a 120-minute diversion time and then another year of experience before gaining authority for 180 minutes. Accelerated approval is possible in six months, with the intent of validating sound processes for extended operations and ensuring a carrier's commitment to them. These processes focus on the concept of precluding in-flight failure of engines and other critical systems, and protecting the aircraft and occupants in the event of a diversion.

Operational planning is fairly straightforward. Generally, the route of flight must remain within the approved maximum diversion time, computed using an approved single-engine cruise speed in still air and standard atmospheric conditions (Figure 1, page 14). For flag and supplemental ETOPS, Part 121.646(b) requires air carriers to plan for a sufficient fuel supply to divert to and land at an adequate airport after one of the following occurs at the most critical

The Narsarsuaq, Greenland, airport might serve as a safe haven for a light jet on an on-demand ETOPS flight over the North Atlantic.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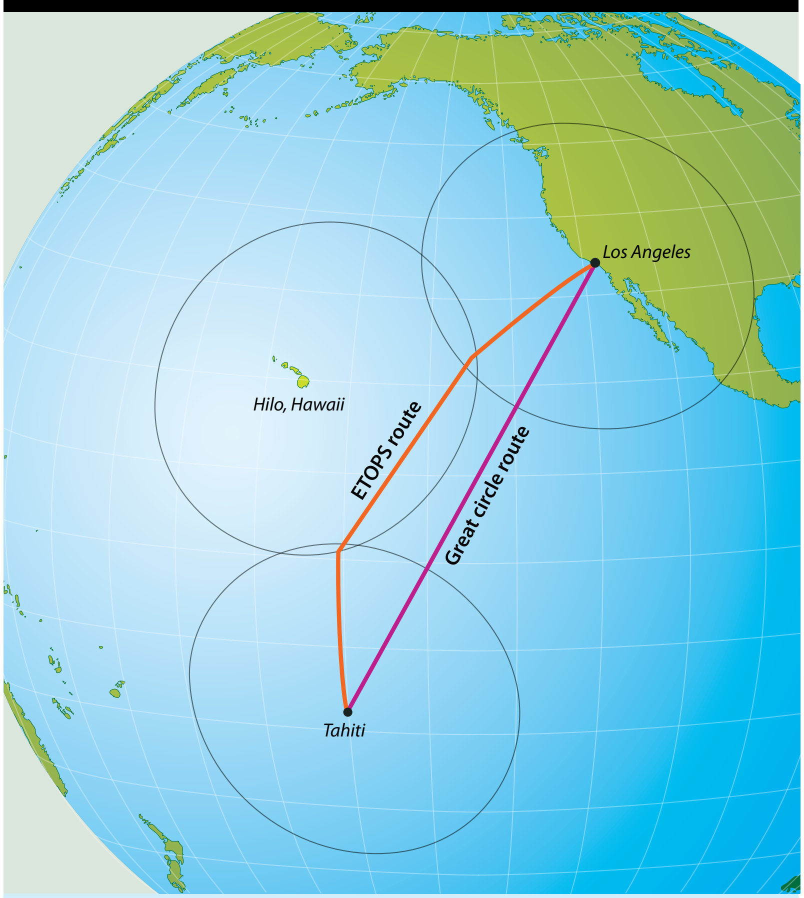
point on the route: an engine failure; a rapid cabin decompression necessitating descent to a safe altitude, typically 10,000 ft; or an engine failure *and* a rapid decompression.

Once the operating area is defined, the carrier is responsible for prudent flight planning with accurate forecast models and thorough operational control. Part 121.624(a) states that sufficient ETOPS alternates must be included in the flight release to ensure that the aircraft remains within the authorized maximum diversion time, based on the alternate weather minimums listed in the carrier's operations specifications (ops specs). Once the flight is under way, conditions at the alternate airports can go down to operating minimums — the published instrument approach minimums. A pilot-in-command for a supplemental carrier or a dispatcher for a flag carrier must update the flight plan as needed for in-flight contingencies, such as changing an ETOPS alternate because of weather conditions.

**ETOPS Versus Great Circle Route**




Note: This example shows an ETOPS (extended operations) route that remains within 180 minutes flying time, under specific conditions, of an adequate alternate airport; the route is 240 nm (444 km) longer than the great circle route from Los Angeles to Tahiti.

Source: Patrick Chiles

**Figure 1**

For twin-engine airplanes operated under Part 121, the ETOPS diversion time threshold is unchanged from the original 60 minutes. Passenger airplanes with more than two engines and Part 135 twins have a 180-minute diversion time threshold. Any operations planned beyond those thresholds require ETOPS approval.

In addition to the obvious concern for an engine failure, route planning must consider the most time-limited aircraft system. For example, diversion time cannot exceed the time limit of cargo fire suppression minus 15 minutes, which means that the fire suppression system must be certified to 195 minutes duration for 180-minute approval.

Operations items to be validated through the approval process include:

- A proven flight planning program and dispatch program appropriate to ETOPS;
- Availability of meteorological information and an ETOPS-specific minimum equipment list (MEL);
- Initial and recurrent training, and a line-check program for ETOPS flight operations personnel; and,
- Assurance that flight crews and dispatch personnel are familiar with the ETOPS routes to be flown.

## Accelerated Approval

Maintenance programs are still the keystone of any successful ETOPS program. The FAA wants to see a commitment to sound processes, demonstrated best practices and continuous monitoring for accelerated approval.

However, the FAA was convinced by comments pointing out the safe operating history of airplanes with more than two engines and agreed that carriers do not have to adopt ETOPS maintenance programs for those aircraft. Also, all-cargo airplanes with more than two engines must meet only the polar operating requirements.

The following items are validated during the accelerated approval process:

- A fully developed maintenance program, including parts tracking and control;
- An ETOPS maintenance manual;
- An oil-consumption-monitoring program;
- An engine-condition-monitoring and -reporting system;
- A plan for resolving discrepancies with the airframe/engine configuration, maintenance and procedures (CMP) document;
- An ETOPS reliability program;
- A propulsion-system-monitoring program. The carrier must establish a high degree of confidence that propulsion system reliability for the requested diversion time can be maintained; and,
- ETOPS-specific qualification programs for maintenance personnel.

The airframe/engine combination must be certified for single-engine operations up to the desired maximum diversion time. This has become common for modern twins. However, it is the carrier's responsibility to keep the aircraft in compliance with the model's CMP document. Developed by the manufacturer, the CMP document includes standards for special inspections, parts control, hardware life limits and maintenance practices that the FAA considers to be the minimum acceptable level for ETOPS.

A significant maintenance requirement is the prohibition against having one technician perform the same task on left and right engines or other redundant critical systems. This protects against a repeatable error resulting in an in-flight shutdown or malfunction. There is also a requirement to use the ETOPS-specific MEL during a predeparture service check prior to each extended operation.


© Anders Presterud/airliners.net

Operators seeking polar ETOPS approval must evaluate adequate alternates, such as the airport in Stord, Norway.

## Polar Routes

Extended operations in polar regions also are governed by the new rules, with exceptions for intrastate operations in the state of Alaska. Effective February 2008, carriers operating in the North Polar Area (above 78 degrees north latitude) and South Polar Area (below 60 degrees south latitude) will need the following approvals in their ops specs:

- Designation of en route alternates, with passenger-recovery plans for these alternates;
- Fuel-freeze monitoring procedures;
- Propulsion-system reliability program;
- Ensured communications capability;
- A polar-operations-specific MEL;
- A plan to mitigate crew exposure to radiation during solar flare activity; and,
- Provisions for at least two cold-weather exposure suits for crewmembers.

Development of passenger-recovery plans could be a greater hurdle for a Part 121 carrier than a Part 135 operator because of the greater number of passengers. A carrier might have to keep an aircraft on standby for recovery operations. Carriers that already have authority to operate in areas of magnetic unreliability and the North Polar track system should not assume that they may continue to operate as before.

## Part 121 Differences

There are some new requirements for Part 121 carriers. Among the most significant is that the planning for passenger flights in airplanes with more than two engines must consider maximum diversion times, instead of the simpler ETP fuel planning. These aircraft now require ETOPS approval if the carrier intends to operate them on routes exceeding a 180-minute diversion time.

There also are allowances for increasing the maximum diversion time. During the ARAC process, carriers had asked for expanded ability to exceed 180 minutes, which the FAA accommodated by allowing maximum diversion times up to 240 minutes in specific areas, along with other operating and MEL requirements. The carrier must already have 180-minute approval and may exceed it only if day-of-flight conditions, considering wind, necessitate going farther. For specific preapproved city pairs, it will even be possible to exceed 240 minutes.

Similar to provisions in the old advisory circular, the new rule mandates compensation for the effects of wind, icing and auxiliary power unit fuel consumption. These factors have been reduced as the FAA has recognized substantial improvements in wind and temperature forecasting models over the last two decades. Diversion fuel burn calculations previously had to be increased by 5 percent to allow for wind-forecasting errors. The requirement now is to increase forecast tail wind or head wind component speed by 5 percent, which reduces the fuel requirements. Similarly, carriers must account for ice drag penalties during 10 percent of the divert segment only if icing is forecast.

## Part 135 Requirements

The new Part 135.364 likely will have a dramatic impact on charter operators. Effective February 2008, passenger charter flights conducted beyond 180 minutes of an adequate airport will require ETOPS approval. The FAA believes that the higher diversion-time threshold is justified because charter operators are not limited to using Part 139–approved airports, so a greater range of alternate airports will be available. Maximum approvable diversion time is 240 minutes.

What remains to be seen is how many Part 135 operators will be able to avoid being forced into an ETOPS program. In effect, that will be determined by the manufacturers. General aviation turbine airplanes usually are not provided with the variety of one-engine-inoperative (OEI) performance data that accompanies large transport aircraft. OEI performance is often based only on the best lift/drag ratio speed or long-range cruise speed. This will probably not be adequate over more remote areas with a 180-minute maximum diversion time. At those speeds, the North Atlantic won't be out of reach, but a trip from Los Angeles to Hawaii could easily exceed the 180-minute maximum diversion time.

Implementation of the Part 135 ETOPS rule is being delayed for one year to allow manufacturers enough time to create more speed profiles. The as-yet-unknown factor will be fuel capacity. In addition to the fuel implications of faster engine-out speeds, the required assumption of a simultaneous cabin decompression will drive the diversion altitude even lower. Exact figures are not available, but there is good reason to believe that the increased fuel consumption could require that the payload be reduced or that the trip be canceled.

Charter operators that have been conducting transoceanic trips may find themselves unable to comply with ETOPS requirements, depending on data their manufacturers generate this year.

If a Part 135 operator finds it necessary to gain ETOPS approval, it will have to meet the same maintenance requirements as the airlines. Conducting predeparture service checks with ETOPS-trained mechanics when operating away from home base will be a serious consideration. Lacking an airline's in-house maintenance resources, charter operators may consider carrying flight mechanics in addition to arranging for more qualified vendors.

In addition to delaying implementation for a year, FAA included an eight-year grandfather clause for newly manufactured airplanes operated under Part 135. This was expected since the large majority of these aircraft have not been subject to an ETOPS configuration management plan.

## A New Chapter

The FAA's codification, refinement and expansion of requirements for extended operations — and similar efforts under way worldwide — begin a new chapter in long-range flight. The pioneering flights by Piedmont and TWA in the 1980s have led to well-established safety practices, improved operating economies and more opportunities for point-to-point travel between a greater variety of airports. Looking to the future, harmonizing standards across the different national regulators will enhance safety for all operators. ●

*Patrick Chiles is the technical operations manager for the NetJets BBJ program and a member of the Flight Safety Foundation Corporate Advisory Committee since 2000.*

# The Composite Evolution

**New uses of composite materials in airliners will result in new ways of thinking for maintenance personnel.**

BY LINDA WERFELMAN

© Boeing

Composite materials have been used in aircraft for decades, but the next generation of airliner airframes will be the first in which many major structural components are constructed from composites instead of metals.

Does this represent a change as dramatic as the switch early in the 20th century from wood and fabric airframes to metal?

Maybe, says Fred Mirgle, chairman of the Department of Aviation Maintenance Science at Embry-Riddle Aeronautical University in Daytona Beach, Florida, U.S., because, even though Airbus and Boeing have used composites for decades in control surfaces and secondary structures, their coming models use composites for primary structures and are "a different breed of airplane … totally different than one that's made from aluminum and steel."

Maybe not, says Gary Oakes, an associate technical fellow at The Boeing Co.

"It's an evolutionary change, not a revolutionary change," Oakes said, referring to the gradual increase in the use of composite materials over the years.

While commercial jetliner manufacturers typically have used composites somewhat sparingly, the manufacturers of helicopters and military and experimental airplanes have for decades produced aircraft with composite airframes. Boeing began using composites more than 30 years ago, in the spoilers of 737s; in the new 787, they will be used much more extensively — the 787 will be the first commercial jetliner made primarily of composites. Airbus used composites on primary airplane structures in the early 1980s and, in the late 1990s, constructed the first carbon-fiber keel beam for a large commercial airplane — the A340; composites are used throughout the new A380.

Years of experience with composites — which typically combine layers of long, strong fibers (usually carbon or glass) with a matrix (a tough plastic glue) to produce strong, lightweight materials — mean that, to a great extent, their advantages and disadvantages, when compared with those of metals, are well understood by aircraft designers and maintenance specialists.

**"Composites are different materials and have their own unique requirements. … They don't present any really surprising challenges to work with — just differences."**

Among the advantages of composites are their greater strength and stiffness, their lighter weight and their resistance to fatigue.

"The weight savings, combined with improved structural efficiency, … directly translated into increased payload, reduced acquisition and operating costs, and increased performance," said a report by the Advanced Materials Research Program at the U.S. Federal Aviation Administration (FAA) Hughes Technical Center. "A pound of weight saved on a commercial aircraft is estimated to be worth \$100 to \$300 over the service life of the aircraft."[1]

The disadvantages, however, include material degradation, which can be associated with heat damage, and the complications associated with the use of many different types of composites, which do not necessarily share the same characteristics.

## No Surprises

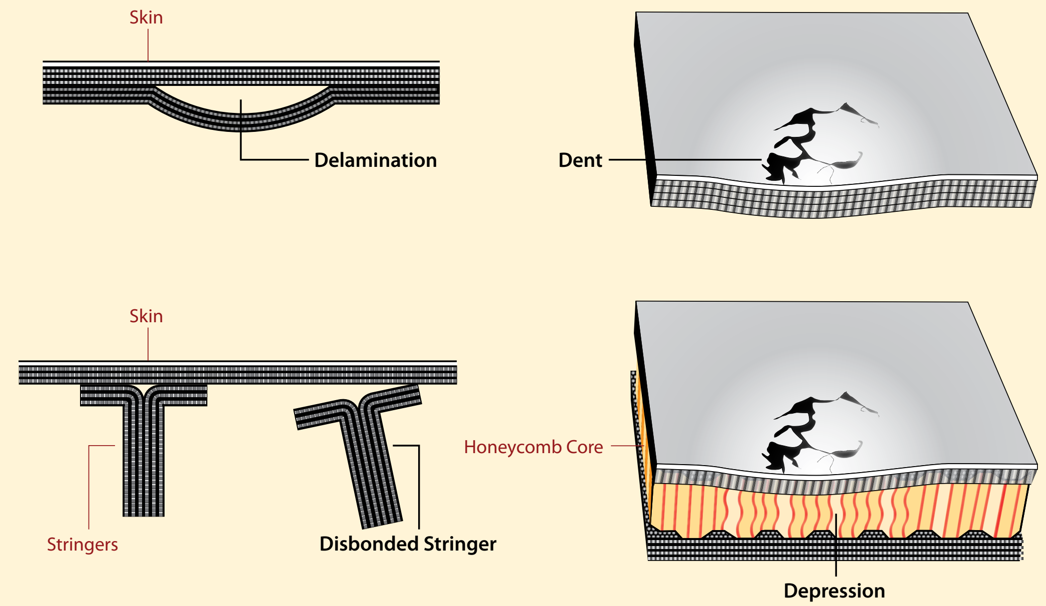
"Composites are different materials and have their own unique requirements," Oakes said. "They're not as simple to engineer with, and their behaviors are more complex. … They don't present any really surprising challenges to work with — just differences."

Among those differences are composites' resistance to the fatigue and corrosion that plague metal components; however, composites are more sensitive to damage caused by impact and have stiffness and strength properties that vary with temperature, moisture content and the manner in which the composite materials are assembled.

As a result, nondestructive testing (NDT) of composite materials is critical, both to check for flaws during the manufacturing process and, later, to check for problems that may develop during the service life of an aircraft.

These checks typically begin with thorough visual inspections. If maintenance technicians see a flaw in an aircraft's skin — such as a surface bulge, a common indicator of a subsurface anomaly — they can determine what types of NDT might be required to further identify the problem, Mirgle said. For example, the many

**Types of Composite Damage**




Source: Airbus

**Figure 1**

varieties of ultrasound tests can "penetrate the material with sound" to help technicians determine if layers of composite material beneath the surface have separated, and "tap tests" — tapping with a coin or other, more sophisticated equipment — on honeycomb structures can provide an indication of their condition, he said. Other testing methods involving X-rays, laser technology and infrared imaging also can be useful.

Roland Thévenin, composites certification specialist for Airbus, said in a July 2006 presentation before an FAA workshop on composites, that comprehensive testing is required throughout the manufacturing process to guard against unacceptable internal defects.[2]

"The aim is to detect any manufacturing anomaly which may not be detected with a detailed visual inspection," Thévenin said. "This is part of the production quality process."

Some minor defects may be permitted during manufacturing, he said, adding that the only allowable defects are those that "do not grow and do not adversely affect strength."

## Inspection Issues

After a composite airplane is placed in service, the most common inspection issues involve impact damage or the degradation of composite materials, Gary Georgeson, a specialist in NDT and nondestructive inspection at Boeing, said in a presentation to an NDT conference in 2001. Impact damage — such as interply delamination (the separation of a composite material along the plane of its layers) and skin-to-core disbonding (a flaw that occurs when a layer of composite material fails to adhere to another layer) — most often is a result of an aircraft encounter with hail, dropped tools or runway debris. Degradation of composite materials can result in part from heat damage, which can occur because of repeated exposure to jet engine exhaust or to the heat generated by a lightning strike (Figure 1).[3]

Manufacturer specialists in composite maintenance say that airworthiness standards have been developed so that, if damage cannot be seen, the aircraft can be safely flown with that damage for the remainder of its time in service.

"Barely visible impact damage is something that, by design, an airplane must be able to tolerate for the life of the airplane," Oakes said.

If damage is visible, however, further inspection is required to determine the extent of the problem and the type of repairs that will be made, if necessary.

Repairs to composite materials typically involve either the use of composite "patches," applied to a damaged area with epoxy and then "cured" under a heat lamp for several hours, or bolted repairs similar to those performed on metallic airplanes (see "Working Safely With Composites").

Justin Hale of Boeing, the 787 deputy chief mechanic, said that scheduled maintenance on the 787 will differ very little from scheduled maintenance on metal aircraft, and composite structures will be managed in much the same way as metal structures — "to accommodate bolted repairs, … to withstand dropped tools and the daily bumps and bruises every aircraft is subjected to during normal handling."

Some materials that might be encountered during normal aircraft operations should be avoided, however, because exposure could lead to degradation of composite material. Hale noted, for example, one insecticide — sometimes sprayed inside aircraft — that must be avoided within the cabin and in cargo areas. A list of all such materials still is being developed for the 787, he said. Items not on the lists will be considered safe for contact with aircraft.

Similar lists exist for metal aircraft, which, for example, can be damaged by exposure to mercury, Hale said.

## Accident Risks

Although maintenance specialists say that knowledge of composites has advanced to a stage that the materials' behavior no longer presents surprises, two specialists in aviation accident analysis say that the substantial increase in the role of composites in the next generation of airliners, and in very light jets, presents an increased risk of aircraft accidents involving composite failures (see "Composites in Accidents").[4]

"Why would … composite structures fail?" Joseph F. Rakow, Ph.D., and Alfred M. Pettinger, Ph.D., of Exponent Failure Analysis Associates asked in a September 2006 presentation to the International Society of Air Safety Investigators.

"First, we are building composite structures on a scale never before achieved. … Second,

## Working Safely With Composites

As composite materials have become more common, so have recommendations to limit the exposure of maintenance personnel to associated fumes, dusts and chemicals.

Adequate ventilation is essential, as is use of personal protective equipment, such as respiratory equipment and safety goggles, maintenance specialists say. Maintenance personnel should always use the protective equipment that is appropriate for the composites that they are working with — and be sure that the equipment is fitted properly.

They also should protect themselves against absorption of harmful chemicals through the skin, using gloves, face shields and other protective clothing when necessary.

Maintenance personnel should review the material safety data sheet (MSDS) that accompanies hazardous substances to determine acceptable exposure levels.

— LW

### Note

1. Feeler, Robert A. "How to Work Safely With Composite Materials." *Aviation Mechanics Bulletin* Volume 39 (January–February 1991).

we are building composite structures through relatively new, automated techniques rather than relying on traditional methods of constructing composites by hand. And third, our inspection and maintenance requirements will no longer be driven by fatigue and corrosion performance, as they are for metallic structures, because composites are not as susceptible to these failure mechanisms. Instead, accidental subsurface damage and subsequent failure progression will be more important.

"Past experience with metallic structures will be relevant, but new methods and techniques particular to composite structures will be required."

They characterized these changes as "a collective departure from applications, techniques and methods of the past" and cautioned that they might "lead to landmark lapses in safety with subsequent 'lessons learned' for composites" in much the same way that investigations of the series of de Havilland Comet accidents in the 1950s and '60s led to new information about stress concentrations and metal fatigue.

They said that aviation accident investigators, generally accustomed to analyzing failed metallic structures to help determine what caused a crash, must look at composite failures differently. For example, composite structures respond differently to loads, depending on such factors as the orientation of fibers in the structure, the thickness of layers in the structure and other design factors, and the direction in which the load is applied. Each of these factors influences the appearance of a failed composite; the difficulty for investigators is that composite structures that fail for similar reasons can look very different.●

## Composites in Accidents


U.S. National Transportation Safety Board

Composite parts have figured in some airliner accidents, including the Nov. 12, 2001, crash of an American Airlines Airbus A300 after takeoff from Kennedy International Airport in New York. The airplane, bound for the Dominican Republic, was destroyed; all 260 occupants of the airplane and five people on the ground were killed. The U.S. National Transportation Safety Board said, in its final report, that the probable cause of the accident was "the in-flight separation of the vertical stabilizer [which was made with composite materials] as a result of the loads beyond ultimate design that were created by the first officer's unnecessary and excessive rudder pedal inputs."

— LW

### Notes


1. U.S. Federal Aviation Administration (FAA) William J. Hughes Technical Center Advanced Materials Research Program. *FAA William J. Hughes Technical Center*. <www.tc.faa.gov/its/cmd/visitors/data/AAR-430/advanced. pdf>.
2. Thévenin, Roland. *Composites at Airbus: Damage Tolerance Methodology — Maintenance and Repairs Validations*. Paper presented at the National Institute for Aviation Research, FAA Workshop for Composite Damage Tolerance and Maintenance, July 19–21, 2006. Chicago.
3. Georgeson, Gary. *NDT: A Continuing Responsibility in the Future of Aerospace*. Presented to the 10th Asia-Pacific Conference on Non-Destructive Testing. Brisbane, Australia. September 2001.
4. Rakow, Joseph F.; Pettinger, Alfred M. *Failure Analysis of Composite Structures in Aircraft Accidents*. International Society of Air Safety Investigators. 2006 Annual Air Safety Seminar, Cancun, Mexico, Sept. 11–14, 2006.

# PREMIUM

The insurance industry took its first steps into aviation just a few years after the airplane was invented. Arrangements for insuring early airline operations sometimes were in place even before client airlines existed because of insurers' experience with the risks of other transportation modes. More than 90 years later, however, aspects of aviation insurance that are familiar to an airline's financial risk manager may not be as familiar to its operations risk manager, although both face challenging demands to quantify the economic value of making specific investments in safety.

The main coverages in 21st century aviation insurance policies — excluding those related to war, hijacking and other perils, including terrorism — are for partial, major partial or total hull loss, meaning damage to the aircraft; liability for injury or death of passengers; and third-party liability, meaning liability for bodily injury, death and property damage external to the aircraft. Hull losses typically are paid within weeks, based on an agreed value of the airplane. For airline accidents as a whole, insurers' third-party loss amounts — for example, payment to the owner of a building damaged by an aircraft — have been almost negligible, but with a potential for catastrophic losses in some scenarios.

Exact individual and aggregate passenger liability after an accident, however, is difficult to determine quickly. "Depending on the size of the aircraft, geographical area of operation and the relative legal requirements, [liability] limits can range anywhere from US$250 million to $2 billion," according to Swiss Reinsurance Co. (Swiss Re). "Insurers provide these liability limits to the airline for each aircraft, each takeoff and hence each occurrence, and there is no limit to the number of occurrences covered in a given [one-year] policy period."[1]

Two major airline losses underscore the concern about potential third-party liability. Swiss Re said, regarding the loss of Pan Am Flight 103, in which 259 occupants and 11 people on the ground were killed after a bomb detonated in a Boeing 747 over Lockerbie, Scotland, in December 1988, "third-party losses were caused by terrorism, the theme, which, unfortunately, many believe has grown into the pre-eminent concern in air travel today." The largest recent loss in aviation insurance terms — about $225 million — occurred when American Airlines Flight 187 crashed at Belle Harbor, New York, U.S., on Nov. 12, 2001, following the in-flight separation of the vertical stabilizer on an Airbus A300, according to Michael Mahoney of GE Insurance Solutions.[2]

Recovered from economic shocks of Sept. 11, 2001, aviation insurers by late 2004 operated in an environment in which the hull value of an airliner could be valued at $1 million to $250 million,

# INFLUENCE

BY WAYNE ROSENKRANS

**Perspectives of aviation insurers widen the scope of resources available to aircraft operations risk managers.**

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and potential liability for the passenger awards in one fatal accident could be $1.5 billion.

## Scenario in 1919

According to 1920 proceedings of the annual U.S. Casualty Actuarial Society (CAS) meeting, England in 1913 became the first country in which an insurance underwriter issued a policy on an airplane; an insurance pool was planned. "Soon after the [World War I] armistice, the leading insurance companies [in England] combined to form a pool to take care of aviation risks," said H.E. Feer, representing the Scandinavian Pool for Aircraft Insurance and its statistical institute. The pool and institute were set up in 1919 by about 90 companies, even before Scandinavian airline service began.[3]

In an early presentation about airplanes to the CAS meeting, Walter Cowles in 1919 said, "The fact that we, here in the United States, are far behind England and all other countries in the development of this most helpful competitive means [the airplane] should not deter us, as representatives of insurance interests, from laying a sound foundation and establishing a useful practice for aircraft insurance, notwithstanding present discouragements, notwithstanding a limited field and notwithstanding the lack of substantial hope for the immediate future. … We must have the aircraft. It must be developed and improved. It must be cheapened in cost and upkeep. It must be dependable. It must be practical."

A. McDougald, commenting on Cowles' paper the following year, urged timely accident investigation and dissemination of related data. "Only by [accident investigation] can weak points in administration, personnel and material be eliminated and the safety of the public proportionately increased. … Aircraft risks as the subject of insurance are new, and it must necessarily be some time before any dependable data can be collected on which to base equitable premium rates. In the meantime, the arbitrary rates will be governed by considerations of analogy and argument, and influenced possibly to some extent by competition."

## Fast Forward

A 2006 survey of 51 of the world's top 200 airlines by revenue — conducted by *Airline Business* magazine and Aon — found that an average of 2.1 percent of participating airlines' total revenue was spent on risk management, with about 70.1 percent of that amount representing costs of aviation insurance premiums. Researchers estimated that the top 200 airlines would spend $5.86 billion on aviation insurance premiums.

Aviation insurers may offer insights to operations risk managers on their airlines' overall scope and scale of exposure. While aviation safety professionals typically work to reduce

**Historically, aviation insurers have influenced operations risk managers by recognizing best practices that reduce the likelihood of losses.**

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risk in all aircraft operations that they can influence, aviation insurers see in the world a very broad range of risks, including natural catastrophes such as hurricanes, tornadoes, earthquakes, floods, hail storms, bird and other wildlife strikes; plus man-made exposures, such as those involving war and terrorism.

Aviation insurers know that passengers on a typical airline flight represent several hundred million dollars of liability exposure, with the exact amount dependent on the passenger profile. "Yet when determining the size of a loss after an accident, the types and nationalities of the passengers on board are more important than their actual number," Swiss Re said. "The 'type' of the passenger refers to the status of the traveler [e.g., each person's earning power and dependents, and the country in which court action can be brought]. … [The jurisdiction] factor is central to insurers' exposure calculation, as compensatory damages can vary greatly from jurisdiction to jurisdiction."

## Where's My Discount?

A question that arises among operations risk managers is whether a specific safety-related change will reduce an insurance premium the following year, which seems like a good incentive for senior management. One problem, however, is that methods of pricing the premium vary widely. Morton Lane, a U.S. broker-dealer, said in 2003, "There is no agreed-upon theoretical method for pricing [aviation] insurance risk. Several approaches have been designed but none can claim ascendancy over another."[4]

Nick Brown, chief underwriting officer–airline insurance, Global Aerospace, said that the imperative of spreading the risk transferred from an aircraft operator to a large number of disparate insurers and reinsurers adds complexity to understanding premium pricing and the underlying economic factors. "As a consequence of the very large limits of indemnity, all airline insurance policies are syndicated among a panel of co-insurers," Brown said. "It is important to understand that each individual insurer will have its own underwriting criteria and its own methodologies for calculating the premium for a given account."

Technical variables familiar to airline operations risk managers are only part of the equation. "Our pricing models take into account a wide range of risk factors in addition to the basic exposure metrics (fleet values, passenger numbers, departures, etc.)," Brown said. "This includes loadings [adjustments that increase premium] and discounts which are specific to quantifiable technological factors — such as the percentage of the fleet equipped with [a terrain awareness and warning system (TAWS)] and traffic-alert and collision avoidance system [TCAS] — and also more subjective evaluations of the quality of the safety management system [SMS] or safety culture of the airline in question.

"However, the overall premium payable by the airline in question will be an amalgam of the offers of individual insurers, who will all quantify such factors in differing degrees according to their own objective or subjective pricing criteria. Additionally, simple 'market forces' will have a significant influence on the actual premium paid. This makes it difficult or impossible to quantify the economic value — in insurance-premium terms — of making investments in safety, at least on a prospective basis. On a retrospective basis, there is a very clear benefit in insurance terms, because the loss record of an airline will have a significant bearing on how its premium is rated. Over time, therefore, airlines [that] have poor safety management pay much higher premiums due to their claims experience and, conversely, airlines that improve their safety management and consequently improve their claims record will benefit from lower premiums."

## Running With Data

Paul Hayes, director of Ascend, said that aviation insurers influence airline management to accept the reality of risks that psychologically may seem incongruous with the safe operations they observe day after day. "Most airlines in the world are small airlines that have never had a catastrophe; in any five-year period, 90 percent have not suffered a loss," Hayes said. "[Accidents] are so far removed from their experience, from operations management — but at some small airlines, if they have an accident the airline is gone."

In many areas of aviation insurance practice, from exposure modeling to insurance premium pricing, external proprietary databases often are used strategically and tactically by brokers, insurers and reinsurers, according to Hayes. "Our data do not allow them to see that airline XYZ does all these good things [for example, TCAS, TAWS, SMS or flight operational quality assurance (FOQA)] but airline ABC doesn't. That has to be part of the information underwriters discover or assume when they're writing the insurance coverage."

Another current application of these databases to aviation insurers' models has been to test hypotheses of why another large aviation insurance loss has yet to occur. "Prior to 9/11, there was an assumption that somewhere in the world, insurers would get a catastrophic loss every year and a half to two years, or something like that," Hayes said. "Six years have gone by, which is an unprecedented period. The American Airlines Airbus A300 in Queens, New York, U.S., in November 2001 was the last catastrophic loss in insurance terms of looking at the dollar cost. One argument put forward is that the recession in the airline industry resulted in so many older-generation aircraft being parked in the desert that we've got a marked change in the fleet makeup … a far higher percentage that are higher technology types, plus TCAS and TAWS are in most of the world's fleet today."

## Advising Corporate Operators

Aviation insurers also may influence operations risk management within corporate aircraft operators, helping them to prioritize how they address exposures and keep them in perspective, according to Bob Conyers, vice president and manager of general aviation safety for Global Aerospace. "We offer safety services free to insured operators, for example," Conyers said. "The most popular service is a flight operations survey, which entails a full review of management policies, training standards, operational procedures and maintenance practices. The idea is to assess a flight department's operation compared to similar operators and to pass along 'best practices' — typically well beyond regulatory minimum requirements — that have been observed."


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Flight Safety Foundation's Ground Accident Prevention project has found losses less than insurance deductibles difficult to quantify.

Safety-problem recognition by an aviation insurer can generate safety recommendations to its insured aircraft operators. "Following the [fatal Gulfstream III] accident in Aspen, Colorado, U.S. [in March 2001], we have encouraged operators — and generally have been successful — to adopt higher-than-published minimums at mountain destinations," Conyers said. "Strict adherence to higher minimums is generally supported by inclusion in the company's flight operations manual."

Aviation insurers' advocacy of simulator training for turbojet pilots was a classic example of positive influence, according to Ed Williams, CEO of the Metropolitan Aviation Group and chairman of the Flight Safety Foundation Corporate Advisory Committee. "[In] the early 1960s, accident rates of both air carriers and the then–brand new corporate jets were much higher than today," Williams said. "Training accidents, using the aircraft itself, were a particularly deadly endeavor. [But] from the World War II and Korean War eras, there were some chief pilots who believed that they didn't need training because of their high number of total pilot flying hours. The attitude was, 'I'm already a highly experienced pilot with no accidents, and I don't need the training.'"

A combination of training accidents and other accidents during the transition from propeller-driven airplanes to corporate jets took a toll on aviation insurers, who, as a group, decided that something had to be done, he said. "About the same time, FlightSafety International began developing the first flight training simulators for the newly introduced corporate jet aircraft," Williams said. "About that same time, the air carriers had begun to utilize their simulators more and more, and their collective training accident rate — compared with using the actual aircraft — was showing a definite decrease.

So aviation insurers collectively required their insured corporate flight departments either to begin utilizing the available simulator-based training programs or face very high premiums or refusal of coverage. "This influence evolved over 40 years into the situation today in which corporate flight departments are effectively uninsurable if they operate a turbine-powered aircraft but professional, ground-based and flight simulator–based training programs aren't an integral part of their operations," Williams said.

## Worldwide Implications

Access to affordable, bona fide aviation insurance coverage remains a critical issue for some aircraft operators in the developing countries with substandard physical and regulatory oversight infrastructure. "It is true that the greatest variation in operating standards is seen in developing parts of the world, and it is in these areas that insurers are most likely to make a positive intervention in order to try and improve the safety of a particular operator," said Brown of Global Aerospace. "Typically, this involves the lead insurer commissioning a third-party expert to conduct a review of the airline's operations and to make recommendations. The lead insurer will then require the airline to address those recommendations and, in the event of non-compliance, may issue notice to cancel coverage."

The opposite concern, however, would be the possibility that this free market can allow substandard aircraft operators to obtain aviation insurance coverage, with a possible implication to passengers that safety standards have been met. "There are certainly airlines to whom Global Aerospace would not offer coverage due to safety concerns," Brown said. "Insurance is a free market, however, and many of these operators will find coverage from other aviation insurers, possibly at very high insurance rates. Others will not be able to buy any coverage in the 'mainstream' aviation insurance market and will either operate without insurance or buy low limits of coverage from local or non-conventional insurers. This will inevitably limit the scope of such airlines [because they] will be unable to meet the insurance requirements necessary to fly into North America or Europe."●

To read an enhanced version of this story go to the FSF Web site, <www.flightsafety.org/asw/mar07/insurance.html>.

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Do you know a person or organization that deserves to be publicly honored for their contributions to aviation safety?

# Call for Nominations

The Flight Safety Foundation (FSF) annual safety awards program recognizes individual achievements and group achievements in aviation safety, as well as heroism by civil aircraft crewmembers or ground personnel. Recipients of these prestigious international awards are selected by independent boards from candidates nominated by aviation professionals and organizations worldwide.

Submit your nominations via our Web site for the awards, shown in the list below, that will be presented at this year's IASS in Seoul, Korea. For more information about the awards go to http://www.flightsafety.org/awards.html.

### Admiral Luis De Florez Flight Safety Award

Recognizing outstanding individual contributions to aviation safety through basic design, device or practice, the award is made possible by a grant from Admiral Luis de Florez, a former president of the Flight Safety Foundation, and consists of a citation and an honorarium.

### Airport Safety Award

This award recognizes advances in ramp environment safety through innovation and implementation of new methods, practices or policies.

### *Aviation Week & Space Technology* Distinguished Service Award

Created in cooperation with *Aviation Week & Space Technology* magazine, this award recognizes individuals and organizations responsible for major advances in aviation safety.

### Flight Safety Foundation–Boeing Aviation Safety Lifetime Achievement Award

Established by the Foundation and The Boeing Company, the Lifetime Achievement Award recognizes an individual for a lifetime commitment to aviation safety. The award consists of a citation and a Waterford crystal trophy on display at the Museum of Flight, Seattle, Washington. The recipient receives a Waterford crystal memento of the award.

### Flight Safety Foundation Cecil A. Brownlow Publication Award

The Brownlow Award recognizes journalists' significant contributions to aviation safety awareness. Candidates for the award may be individuals, publications or organizations. Nominees should write and report accurately and objectively about commercial aviation safety or business aviation safety. Nominations may be for long-term achievement or for outstanding articles, books or works in electronic media, published or broadcast between July 1, 2006 and June 30, 2007. The recipient will receive US$1,000; a framed, hand-lettered citation; and transportation to the FSF International Air Safety Seminar and joint meeting with the International Federation of Airworthiness and International Air Transport Association.

### Flight Safety Foundation Heroism Award

Sponsored by Kidde Aerospace, the Heroism Award recognizes civil aircraft crewmembers or ground personnel whose heroic actions exceeded the requirements of their jobs and, as a result, saved lives or property. Selection of award recipients is determined by the degree of personal risk involved in the heroic act; the nature of the courage, perseverance and other personal characteristics that were displayed; and the degree to which the heroism exceeded normal levels of duty. The award includes a miniature replica of the Graviner Sword, US$1,000 and a framed, hand-lettered citation.

### Honeywell *Bendix Trophy* for Aviation Safety

Revived by Honeywell in 1988 to recognize contributions to aerospace safety, this award is given to individuals or organizations to honor improvements to aerospace safety through advances in equipment or technology. Recipients receive a replica of the original Bendix Trophy.

### The Laura Taber Barbour Air Safety Award

Recognizing notable achievement in the field of aviation safety — civil or military — in method, design, invention, study or other improvement, the Laura Taber Barbour Air Safety Award consists of a gold medallion, certificate and honorarium.

### Richard Teller Crane Founder's Award

This award recognizes sustained corporate leadership contributing to aviation safety and aviation safety programs.

# Forging New ATM Links in the Global Safety Chain

BY ALEXANDER TER KUILE

The historic geo-political attitude towards aviation safety as a purely national issue must transform into a global systems design. If the aviation industry is to make the required improvements in safety performance to meet the forecast traffic loads of the next 20 years it will have to take more of a "total systems" approach, with airlines, airports, support organizations, manufacturers and air navigation service providers (ANSPs) working together on common improvement initiatives.

That is the guiding vision behind the *Global Aviation Safety Roadmap* endorsed by the International Civil Aviation Organization (ICAO) and its industry partners. It is also the guiding principle behind the work of the Civil Air Navigation Services Organisation (CANSO), the global association of ANSPs and air traffic management (ATM) technology providers.

**Historically governments have regulated aviation … with insufficient recognition of the interdependencies or consideration for the impacts on others.**

Within the aviation safety chain there can be no disconnects. Historically governments have regulated aviation with unique and individual policies for each sector with insufficient recognition of the interdependencies or consideration for the impacts on others. This has resulted in significant friction among the aviation players in our global system — airlines, airports and ANSPs. As an industry we now fully recognize the need to strengthen the links among the players and to ensure that all regulations consider the dynamics within the system.

The *Global Aviation Safety Roadmap* is a coordinated industry approach to ensure that everyone — regulators, industry and coordination bodies — recognizes the interdependence of players as well as the need to guarantee that agreed global standards are adopted and maintained.

The next generation of ATM systems will require a new way of thinking, as these will be configured around regional and even larger trans-national blocs of airspace — what ICAO now calls "homogeneous ATM areas." They will also have to work from the packed airport apron to the upper airspace; otherwise, the new space-based, aircraft-based surveillance, navigation and communications technologies will merely speed aircraft from one area of congestion to another.

Over the last few months CANSO has been involved with some "break-through initiatives" to ensure that new safety standards are considered in a global context and founded on the best-practice principles developed by the organization's workgroups.

In November 2006, CANSO's Global Safety Standing Committee brought together 35 representatives from the worldwide ANSP community to exchange views and create progress in areas such as:

- Developing the *Global Aviation Safety Roadmap* — the joint industry-ICAO initiative to improve global safety
- Promoting air navigation system safety information exchange
- Understanding and managing key ATM safety risks
- ATM safety metrics
- Implementing ATM safety management systems
- Establishing a Just Culture
- Measuring and managing a safety culture

A key element in CANSO's contribution to the implementation of the ICAO Global Aviation Safety Plan (GASP) will involve the completion of regional gap analyses to establish a clear picture of activities in place to improve safety, and highlight where further action is required or where improved coordination of efforts might deliver added benefits.

October 2006 saw the development of the CANSO *Practical Guide to the Implementation of Safety Management Systems — Experiences of CANSO Members* guidebook, where members can relate their own experiences and lessons learned implementing safety management system (SMS) programs. The exchange of safety information lies at the heart of the safety standing committee and submissions to the Safety Information Exchange Program (SIEP) identifying a number of key risk areas that were reviewed at length during the November meeting. The SIEP has been developed so members, in total confidence, can exchange information on key concerns, risk areas and how to mitigate risks pragmatically.

Work to address key risk areas such as runway safety has been incorporated into the Global Safety Standing Committee work plan. Another major issue for the group is the establishment of global safety metrics. A sub-group of CANSO ANSP experts has been set up to look at this issue, and the first step will focus on losses of separation between aircraft under instrument flight rules and risk assessment. A progress report will be presented to CANSO ANSP chief executive officers (CEOs) in May 2007. Longer term, the scope of measures will be expanded to cover other risk areas including runway incursions and safety culture measurement.

Earlier in the year the committee had developed a position paper on the establishment of global safety metrics which was presented at the CEO conference in February 2006 in Maastricht, Netherlands, to a good deal of support from CEOs.

CANSO is also working hard to improve the dialogue between ANSPs and their stakeholders, including regulators. In late 2006 the organization opened an office in Montreal to facilitate better communications between the ANSP community and ICAO. It is clear that now, more than ever, we need to make the links in the chain strong, and we fully support the role of Flight Safety Foundation as the institution which can take the lead in bringing together all players within the safety chain, coordinating the various safety initiatives, and developing an aviation safety improvement network that will meet the needs of our demanding industry.●

*Alexander ter Kuile is Secretary General of Civil Air Navigation Services Organisation.*

U.S. National Transportation Safety Board

# Off-Balance

**Nose-heavy Challenger would not rotate for takeoff.**

BY MARK LACAGNINA

The flight crew's failure to calculate the airplane's weight and balance, and the charter operator's failure to ensure compliance with safety regulations were blamed for the Feb. 2, 2005, crash of a Bombardier Challenger 600 during takeoff at Teterboro (New Jersey, U.S.) Airport.

In its final report on the accident, the U.S. National Transportation Safety Board (NTSB) said that the airplane's center of gravity (CG) was substantially beyond the forward limit. The captain was unable to rotate the airplane at the intended rotation speed and rejected the takeoff about five seconds later. The Challenger ran off the end of the runway, passed through an airport-perimeter fence, struck a vehicle while crossing a six-lane highway, struck five more vehicles in a parking lot and crashed into a building. Both pilots and two occupants of the vehicle struck on the highway were seriously injured. The cabin aide, all eight passengers and a person inside the building received minor injuries. The airplane was destroyed.

The passengers were affiliated with a company that had operated two of its own airplanes. However, one airplane had been sold and the other was in maintenance. The company used a charter broker, Blue Star Jets, to arrange the charter flight to Chicago Midway Airport. The broker selected Platinum Jet Management (PJM) of Fort Lauderdale, Florida, to conduct the flight. PJM was not certified to conduct on-demand service under U.S. Federal Aviation Regulations (FARs) Part 135 but had a charter management agreement with Darby Aviation, a certified Part 135 operator based in Muscle Shoals, Alabama.

The captain, 58, had 16,374 flight hours, including 3,378 flight hours in type. He was retained by PJM as a contract pilot on Jan. 6, 2005. He had conducted several flights for PJM under the general operating and flight rules of Part 91

# Overrun

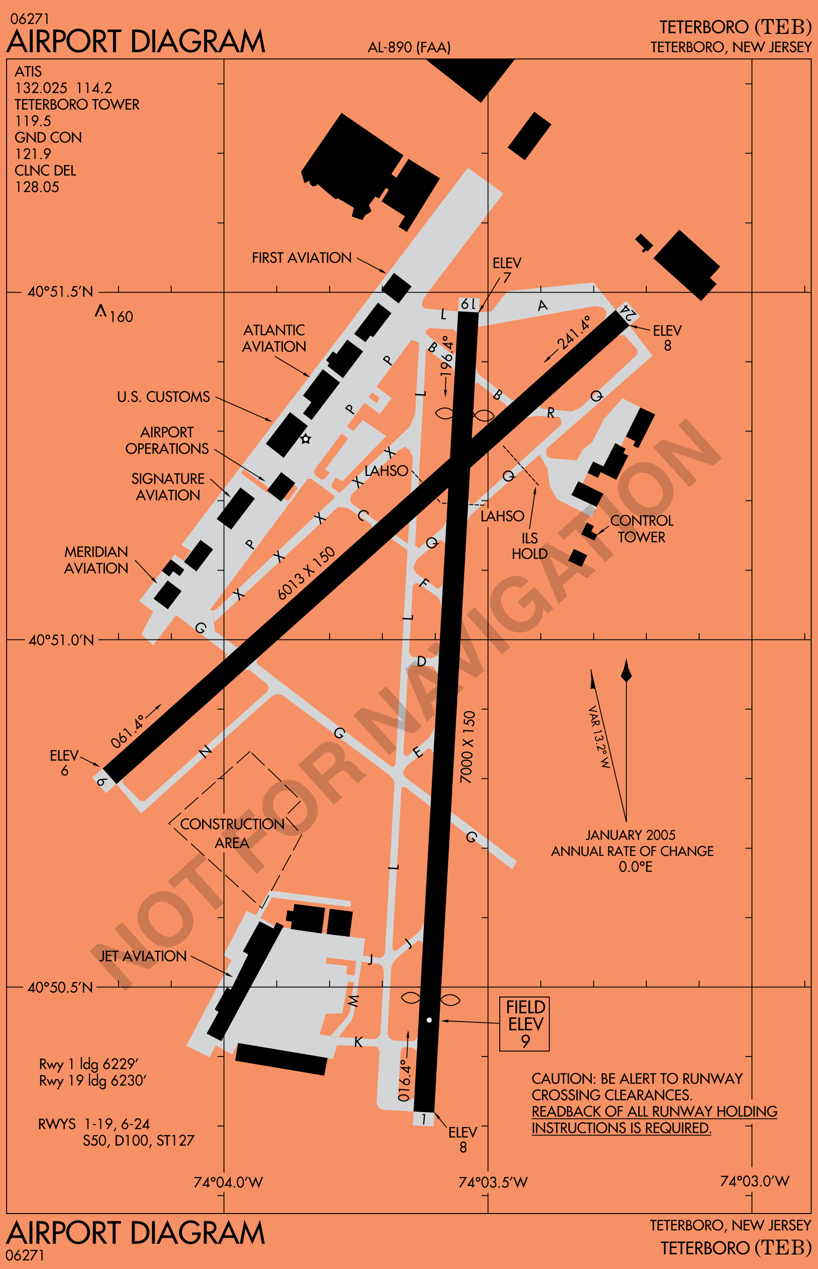
but had not received the training required to conduct Part 135 flights for Darby Aviation.

The first officer, 31, had 5,962 flight hours, including 82 flight hours in type. He was retained by PJM as a contract pilot in November 2003. He had received 22 of the 31 hours of training required to serve as second-in-command of Part 135 flights for Darby Aviation. His medical certification to conduct commercial flights had expired.

The cabin aide was not a qualified flight attendant, but a qualified flight attendant was not required aboard the Challenger for Part 135 flights because it has fewer than 20 passenger seats. She had not worked in aviation before she was retained by PJM as a contract customer-service representative in October 2004. She told investigators that she received on-the-job training in the company's Challengers from the lead cabin aide and received some emergency training in the accident airplane.

## Sleep Deficit Discounted

The pilots and cabin aide took a commercial flight from Fort Lauderdale to New York the evening before the accident and arrived at their hotel soon after midnight. The Challenger was flown from Las Vegas by another crew and arrived at Teterboro Airport about 0040. The flight to Chicago was scheduled to depart at 0700, and the accident crew arrived at the airport about 0520. The report said that although the pilots received less sleep than normal the night before the accident, "they had had



adequate sleep during the previous two nights. … There was no evidence that fatigue affected the pilots' performance on the morning of the accident."

Both pilots performed preflight inspections of the Challenger and found no discrepancies. "The captain stated that there were no entries in the airplane logbook and added that the airplane was 'absolutely clean,'" the report said. "The pilots requested that line-service technicians top off the fuel, and the first officer monitored the airplane as 1,842 gallons [6,972 liters] of fuel were loaded."

Airport weather observers and line-service technicians on duty that morning told investigators that there was no frost on vehicles left outside overnight or on the accident airplane. The pilot of an airplane parked next to the Challenger said that he found no frost on his airplane.

Reported weather conditions included calm winds, 10 mi (16 km) visibility, clear skies, temperature minus 6 degrees C (21 degrees F) and dew point minus 8 degrees C (18 degrees F). Runway 06, which is 6,015 ft (1,835 m) long, was in use; Runway 01/19, which is 987 ft (301 m) longer, was closed because of a nearby construction project.

## Full Fuel = Forward CG

The passengers intended to return to Teterboro later that day, and they brought aboard only light baggage, which was stowed throughout the cabin. "The only bags stowed in the aft baggage compartment were suitcases belonging to the pilots and cabin aide," the report said.

The pilots did not prepare a load manifest, as required by Part 135. "Although they obtained an estimate of the airplane's weight by inputting fuel-load information and average passenger weights into the airplane's FMS [flight management system], they did not calculate the airplane's CG in any way," the report said.

According to investigators' calculations, the airplane's takeoff weight was 41,320 lb (18,743 kg) — 70 lb (32 kg) over maximum takeoff weight. The CG was 12.47 percent mean aerodynamic chord (MAC), which exceeded by 3.53 percent MAC the forward CG limit of 16 percent MAC (Figure 1, p. 34).

"Review of weight-and-balance materials for the accident airplane indicated that, under many loading configurations, the airplane could not be loaded with fuel without exceeding its forward CG limit," the report said. "Further, investigators found that this fuel-loading characteristic appeared common among corporate

### Bombardier CL-600 Challenger

© Tomás Cubero Maingot–SJO Spotter/jetphotos.net

The Challenger series of business jets was developed from the LearStar 600, designed by William P. Lear Sr. and acquired by Canadair in 1976. The prototype featured an advanced-design, "supercritical," airfoil developed by Robert Whitcomb of the U.S. National Aeronautics and Space Administration, and high-bypass-ratio Avco Lycoming — now Honeywell — ALF502L turbofan engines. Canadair incorporated design changes that included a larger fuselage for an 18-passenger "stand-up" cabin, a larger wing for more fuel capacity and a T-tail, and began production of the CL (Canadair/Lear)-600 Challenger in 1980. The Challenger 601 was introduced in 1982 with winglets and more powerful General Electric CF34 engines.

Bombardier Aerospace, which acquired Canadair in 1986, continues production of the Challenger 604, introduced in 1995; the 13-passenger Challenger 300, which has Honeywell HTF7000 engines; and the Challenger 800, a corporate version of the CRJ200 regional jet.

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


The Challenger struck a building after running off the end of the runway and over a six-lane highway.

jet airplanes with interior cabin furnishings designed for luxury business transport."

The airplane flight manual (AFM) for the Challenger includes stabilizer-trim — pitch-trim — settings for approved CG locations. The first officer did not consult the AFM when he selected a setting appropriate for a mid-range CG. "The captain told investigators that he checked the pitch-trim setting selected by the first officer while they taxied and that he believed that the trim setting was satisfactory," the report said. "The captain stated that he recalled a table in one of the airplane's manuals that specified trim settings but that he thought the trim could be adjusted to various settings depending on the pilot's preference."

## Hasty Departure

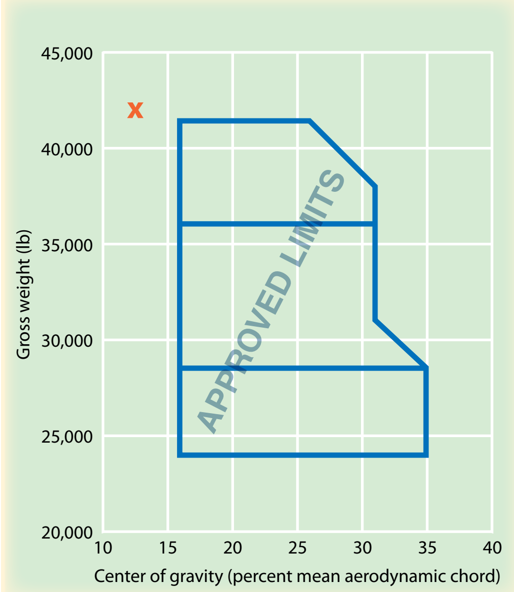
The passengers did not receive a preflight safety briefing. Under Part 135, the pilot-in-command is required to ensure that a preflight briefing on specific items, including the use of seatbelts, is conducted. While boarding the airplane, the captain told the passengers only that turbulence was expected during the flight. He believed that the cabin aide would conduct the safety briefing. The cabin aide believed that the captain had conducted the briefing.

The crew began taxiing the airplane about 0711. Cockpit voice recorder (CVR) data indicated that at 0715, the captain told the first officer, "OK, let's do the before takeoff [checklist]. Go to tower and tell them we're ready." The first officer, however, continued the "Taxi" checklist, which included checks of the pitch-trim setting and the hydraulically actuated flight controls. The pilots told investigators that movement of the flight controls was satisfactory and unrestricted.

Immediately after the flight-control check was conducted, the tower controller

This trim indicator is similar to the one in the accident airplane, in which stabilizer trim had been set for a mid-range, rather than a forward, center of gravity.

**Approximate Center of Gravity Location**




Source: U.S. National Transportation Safety Board

**Figure 1**

told the crew to taxi the airplane into position on the runway and hold. The crew began conducting the "Before Takeoff" checklist at 0716:36, and the first officer announced that the checklist was complete at 0716:54. About 15 seconds later, as the airplane was being taxied onto the runway, the controller told the crew to "keep it on the roll, runway six, cleared for takeoff. Traffic is a Learjet [on a] four-mile final." The first officer verbalized an acknowledgement of the clearance but apparently did not key his microphone; the CVR recorded the acknowledgement as an intra-cockpit communication. A few seconds later, at 0717:17, the captain said, "Hurry up, we're on the roll."

At 0717:19, the controller said, "Challenger seven zero victor, just confirm runway six cleared for takeoff." The first officer acknowledged the clearance.

At 0717:32, the captain said, "Let's go," and engine power was increased. Four passengers did not have their seatbelts fastened when the takeoff was begun. Two passengers fastened their seatbelts as the airplane began to accelerate. The other two, who were seated on a side-facing divan, could not locate their seatbelts because they had been stowed behind the seat cushions.

## Both Pilots Pulled

Acceleration appeared normal, and the first officer called out "V one" — 127 kt — at 0717:56 and "rotate" two seconds later. "During postaccident interviews, the captain stated that, when the airplane reached the rotation speed, he attempted to pull the control yoke aft, but, even though he pulled very hard, the airplane did not lift off," the report said. "The first officer told investigators that, as the airplane continued to accelerate on the runway without lifting off, he also began pulling back on the control yoke."

About five seconds after the airplane accelerated through rotation speed — 135 kt — the CVR recorded the sound of decreasing engine power and the captain saying, "Abort." Groundspeed at this time was about 160 kt, and about 2,100 ft (641 m) of runway remained.

"The captain told investigators that he applied [wheel] brakes, speed brakes and thrust reversers in an attempt to stop the airplane, and that all of those systems appeared to be working," the report said. A performance study conducted by Bombardier indicated that the minimum accelerate-stop distance under the existing conditions was 6,550 ft (1,998 m).

The airplane came to a stop with the forward fuselage, to near the wing root, embedded in the building. The pilots initially were trapped in their seats by wreckage that entangled their legs. The report said that their injuries included fractures, dislocations and lacerations of their lower limbs.

"The pilots stated that they urgently wanted to exit the airplane because fuel was spilling and they could see smoke and flames," the report said. "The captain reported that he shut down the engines and master battery switch, and that he then grasped the first officer by the belt and pulled on his lower body while the first officer pulled on an overhead bar with his arms. Through these efforts, the pilots were able to free the first officer's legs from the wreckage."

The two unrestrained passengers had been thrown to the cabin-aisle floor on impact. Injuries to the passengers and cabin aide included contusions (bruises), abrasions (scrapes), lacerations, sprains and strains, the report said.

The cabin aide decided not to use the right overwing emergency exit because of the proximity of burning vehicles. However, she was not able to open the cabin door, which had become partially jammed. The door was pushed and kicked open by two passengers, and the cabin occupants exited the airplane.

The first officer crawled through the cabin door and onto the wing, and was pulled clear of the airplane by two passengers. The captain freed his legs from the wreckage by pulling on the overhead bar. After ensuring that everyone else was out of the airplane, he exited through the cabin door and walked away from the airplane.

Tower controllers had observed the Challenger fail to rotate and had notified aircraft rescue and fire fighting (ARFF) personnel before the airplane overran the runway. ARFF personnel arrived at the accident site as the occupants were exiting the airplane. Fire fighting personnel from neighboring communities also responded. A high-reach extendable turret vehicle with a skin-penetrating nozzle, which was based at Newark Liberty International Airport, was used to extinguish fire that had spread into the cabin.

"Postaccident investigation and extensive component testing revealed no evidence of a flight control system malfunction or failure, and there was no indication of foreign-object obstruction," the report said.

## Similar Accidents

The report included information on two other overrun accidents that occurred after flight crews were unable to rotate Challengers on takeoff. One airplane was brought to a stop in mud 75 ft (23 m) beyond the end of Runway 24 at Teterboro Airport after the crew rejected the takeoff at about 139 kt on Dec. 16, 2003.[1] None of the eight occupants was injured, and damage was minor. The investigation found that the airplane exceeded weight-and-balance limits; the CG was about 13.6 percent MAC.

The other airplane was substantially damaged when the nose landing gear collapsed during an overrun of Runway 36 at Tupelo (Mississippi) Regional Airport on March 9, 2005.[2] A microphone holder installed at the base of the first officer's control column had rotated 90 degrees from its normal position and interfered with aft movement of the column during rotation. The crew rejected the takeoff at 140 to 145 kt. None of the seven occupants was injured in the accident.

## Nonstandard Safety Area

The runway safety area (RSA) off the end of Runway 06 did not meet U.S. Federal Aviation Administration (FAA) standards, which call for an RSA to be 1,000 ft (305 m) long and 500 ft (153 m) wide. The RSA met the width requirement but extended only 90 ft (27 m) beyond the end of the runway. The FAA had officially determined that extending the RSA was not practicable because of the highway and buildings near the end of the runway.

In April 2005, the FAA issued a revised RSA determination saying that the safety area could be enhanced by the installation of a nonstandard engineered materials arresting system (EMAS; *ASW*, 8/06, p. 13). Initial studies indicated that an EMAS 265 ft (81 m) long and 162 ft (49 m) wide would be capable of stopping a Bombardier CRJ200, Cessna Citation X, Gulfstream III/IV or Learjet 35 overrunning the runway at 60 to 65 kt.

The burned-out hulk of one of the six vehicles struck during the overrun rests near the airplane's left overwing exit.

U.S. National Transportation Safety Board

An EMAS this size, however, would not have stopped the Challenger, which overran the runway at 110 kt. "Simulations performed by the EMAS manufacturer indicated that … the accident airplane would have exited the EMAS at a speed of about 97 kt," the report said.[3]

## 'Systemic Deficiencies'

The report said that the charter management agreement between PJM and Darby Aviation was, in effect, a "wet lease" that is allowed only between certificated operators. Under the agreement, PJM paid Darby Aviation a monthly "certificate fee" and provided one of its three Challengers, a flight crew, maintenance support and scheduling services for each flight operated under Darby Aviation's Part 135 operating certificate. Darby Aviation was responsible for crew training and record keeping.

As the certificate holder, Darby Aviation was required by Part 135 to exercise operational control of flights conducted under its certificate by PJM. However, the report said that the company exercised minimal oversight and operational control, which "resulted in an environment conducive to the development of systemic patterns of flight crew performance deficiencies like those observed in the accident."

For example, Darby Aviation was not aware that PJM pilots frequently modified the empty weight shown on weight-and-balance forms for the accident airplane to ensure that the results of their weight and CG calculations were within approved limits. "It is likely that the airplane was actually operated outside its specified weight-and-balance limits on numerous previous flights," the report said.

"Further, review of PJM and Darby documentation showed that Darby was often unaware of on-demand charter flights conducted by PJM under Darby's certificate. For example, in some cases, including the accident flight, PJM conducted on-demand revenue flights under Part 91 when they should have been conducted under Part 135."

The report said that the FAA failed to recognize that PJM was operating as a de facto Part 135 operator. The agency's "tacit approval of arrangements such as that between Darby and PJM," and its inadequate surveillance and oversight of operations conducted under Darby Aviation's Part 135 certificate were cited by NTSB as contributing factors in the accident.

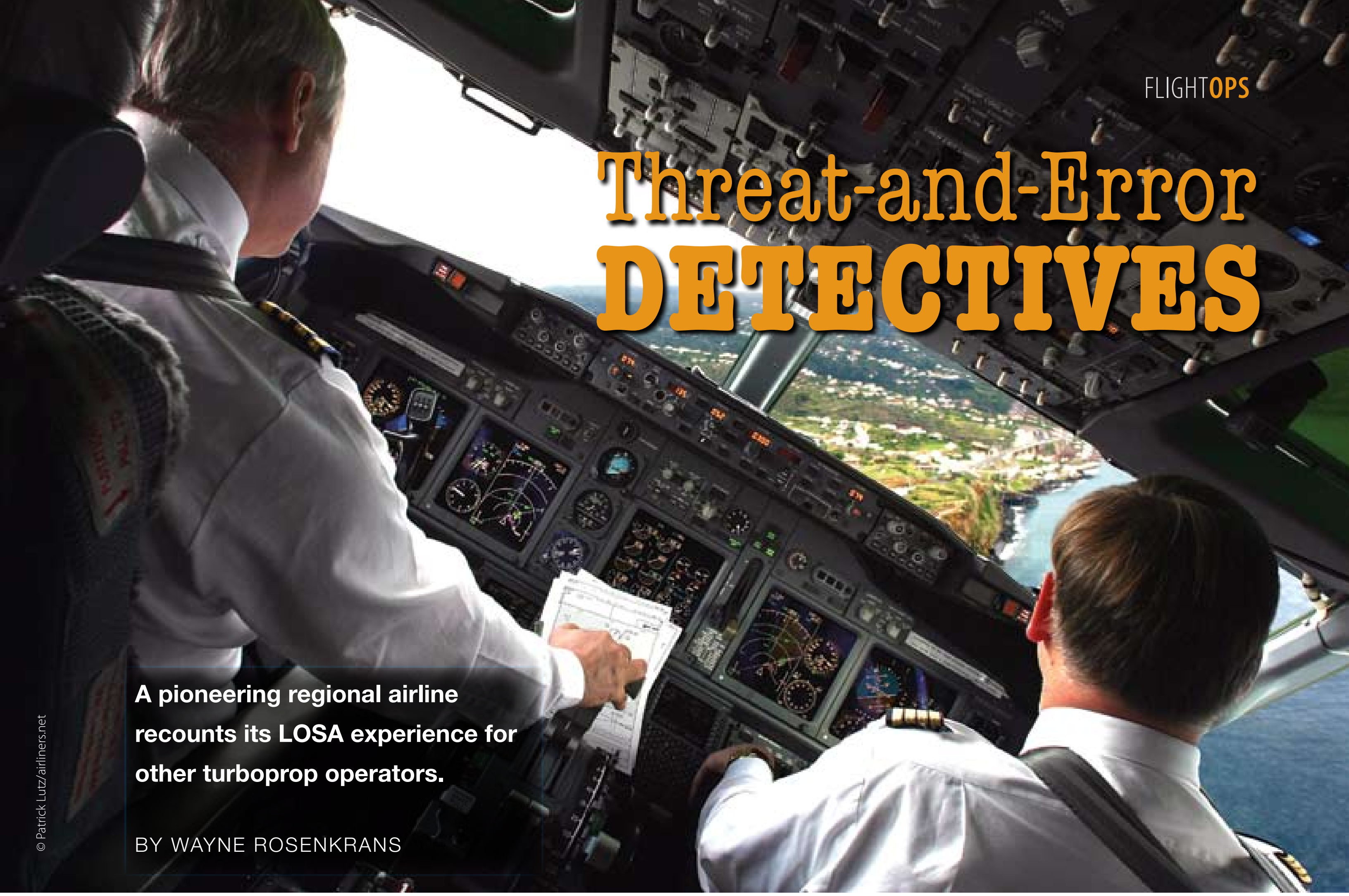
In March 2005, the FAA ordered PJM to cease operations and suspended Darby Aviation's Part 135 operating certificate. The FAA subsequently reinstated Darby Aviation's operating certificate after the company rewrote its operations specifications, in part to include a detailed section on operational control. The report also said that Blue Star Jets established a review system with a charter-audit company to ensure that charter flights are arranged only with properly certified Part 135 operators.

In June 2005, the FAA issued a notice to its principal inspectors, reminding them that operations conducted under wet-lease agreements are not permissible and directing them to ensure that Part 135 operators understand the requirements for maintaining operational control and demonstrate that they exercise operational control of flights conducted under their certificates. ●

*This article is based on U.S. National Transportation Safety Board Accident Report NTSB/AAR-06/04, "Runway Overrun and Collision, Platinum Jet Management, LLC, Bombardier Challenger CL-600-1A11, N370V, Teterboro, New Jersey, February 2, 2005." The 124-page report contains illustrations and appendixes.*

## Notes

1. U.S. National Transportation Safety Board (NTSB). Report no. NYC04IA054.
2. NTSB. Report no. ATL05FA061.
3. An airport diagram current at press time indicated that a nonstandard engineered materials arresting system measuring 170 ft by 251 ft (52 m by 77 m) had been installed at the end of Runway 06 at Teterboro Airport.



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# Threat-and-Error DETECTIVES

**A pioneering regional airline recounts its LOSA experience for other turboprop operators.**

BY WAYNE ROSENKRANS

Regional airlines, especially those operating turboprop airplanes, for the first time can visualize potential benefits of a line operations safety audit (LOSA) program by considering the experience of a comparable operator, thanks to an Australian case study. By comparison, more than 20 operators of commercial passenger jets have used the LOSA program since its 1996 introduction by a human factors research team led by Robert Helmreich, Ph.D., and the 2001 creation of the University of Texas (U.S.) Human Factors LOSA Collaborative, which runs the program.

Data from 57 observations of 30 flight crews at Regional Express showed that, on average, they experienced 4.9 LOSA-defined threats per flight sector — with at least one threat on every flight sector, said a January 2007 report prepared for the Australian Transport Safety Bureau (ATSB), which funded this LOSA case study.[1] The most prevalent threats were air traffic control (ATC) issues and weather issues — each threat category affecting 32 percent of all flight sectors — and ground and ramp operations issues, affecting 19 percent.

Trained LOSA observers, who assume error to be an inherent part of flying, analyze data collected on a confidential basis through a prism of various human factors models. The outputs of their analysis enable airlines to determine safety margins during routine flight operations. The data collected represent factors such as environmental conditions, operational complexities and flight crew performance as pilots manage, or mismanage, problems. Current LOSA programs also incorporate among their methods Helmreich's threat-and-error management model of reducing the risk of accidents.

An international outreach by the LOSA Collaborative, part of a plan to bring regional airlines into the LOSA sphere, attracted both Regional Express and an unnamed New Zealand–based

**From the jump seats of commercial jets, such as the Boeing 737, trained LOSA observers have collected data since the late 1990s.**

**"A LOSA [program] can help an airline discover the safety margins associated with its operations [and] provides unique data about an airline's defenses and vulnerabilities."**

operator to be the world's first regional airlines to implement LOSA. "Traditionally, the regional airline sector has experienced a higher accident rate than larger carriers, both in Australia and worldwide," the ATSB safety report said. "Regional carriers generally operate with less stringent regulatory requirements, fewer company resources, less sophisticated aircraft and in a more hazardous operating environment than their mainline jet counterparts. Furthermore, unlike jet operators, regional airlines rarely have the resources to implement flight data recorder–based flight operational quality assurance programs. … A LOSA [program] can help an airline discover the safety margins associated with its operations [and] provides unique data about an airline's defenses and vulnerabilities."

Regional Express was created by the 2002 merger of Hazelton Airlines and Kendell Airlines. The new airline was successful in encouraging voluntary participation by its flight crews in a LOSA program while seeking insights into the effects of dynamic organizational changes on safety performance. Other company goals were to explore the feasibility of routinely using this tool, to eventually "focus and redirect training" within the country's regional airlines, and to help the LOSA Collaborative to refine its data archive and methodology for use by all regional airlines.[2] Regional Express operates Saab 340 and Fairchild Metro 23 airplanes; the Saab 340 fleet was the focus of its LOSA observations.

## Affordability Problems

"Until now, largely due to cost, LOSA [has] only been available to larger airlines operating above the regional airline profitability threshold," the report said. "While this project specifically


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sampled Saab 340 turboprop operations … the LOSA Collaborative also conducted a number of observations on the Fairchild Metro 23 turboprop fleet as a case study, to examine how LOSA might be further developed for smaller aircraft applications that do not have a dedicated cockpit third pilot/observer jump seat station."

Six observers flew the LOSA flight sectors during April and May 2005, including operations at 26 Australian airports. The observers included two representatives from the LOSA Collaborative and a captain and three first officers from the airline.[3] "An agreement … between Regional Express airline management and the Regional Express pilots' association … ensured that all data was de-identified, kept confidential and sent directly to the LOSA Collaborative for final analysis," the report said.

Coding of data was checked for technical accuracy by LOSA Collaborative analysts, then the airline's fleet subject matter experts conducted a "data cleaning roundtable," ensuring that coding corresponded to the airline's standard operating procedures. "This enhanced not only the credibility of the findings [but also] instilled confidence within the airline to use the data to implement meaningful safety changes," the report said. "Completing this task also included the [highlighting,] extraction and amplification of any high-risk events [undesired aircraft states (UASs)] that may have been observed."[4]

The resulting data set captured numbers and types of threats to flight safety, flight crew


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management of threats, errors made by flight crews and flight crew management of errors. The observers also rated flight crews according to crew resource management (CRM) behavioral markers. The LOSA Collaborative produced a confidential final report for Regional Express containing analysis of these data accompanied by comparisons with some of the data added most recently to the LOSA data archive. This report — accompanied by raw data and full-text observer narratives — presented findings on threats, errors, UASs and organizational threat-and-error countermeasure profiles.

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## Threat/Error Profiles

The following findings were in the ATSB report:

- Captains and first officers were equally represented as the pilots flying on the observed flight sectors.
- Most threats — 59 percent — were categorized as "environmental threats," or beyond the airline's control, and the remaining 41 percent were "airline threats," or related to operations such as pilot, maintenance and ground support issues.
- Within the environmental category, the ATC-related threats and adverse weather–related threats occurred on 54 percent of flight sectors; about 50 percent of all threats in this category were during the descent or approach-and-landing phases of flight.
- Within the airline category, threats related to ground and ramp operations occurred on 46 percent of flight sectors; 75 percent of all threats in this category were during the pre-departure/taxi phase of flight.

Twenty-three of the 30 flight crews, during the cruise phase of flight on the observed flight sectors, answered four standardized open-ended questions that were asked by observers, probing the pilots' perceptions of various safety and training issues, including potential accident risks, safety improvement opportunities, aircraft operational confusion/automation traps and differences between training and line operations.

Post-LOSA changes at Regional Express have included an internal review of training and checking policies with a related business plan to improve quality assurance processes; database tools to compare pilot training and outcomes with measurable internal benchmarks; and remedial initiatives, supported by regulatory amendments, that will address any individual pilot issues that surface during new training/checking processes. "Regional Express will consider scheduling an internally run LOSA [program] toward the end of 2007 or in early 2008 … after the current safety programs and initiatives become embedded in the Regional Express flight operations culture," the report said.●

### Notes

1. This article is based on the Australian Transport Safety Bureau (ATSB) safety report *Regional Airline Line Operations Safety Audit* by Capt. Clinton Eames-Brown and Geoffrey Collis. The 39-page report, published in January 2007 under ATSB Aviation Safety Research Grant B2004/0237, includes tables. Eames-Brown is safety manager of Regional Express.
2. The database of the Line Operations Safety Audit (LOSA) Archive contains more than 4,000 de-identified observations from approximately 20 participating airlines based in several countries.
3. The LOSA Collaborative's observers collected data on six flight sectors; observers employed by Regional Express collected data on 51 flight sectors.
4. An undesired aircraft state is "a position, condition or attitude of an aircraft that clearly reduces safety margins and is a result of actions by the flight crew." Examples in the report were unstabilized approaches, lateral deviations, hard landings and flight crews proceeding toward the wrong taxiway or runway.

Steve Morris — AirTeamImages/airliners.net

# Sidestepping

**Some voices in the aviation industry are challenging the traditional belief that the centerline of an airway is the safest position for an airplane.**

BY LINDA WERFELMAN

Soon after the initial implementation of reduced vertical separation minimum (RVSM) procedures in 1997, concerns about crowded North Atlantic routes prompted development of an option designed to reduce collision risks: strategic lateral offset procedures, which allow pilots to fly parallel to and slightly to the right of an airway centerline.

In the years that followed, offset procedures also began to be viewed as a method of reducing exposure to wake turbulence within "oceanic and remote continental" RVSM airspace — airspace between Flight Level (FL) 290 (approximately 29,000 ft) and FL 410, where the standard vertical separation of aircraft was reduced from 2,000 ft to 1,000 ft.

In 2007, some in the aviation industry, especially in light of the recent midair collision in Brazil, are urging that flight crews increase their use of offset procedures and that authorities expand the airspace in which these procedures are specifically authorized. Others are discouraging wider use as unnecessary.

The discussion "goes to the roots of our assumption that the centerline of an airway is the safest place to be," said William R. Voss, president and CEO of Flight Safety Foundation. A thorough evaluation of the issue is needed to determine effective methods — consistent around the world — for ensuring adequate separation on the airways, he said.

"There's an absence of clear information for pilots to act upon," Voss said. "The question has to be examined carefully. It should be taken up by ICAO [the International Civil Aviation Organization] and worked out with pilot groups and air navigation services providers, and their decision should be communicated clearly to the aviation community."

## Previously Not an Issue

Lateral separation was not an issue in the early days of jet airliners; in 1960, the international standard for the vertical separation minimum between aircraft at and above FL 290 was set at 2,000 ft — double the previous minimum. The rationale for the 2,000-ft requirement was the recognition that barometric altimeters might not be accurate enough at the high altitudes occupied by these aircraft to allow pilots to maintain the 1,000-ft vertical separation that had been required for propeller-driven airplanes. At the same time, lateral navigation cockpit instruments were accurate enough to allow airplanes to be flown along an airway, but not so accurate

# the Airway

that they could keep pilots precisely on the airway centerline.

After years of study and discussion — considering technological advances in flight deck instrumentation and autopilots — RVSM was phased in, region by region, in an eight-year program that began in 1997 in the North Atlantic and ended in 2005 in North America, South America and parts of Asia. Along with RVSM came a need for more precise aircraft altimeters and automatic altitude-control systems.

After implementation of RVSM in the North Atlantic, flight crews began reporting encounters with wake turbulence from airplanes close in front of them and 1,000 ft higher. They also expressed concerns about what might happen if an altimeter error brought one of those aircraft several hundred feet closer than the 1,000-ft vertical separation minimum.

In addition, many pilots began to question assumptions about the safety of flight on airway centerlines, recognizing that the lateral accuracy of 21st-century flight deck technology places an increasing number of airplanes exactly on the centerline.

"Where airplanes used to be spread over a mile, they are now within a few feet of the centerline," Voss said.

## Looking for Options

In response to the pilots' concerns, the ICAO North Atlantic Systems Planning Group began reviewing options "and carried out some research to see how far the aircraft could offset from their cleared course without requesting a clearance from air traffic control (ATC) and without increasing the risk," said Dražen Gardilčić of the ICAO Air Traffic Management Section. "The group recommended a maximum offset of 2 nm [3.7 km]."

As a result, the North Atlantic Regional Supplementary Procedures document for RVSM operations was amended to allow lateral offsets of 1 nm (1.8 km) or 2 nm to the right of the course.

"It was felt that these procedures would not only alleviate the [RVSM-related] wake turbulence issue but they would also introduce an

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additional 'randomness' to aircraft flight paths, and thus, the procedure would reduce the possibility of collision in the event of a vertical error," Gardilčić said. "In other words, this would artificially degrade the accuracy of navigation systems so if there was a vertical error, aircraft would not be precisely on the centerline and possibly collide."

After a form of the procedure was approved around 2000 for ICAO's North Atlantic region, most other ICAO regions adopted similar procedures for lateral separation in oceanic and remote continental areas within their airspace. Much of the phrasing and reasoning in those separate documents subsequently was incorporated into ICAO's *Procedures for Air Navigation — Air Traffic Management* manual, making the lateral offset applicable in oceanic and remote airspace worldwide.[1]

The document discusses lateral offset procedures "for both the mitigation of the increasing lateral overlap probability due to increased

navigation accuracy, and wake turbulence encounters.

"The use of highly accurate navigation systems, such as the global navigation satellite system (GNSS), by an increasing proportion of the aircraft population has had the effect of reducing the magnitude of lateral deviations from the route centerline and, consequently, increasing the probability of a collision should a loss of vertical separation between aircraft on the same route occur."

According to the document, the use of strategic lateral offsets in a particular airspace must be authorized by the appropriate air traffic services (ATS) authority, and, with that authorization, the offsets may be flown in en route oceanic or remote continental airspace on uni-directional and bi-directional routes and on parallel route systems whose centerlines are separated by at least 55.5 km (30 nm).

"The decision to apply a strategic lateral offset shall be the responsibility of the flight crew," the document says. "The flight crew shall only apply strategic lateral offsets in airspace where such offsets have been authorized by the appropriate ATS authority and when the aircraft is equipped with automatic offset tracking capability."

When offset procedures are flown to mitigate the effects of wake turbulence, pilots may contact the flight crews of other aircraft on the inter-pilot air-to-air frequency of 123.45 MHz to coordinate the offsets, the document says.

Although ATC is made aware of the airspace in which offset procedures are authorized, controllers do not issue clearances to flight crews to fly the procedures — and crews that fly them are not required to inform ATC.

## 'I Feel Relieved'

Although offset procedures have been recommended for North Atlantic operations for several years, "too few pilots actually use them," said Capt. Heinz Frühwirth of Austrian Airlines, vice chairman of the International Federation of Air Line Pilots' Associations (IFALPA) ATS Committee and a member of the ICAO Separation and Airspace Safety Panel that developed the offset procedures.

Frühwirth, who regularly flies North Atlantic routes in Airbus A330s and A340s, said that he regularly uses offset procedures.

"In the North Atlantic, it's recommended to use offsets whenever you can, and it's straightforward enough — program it into flight management," he said. "I feel relieved to see all those other airplanes off to the side."

Gardilčić said, however, that ICAO's North Atlantic Systems Planning Group has recently expressed concern that not enough aircraft appear to be flying the offset procedure in the North Atlantic, "thus negating, in part, the safety benefits that could be obtained with greater participation."

Data collected by U.K. National Air Traffic Services (NATS), which provides ATC services for aircraft in the eastern portion of the North Atlantic, show a "disappointing" frequency of offset use by airliners — less than 10 percent, compared with the hoped-for 67 percent, NATS senior press officer Richard Wright said.

"In trying to understand why, we have been talking to the airlines, and it seems that pilots are reluctant to stray from company procedures," Wright said. "The best performers are the airlines who have incorporated [offset procedures] into their standard operating procedures."

**"There is a lot of operational wisdom that could easily be used to increase safety at little cost."**

Airlines are now being encouraged to do just that, said Wright and Ron Singer, communications adviser for Nav Canada, which provides ATC services for the western North Atlantic.

"We believe offsets are an effective procedure and add a layer of defense" against wake turbulence and midair collisions, Singer said, adding that Nav Canada is encouraging wider use of offsets on North Atlantic routes.

Wright said that, in addition, NATS and Nav Canada are examining the possibility of issuing lateral offsets along with oceanic clearances. Such a change would require approval from civil aviation authorities and ICAO, in addition to detailed discussions with airline officials.

IFALPA has repeatedly encouraged pilots and operators to use offset procedures.

"Strategic lateral offset procedures should be a [standard operating procedure], not a contingency, and operators should be endorsing the use of lateral offsets for safety reasons on all oceanic and remote airspace flights," IFALPA said in a June 15, 2006, *Safety Bulletin.* "Operators are reminded that the current [offset procedure] is designed to mitigate the effects of wake turbulence, as well as to enhance flight safety."[2]

## Fatal Midair Collision

Calls for increased use of lateral offsets intensified after the Sept. 29, 2006, midair collision over the Brazilian Amazon jungle of a Gol Airlines Boeing 737-800 and an Embraer Legacy 600 business jet owned and operated by ExcelAire, a jet charter firm with headquarters in Ronkonkoma, New York, U.S. The crash occurred while the two airplanes, which were being flown in opposite directions, were on the same airway and at the same altitude.

The 737 was destroyed and all 154 occupants were killed. The seven occupants of the business jet were uninjured. The airplane's left wing and left horizontal stabilizer were damaged, but the crew was able to conduct an emergency landing at Cachimbo Air Base.

"The accident over Brazil confirmed our worst fears — that the only two airplanes in that part of the sky could collide," Voss said.

The investigation was continuing, but some in the aviation industry have cited the accident in their calls for expanded use of lateral offsets in areas where they already are authorized, as well as expansion of the areas of authorization.

"While the strategic lateral offset procedure that is in use in other areas of the world does not yet exist in South America, some member associations are actively debating the benefits of this concept and may soon put forth positions encouraging the use of this procedure," IFALPA said in a January 2007 *Safety Bulletin.*[3]

Frühwirth said that IFALPA would "try to push the issue wherever we can in the immediate future."

"It is very unfortunate that it took an accident that cost many lives to make people aware that there is a lot of operational wisdom that could easily be used to increase safety at little cost," he said. "Of course, even though we are convinced that the use of offset procedures enhances safety, we remind pilots that they should adhere to published, authorized procedures."

Capt. Rick Valdes of United Airlines, a member of numerous safety committees within IFALPA and the Air Line Pilots Association, International (ALPA), said that — authorized or not — some pilots have begun using offset procedures on South American routes.

"Offsets are very advantageous when you happen to have traffic coming in the opposite direction, and in South America, you come nose to nose [with other airplanes] every flight," Valdes said. "You want to have that extra margin of safety."

If the pilots of either airplane involved in the Amazon midair collision had been using offset procedures, he said, the crash wouldn't have occurred.

Valdes, who flies Boeing 767s from the United States to South America and Europe, said that the offset procedures, as implemented over the North Atlantic, are "awesome. I wish we had more people participating."

Not all carriers have authorized their pilots to use the procedures, perhaps because of a lack of understanding of their safety benefits, he said.

Offset procedures should become a standard practice in the regions where they are already authorized and should be expanded to other airspace, he said.

Capt. Erik Reed Mohn of Scandinavian Airlines System (SAS) agreed that offset procedures should be "expanded to any airspace that can accommodate them." Reed Mohn said that he usually flies Airbus A330s and A340s on North Atlantic routes that are so far north that they are outside the region where offset procedures have been authorized. As a result, his flights are on "random" routes determined by the airline's planning staff, he said.

Nevertheless, he added, "We're invariably meeting other airplanes absolutely head-on" — although the safety provided by vertical separation has prevailed.

"It's actually amazing to see the extreme accuracy of modern navigation equipment demonstrated every time you meet an aircraft going in the opposite direction," he said.

## 'Systems Seem to Work'

Some air navigation services providers say that equipment accuracy and current ICAO policies on offset procedures are major factors in the general safety of the current systems of aircraft separation.

"These systems seen to work with no problem and are consistent with ICAO … standards for their use," said Phil Peguero, safety director at Airways New Zealand.

"The reality is that, while ATC systems are generally extremely reliable, there are the odd errors, and the issue of offsets is raised to mitigate the possibility of such errors," Peguero said. "The irony of the situation is … that the greater the accuracy of navigation without an offset strategy, the greater the chance is these days of a collision if ATC gets it wrong. The offset achieves a controlled degrade of the navigation accuracy so that a small degree of horizontal distancing is created in case vertical application by the ANSP [air navigation services provider] has failed."

Although ANSPs should never rely on offset procedures or airborne collision avoidance systems (traffic-alert and collision avoidance systems), pilots should implement these and other safety strategies that "mitigate the risk of failure in the ANSP," he said. For that reason, the Civil Air Navigation Services Organisation (CANSO), which represents ANSPs, "could take a view that the issue is one to be decided by the pilot fraternity, according to their own perception of the risk they face being exposed to a failure in an ANSP," he said.

Wright, of U.K. NATS, said that NATS officials were beginning to review the possibility of using lateral offsets in domestic airspace.

"We will need to consider the risk reduction and whether any new risks might be introduced, especially in busy Terminal Area airspace," he said. "We will need to have detailed technical discussions with airlines before putting any proposals to our regulator."

Despite differing opinions on how to proceed, Voss said that uniform, well-defined procedures are essential worldwide. Without a coordinated means of handling offsets, individual operators and, in some cases, individual pilots, will develop their own methods, he warned.

"What you don't want is pilots doing random offsets," he said. "This is a global problem and should be dealt with globally." ●

## Notes

1. International Civil Aviation Organization (ICAO). *Procedures for Air Navigation Services — Air Traffic Management.* Document 4444, 15.2, "Special Procedures for In-Flight Contingencies in Oceanic Airspace," 15.2.4 "Procedures for strategic lateral offsets in oceanic and remote continental airspace." ICAO does not specifically define "remote" airspace, but it often is considered to be airspace where surveillance by air traffic control is not available.
2. International Federation of Air Line Pilots' Associations (IFALPA). "Navigation Errors on the North Atlantic." *IFALPA Safety Bulletin,* no. 07SAB02. June 15, 2006.
3. IFALPA. "ATC Operations in Brazilian Airspace." *IFALPA Safety Bulletin*, no. 07SAB14. Jan. 29, 2007.

## Further Reading From FSF Publications

FSF Editorial Staff. "RVSM Heightens Need for Precision in Altitude Measurement." *Flight Safety Digest* Volume 23 (November 2004).

FSF Editorial Staff. "Global Implementation of RVSM Nears Completion." *Flight Safety Digest* Volume 23 (October 2004).

FSF Editorial Staff. "Bracing the Last Line of Defense Against Midair Collisions." *Flight Safety Digest* Volume 23 (March 2004).

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**Birds never land downwind. Should we?**

BY GUNNAR FAHLGREN

# Tail Wind Traps

Although the great majority of landings are made into the wind, many airport operating procedures permit runway use with tail wind components up to 10 kt. This could give a false impression that a tail wind won't cause any problems. Actually, tail winds regularly contribute to approach and landing accidents.

A recent example appears to be the BAe 146 that crashed while landing at Stord, Norway, the morning of Oct. 10, 2006. Preliminary reports say that the surface winds were from 110 degrees at 6 kt when the aircraft touched down on Runway 33, which was 1,200 m (3,937 ft) long and damp. Four of the 16 people aboard were killed when the aircraft overran the runway, continued down a rocky, wooded slope and caught fire.

A tail wind component of 3 kt might seem harmless. A key factor to consider, however, is that wind velocity normally is higher at the initial approach altitude than over the runway. For example, at 2,000 ft above ground, your tail wind component might be 24 kt. The greatest change of wind velocity usually can be expected about 400 ft above ground. If the aircraft is stabilized on glide path, the following might take place during the approach:

- Initially, you notice a much higher rate of descent than normal because of the increased groundspeed;
- With full flaps and gear down, you have throttled back to a much lower power setting than normal to stabilize airspeed on your desired value — let us agree on 140

kt. When the tail wind rapidly decreases at 400 ft, your airspeed indicator shows a *higher* speed, and you respond by reducing power to get back to the desired speed; and,

- A few seconds later, with the aircraft still on glide path, your airspeed rapidly drops through 140 kt to 130 kt. Angle-of-attack is increasing. Drag is increasing. Now, you must increase power quickly and decisively — you might even end up with takeoff power — to reach the runway.

## 'Extra Engine'

Few pilots who experience a scenario like this will scrutinize what actually happened. The fact is that you acted improperly when you reduced power. As the pushing wind — your "extra engine" — stops, you must *increase* power to compensate for that effective power loss. Otherwise, you might not reach the runway.

The underlying issue is that, for years, pilots have been taught to reduce power when airspeed increases above the desired value on approach. It has been stored in our motor memory, which will act automatically, like autothrottles. This erroneous action is a contributing factor in one or two controlled flight into terrain (CFIT) accidents every year.

Some new-generation autothrottle systems have been modified so that they increase power instead of reducing power. They get information not only from airspeed but also from groundspeed. This reduces the risk of hitting the ground before the runway but might cause an overrun on a wet or slippery runway.

These types of accidents can be avoided by the following:

- Avoid tail wind landings. Request another runway;
- If you have to make a tail wind approach, do not accept an initial altitude below 2,500 ft. A longer final approach will give you more time for preparation;
- Be prepared to manually override your autothrottles; and,
- Train your brain to respond with more power when airspeed is increasing.

One should also keep in mind that because of the longer landing distances associated with tail winds, the preceding aircraft might still be on the runway when you are ready to land.

## Internal Timing

All those approaches we typically make into head winds create an unconscious "timing" that makes it possible for professional pilots to conduct safe landings several times a day in all types of weather conditions without undue stress.

This unconscious or instinctive timing, which I call *internal timing*, is activated for a brief period during the final stage of the approach and landing. We automatically start this internal timing, as well as communication and action synchronized to that timing. At specific points in time, we make callouts, select flap settings, select and check gear down, check final approach fix altitude and decision altitude, check speed and sink rate, and evaluate braking action.

With training and experience, internal timing produces a rhythm — and skill — in conducting approaches and landings. A tail wind can disrupt that rhythm. You start the internal timing and communication the usual way. Everything seems normal for a while. But, gradually, you get a feeling that something is not correct. A disrupted rhythm can cause a cognitive disruption or even a cognitive breakdown, depending on the level of stress that has developed, and could lead to an accident.

Tail wind landings increase the risk of a runway overrun or CFIT accident. They can't be avoided all the time, but they should be avoided whenever possible.●

*Gunnar Fahlgren is a retired Scandinavian Airlines System captain, flight instructor and chief pilot. Now a human factors consultant certified by the Swedish Civil Aviation Authority, Fahlgren has conducted human factors courses for thousands of pilots worldwide and has served as a member of the International Air Transport Association's Human Factors Working Group, the International Civil Aviation Organization's Human Factors Study Group and The Royal Aeronautical Society's Crew Resource Management Working Group. He is author of "Life Resource Management CRM and Human Factors."*

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# Is There a Doctor Aboard?

**Most passenger in-flight medical events over a 30-year period were not emergencies and had no severe consequences, but one-third led to aircraft diversions.**

BY RICK DARBY

Passenger in-flight medical events, injuries and emergencies pose significant questions for air carriers and regulatory authorities. How much medical equipment, and what kind, should be required aboard aircraft?[1] To develop reasonable requirements for on-board medical equipment and cabin crewmember training for its use, objective data about the frequency and types of events are helpful.

The Australian Transport Safety Bureau (ATSB) sponsored a study of passenger in-flight injuries and medical conditions using data from Jan. 1, 1975, to March 31, 2006.[2] The study examined a database of 284 events — 15 accidents, one serious incident and 268 incidents, according to ATSB definitions — gleaned from the ATSB accident and incident database. The key findings included these:

- In-flight deaths represented only 3 percent of medical events.
- The most common cause of in-flight death was heart attack.
- The most common medical event was minor musculo-skeletal injury.
- One-third of medical events resulted in the aircraft being diverted.

**In-flight deaths represented only 3 percent of medical events.**

"In-flight medical events are a potentially significant problem," the report said. "The airliner cabin at 35,000 feet is far from advanced medical care, space is restricted, the appropriate and necessary equipment for handling a given emergency may or may not be present, and qualified medical personnel are not generally available unless they are traveling on-board as passengers. The cabin environment is also pressurized to an altitude in the range of 4,000 to 8,000 feet, which may pose its own difficulties for passengers with certain emergencies such as respiratory or cardiac arrest. Without treatment, a passenger suffering from a heart attack is unlikely to survive."

The aim of the study, the report said, was to determine the most common passenger in-flight medical events and what proportion resulted in diversions.

The database that was analyzed contained occurrences aboard Australian-registered civil aircraft operating within and outside Australia, and non-Australian-registered aircraft operating within Australian territory. Medical events included in the study were "passenger injuries sustained during routine or regular operations on board serviceable aircraft, which either complete the flight as originally planned or result

## Injury Levels in Passenger In-Flight Medical Events

| Injury Level | Number | Percentage |
|---|---|---|
| Fatal | 9 | 3% |
| Serious | 100 | 35% |
| Minor | 150 | 53% |
| Not specified | 25 | 9% |
| **Total** | **284** | **100%** |

**Note:** Passenger in-flight medical events occurred in Australian-registered aircraft within and outside Australia, and non-Australian aircraft within Australia, January 1975 through March 2006.

Source: Australian Transport Safety Bureau

**Table 1**

in a diversion due to the state of the passenger's health." Injuries during boarding or exiting were included.

Medical events occurred during all types of civil operations. Airline operations represented about 75 percent of the total, charter operations 5 percent and commuter flights 2 percent.

The majority of injuries, 53 percent, were classified as minor (Table 1). Thirty-five percent were considered serious.[3] Nine fatalities occurred. In 25 events, 9 percent of the total, the nature of the passenger injuries was not specified. The report said that these were likely to have been minor, because any more serious injury would have been investigated and reported.

Types of medical event are shown in Table 2. The musculo-skeletal injuries were about 26 percent of the total. These included "minor joint, skin or limb injury, direct blunt trauma of a relatively trivial nature, etc." Frequent causes were turbulence, a minor fall or slip, and being struck by a cabin service cart, usually on the elbow, knee or foot.

In 43 events, 15 percent, a passenger had a heart attack during a flight. All but four of those passengers survived. There were four cases of burns, resulting from hot drinks served as part of the meal service being spilled. One passenger sustained second-degree burns to the arm.

Nine medical events were classified as fractures or dislocations. "The bones affected were generally limbs, such as ankles, arms and legs," the report said. "Falling [and] tripping were the most common reasons for a fracture or dislocation."

The data set included 29 instances of head injury. "The most common reason for this was loose objects falling out of the overhead locker [bin] onto the seated passenger underneath," the report said. "The responsible items usually consisted of briefcases, bottles and laptop computers. The next most common head injury was due to the passenger being thrown up and out of their seat during a period of turbulence and colliding with the overhead locker."

Nine passengers developed respiratory problems during a flight such as acute asthma attack, respiratory arrest or hypoxia — insufficient oxygen. "Asphyxiation occurred in one case and resulted in the death of the passenger," the report said. "This event involved a passenger choking on a small piece of steak which had been served as part of the in-flight meal."

Other than the deaths resulting from heart attack, no cause was responsible for more than one fatality (Table 3, page 52). One suicide was reported, a passenger who set fire to himself in the lavatory and died from burns.

Suspected heart attack was the most frequent reason for an aircraft diversion, in 33 of 95 diversions (Table 4, page 52). "The next

## Factors in Passenger In-Flight Medical Events

| Factor | Number | Percentage |
|---|---|---|
| Anxiety/panic attack | 2 | 0.70% |
| Bruising/lacerations | 14 | 4.93% |
| Burns | 4 | 1.41% |
| Drunkenness and/or violence | 14 | 4.93% |
| Ear injury | 1 | 0.35% |
| Eye injury | 3 | 1.06% |
| Fitting episode (seizure) | 8 | 2.82% |
| Food poisoning | 3 | 1.06% |
| Fractures/dislocations | 9 | 3.17% |
| Fumes inhalation | 1 | 0.35% |
| Head injury | 29 | 10.21% |
| Heart attack | 43 | 15.14% |
| Loss of consciousness | 5 | 1.76% |
| Motion sickness | 4 | 1.41% |
| Musculo-skeletal injury | 74 | 26.06% |
| Obstetric emergency | 1 | 0.35% |
| Pain | 2 | 0.70% |
| Respiratory illness | 9 | 3.17% |
| Stroke | 2 | 0.70% |
| Suicide | 1 | 0.35% |
| Unspecified serious illness | 11 | 3.87% |
| Unspecified illness | 44 | 15.49% |
| **Total** | **284** | **100.00%** |

**Note:** Passenger in-flight medical events occurred in Australian-registered aircraft within and outside Australia, and non-Australian aircraft within Australia, January 1975 through March 2006.

Source: Australian Transport Safety Bureau

**Table 2**

## Fatalities in Passenger In-Flight Medical Events

| Aircraft Type | Operation | Cause |
|---|---|---|
| Boeing 727 | Airline | Heart attack |
| Piper PA-28 | Private | Heart attack |
| Douglas DC-3 | Airline | Respiratory arrest |
| Boeing 747 | Airline | Heart attack |
| Boeing 747 | Airline | Asphyxiation |
| Cessna 402 | Commuter | Heart attack |
| McDonnell Douglas DC-10 | Airline | Suicide |
| Bell 206 | Private | Fall from aircraft |
| Cessna 208 | Sport aviation | Head injury |

**Note:** Passenger in-flight medical events occurred in Australian-registered aircraft within and outside Australia, and non-Australian aircraft within Australia, January 1975 through March 2006.

Source: Australian Transport Safety Bureau

**Table 3**

## Passenger In-Flight Medical Conditions Leading to Aircraft Diversion

| Condition | Number | Percentage |
|---|---|---|
| Drunkenness and/or violence | 1 | 1% |
| Fall from aircraft | 1 | 1% |
| Fitting episode (seizure) | 6 | 6% |
| Food poisoning | 3 | 3% |
| Head injury | 1 | 1% |
| Heart attack | 33 | 35% |
| Loss of consciousness | 2 | 2% |
| Motion sickness | 1 | 1% |
| Obstetric emergency | 1 | 1% |
| Pain | 1 | 1% |
| Respiratory illness | 4 | 4% |
| Stroke | 2 | 2% |
| Unspecified serious illness | 10 | 11% |
| Unspecified illness | 29 | 31% |
| **Total** | **95** | **100%** |

**Note:** Passenger in-flight medical events occurred in Australian-registered aircraft within and outside Australia, and non-Australian aircraft within Australia, January 1975 through March 2006.

Source: Australian Transport Safety Bureau

**Table 4**

most common specified condition was 'fitting episode' [seizure caused by epilepsy or another neurological disorder]," the report said. Unspecified illnesses, described as serious or otherwise, prompted 42 percent of all diversions.

First aid training for cabin crewmembers, advanced on-board medical kits and "telemedicine" communication links with emergency physicians on the ground may reduce the need for diversions and improve the outcomes of passenger emergencies, said the report.

"Increasingly, on-board medical kits are becoming more sophisticated," the report said. "There is also a growing trend among the world's airlines to make use of 24-hour ground-based medical centers that are able to directly communicate with an aircraft wherever it might be in the world, with the added ability to transmit patient medical data to the ground for definitive diagnosis. Coupled with greater levels of crew training, it is hoped that this will not only improve the chances of a passenger surviving the emergency, but also reduce the requirement for a diversion."

Passengers can improve the odds of avoiding injury. "Wearing seat belts during all phases of flight, as instructed by the cabin crew, and taking particular care with opening overhead lockers can help to prevent or minimize the possibility of some of the more common injuries suffered on an aircraft," the report said. "Furthermore, passengers with medication for pre-existing medical conditions need to ensure they have easy access to their medication, particularly as some sectors are now between 14 and 19 hours long." ●

### Notes

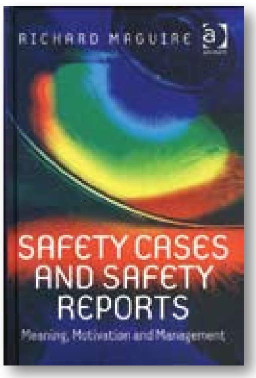
1. FSF Editorial Staff. "Enhanced Emergency Medical Kits Increase In-Flight Care Options." *Cabin Crew Safety* Volume 26 (November–December 2001).

2. Newman, David G. *An Analysis of In-Flight Passenger Injuries and Medical Conditions, 1 January 1975 to 31 March 2006.* Australian Transport Safety Bureau (ATSB), Aviation Research and Analysis Report B2006/0171. October 2006.

3. For the study, *serious injury* was defined as an injury that required, or would usually require, admission to a hospital within seven days after the injury occurred. *Minor injury* was defined as an injury that would not require hospitalization, could be treated by first aid or other simple measures, and did not significantly affect the health of the individual.

# A Case of Safety

**Creating a safety case early can avoid a lot of grief later — but it needs to be argued clearly.**




**BOOK**

## Safety Cases and Safety Reports: Meaning, Motivation and Management

Maguire, Richard. Aldershot, England, and Burlington, Vermont, U.S.: Ashgate, 2006. 190 pp. Figures, tables, references, index.

The author says in effect that you have two chances to prove your system, project or process is reasonably safe. The first is to develop what is called a safety case before it goes into operation. The second is in a law court after being sued. Creating a safety case is preferable, but it must be built with as much evidence and logic as a legal case.

"The key elements of this text are based around identifying the meaning and measurement of safety and risk; the motivation behind the need to construct a safety case; the management of the task of generating and presenting one; and how to maintain it once it has been produced," Maguire says.

In many respects, a safety case is similar to a legal case. "[A safety case] report summarizes all the key component parts of the safety case, it makes the safety argument explicit and describes the supporting evidence," Maguire says. In addition to showing that the system meets all laws, regulations and standards, "it should confirm that key staff are in place with defined responsibilities; that any further safety requirements and targets that have been set and met are appropriate; that hazard analysis has been carried out correctly; that the level of residual risk is tolerable; and that the safety performance of the entity, process or system has been independently assessed."

A safety case can be only as sound as the language that embodies it, a requirement that Maguire says holds traps for the unwary. At the most basic level, while it is generally accepted that absolute safety is impossible and there must be some satisfactory reasonable degree of safety, what one person means by that may not match what another means. Although he does not use extended twin-engine operations as an example, he might have: The chance of both engines of an approved twin-engine jet failing in oceanic flight is so low that worrying about it hardly seems worth the bother. But it is not zero, and those whose job it is to worry about such things have not always agreed about how many hours flight time should be permitted from the nearest airport suitable for diversion.

Another pitfall in talking about safety in the English language is called *ellipsis*, which Maguire says "allows you to leave out words you think are obvious, and it is perfectly acceptable grammar." He offers as an example a paragraph from an actual safety requirement document, from the section about tracking software failures:

"Visible Bug Tracking. Here we provide evidence of bug tracking for the software. 'XXXXX' is the database that is used to track all issues regarding this system. It has full visibility and is extremely detailed."

This sounds straightforward, but Maguire says it conceals ambiguities. "What is actually mean by 'all issues'?" he asks. "Should this really be 'all *software* issues,' 'all *bug* issues' or 'all *safety* issues'? What does 'full visibility' mean? Full visibility of what? 'Full visibility *of the software*'?

'Full visibility *of bug information*'? Does the 'it' really mean that 'it' *presents* full visibility to the viewer? Or is there something more here, perhaps some extra functionality that we need to know more about? From the text as it is, we just don't know, we have to make assumptions."

The author discusses many standard concepts in safety cases: for example, ALARP —risk "as low as reasonably possible," SFAIRP —"so far as is reasonably practicable" and GALE — "globally at least equivalent," which means that if one particular hazard increases, risks from others must decrease at least as much so that the risk within the whole system is acceptable. Such concepts are valid and necessary, but they can be more complicated than they appear, he says.

Critiquing one "perfectly adequate" risk assessment description for a safety case, he notes that its focus is too narrow. "The risk assessment team explicitly says that they used their 'professional judgment' in the analysis — excellent, very often this is actually missed out," he says. "The process also states that they considered the 'cost of implementing' the potential control measures that they had identified. Again very good.

"Potential concerns are that while human factors get a special mention (good), mechanical, software and managerial factors do not. This implies some special attention to human factors. Also, it is not clarified what the 'cost' actually contains — it should contain factors relating to time, resource and trouble, not just a financial consideration."

The overall conclusion to be drawn from *Safety Cases and Safety Reports* seems to be that the more risk factors that are considered and explicitly discussed before they actually arise, the better.

## REPORTS

### Human Factors Review of the Operational Error Literature

Schroeder, David; Bailey, Larry; Pounds, Julia; Manning, Carol. U.S. Federal Aviation Administration (FAA) Office of Aerospace Medicine. DOT/FAA/AM-06/21. Final report. August 2006. 66 pp. Figures, references, appendixes. Available via the Internet at <www.faa.gov/library/reports> or from the National Technical Information Service.*


The report reviews documents about research and initiatives to reduce operational errors (OEs) in air traffic control (ATC) — 154 documents published from 1960 to 2005 and 222 OE reduction initiatives from 1986 to 2005.

The literature analysis identified some consistent findings:

- "The amount of [air] traffic measured on a national basis is the single most important determinant of the frequency of OEs."
- "A relatively high percentage of OEs occurred during the first 20 minutes on [the air traffic controller's] position."
- "Pilot-controller miscommunications were historically identified as a primary causal factor associated with OEs, and hearback/readback errors were studied most often. Although analysis of recorded communications revealed that few hearback/readback errors resulted in an OE, a sizeable proportion of OEs were attributed to hearback/readback errors."

The review of initiatives related to organizational and management issues found that some "described concerns about resources available to supervisors to accomplish their jobs and recommended additional supervisory training," while others "focused on mental processes, especially those efforts addressing skills training."

Most initiatives that involved the conditions under which controllers worked were about training, teamwork and communications.

The report says, "Both the research reports and OE reduction initiatives emphasized the same six contextual conditions (although not necessarily in the same order): training and experience; teamwork; pilot-ATC communications; human-machine interaction and equipment; airspace/surface; and traffic."

Appendixes reference research documents by type of study and by categories of contributing factors to OEs.

## Developing a Methodology for Assessing Safety Programs Targeting Human Error in Aviation

Shappell, Scott; Wiegmann, Douglas. U.S. Federal Aviation Administration (FAA) Office of Aerospace Medicine. DOT/FAA/AM-06/24. Final report. November 2006. 13 pp. Figures, references. Available via the Internet at <www.faa.gov/library/reports> or from the National Technical Information Service.*


Developing a Methodology for Assessing Safety Programs Targeting Human Error in Aviation

According to studies based on the Human Factors Analysis and Classification System (HFACS), the percentage of accidents associated with flight crew error — classified in the system as skill-based errors, decision errors, perceptual errors and violations — has remained essentially stable. In other words, it appears that no intervention program has been clearly effective.

But, the report says, unlike the validated HFACS framework for investigation and analysis of human error, there is no similar framework for evaluating the benefits of current and proposed human error intervention strategies. This report describes two studies conducted using recommendations from U.S. National Transportation Safety Board (NTSB) investigators and several joint FAA and industry working groups, intended to validate a proposed framework for developing and examining initiatives targeting human error.

The first study was based on 622 unique safety recommendations contained in NTSB aviation accident reports, which were analyzed and classified. Researchers found that these recommendations, also called intervention strategies, could be subdivided into four broad categories: administrative/organizational, human/crew, mechanical/engineering and task/procedure. The report said that "surprisingly few" — 11.5 percent of interventions — were in the human/crew category, given the importance of flight crew human error in today's understanding of accidents.

The four categories might be expanded with further study, the report said, but categories are important because "to ensure that safety professionals generate effective intervention strategies, rather than a single 'knee jerk' fix to a problem, knowledge of all viable interventions is required."

The second study was designed to develop a way of mapping the types of human error described in HFACS against the kinds of intervention strategies identified in the first study. This entailed the creation of a grid called HFIX — the Human Factors Intervention Matrix — with human error categories on the vertical scale and five types of intervention strategies on the horizontal scale. Researchers calculated the percentages of recommendations by joint safety analysis teams (JSAT) and joint safety implementation teams (JSIT), created by the U.S. Commercial Aviation Safety Team as part of the FAA's Safer Skies Initiative, according to intervention type. These were then correlated with the four types of HFACS errors. "Perhaps not unexpected, interventions aimed at decision errors were associated with nearly three out of every four JSAT/JSIT recommendations examined," the report said. This represented an apparent incongruity: "Roughly one-third of the accidents were associated with decision errors, yet 72.6 percent of the interventions have some component that will potentially affect pilot decision making."

The report said, "Also noteworthy, few interventions attempted to modify/change the task itself or the environment. A closer examination of the actual types of errors may suggest changes in routes people fly or the actual type of flights being flown."

### WEB SITES

## Aerospace Acronym and Abbreviation Guide, <www.aviationtoday.com/av/acronym/a.html>

A is for *autotuned navaid*. Z is for *Zulu* — coordinated universal time, formerly called Greenwich Mean Time. Between A and Z are abbreviations and acronyms for technologies, procedures, jargon and organizations in the aerospace world.

This is the go-to site when you want to know the meaning of BOP/COP — *bit-oriented protocol/character-oriented protocol*; MALE — *medium-altitude, long-endurance*; DREAMS — *disaster response and emergency medical*


*services*; SPEAR — *system performance evaluation and analysis reporting*; and many other useful terms.

*Avionics* magazine has compiled and published this reference guide. Now in its third edition, the list has grown to 2,966 entries. The list is indexed by letters of the alphabet for faster locating. X has the fewest entries, with 14.

The publisher says, "Though it is not an exhaustive list, we trust it will serve you well."

It certainly should. No one in the industry could get through a day's work if everyone had to fully write or speak the phrases for which acronyms and abbreviations have been adopted. IAAWT — In Abbreviations and Acronyms We Trust.

## Air Accident Digest, <www.airaccidentdigest.com>

This new aviation safety Web site describes itself as "the place for real-time cutting-edge news and analysis of aviation safety." The Web site has two parallel publications, *Air Accident Digest Newsletter* and *Air Accident Digest Blog*. One is a traditional, factually oriented newsletter and the other is a personal-opinion Web log or blog. The two publications cover similar topics, but there are significant differences in writing style, information delivery and publishing technology.

The site says the "newsletter [is] dedicated to nonpartisan reporting on aviation safety and security." In-depth articles include color photos, graphics and Internet links to references and sources, as appropriate. Each newsletter has a table of the previous month's accidents and incidents for airline, corporate, general aviation, helicopter and military aviation. The newsletter can be read online, downloaded or received via e-mail at no cost.

While the newsletter aims at factual reporting, the blog is written from the author's subjective viewpoint and opinions. The blog contains commentary on aviation safety and security news; activities surrounding accidents and incidents; and noteworthy industry events. Each discussion item contains the time and date of posting and gives readers the opportunity to comment using a submission form.


The blog uses Internet technology to permit readers to respond to the discussions, track back from another Web site to this blog, and use RSS — "really simple syndication" — feed software to follow blog commentary and responses. ●

### Source

* National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161 U.S.A.
Internet: <www.ntis.gov>

— *Rick Darby and Patricia Setze*

# Right Layout, Wrong Airport

**The A320 pilots were convinced that they had their destination in sight.**

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 on aircraft accidents and incidents by official investigative authorities.

## JETS

### Airplane Landed at a Military Airfield

Airbus A320. No damage. No injuries.

The aircraft was being operated on a scheduled flight with 39 passengers and six crewmembers from Liverpool, England, to Londonderry-Eglinton Airport (LDY) in Northern Ireland the afternoon of March 29, 2006. Nearing LDY from the east in visual meteorological conditions, the flight crew was cleared by air traffic control (ATC) to conduct the ILS/DME (instrument landing system/distance measuring equipment) approach to Runway 26, said the U.K. Air Accidents Investigation Branch (AAIB) report.

During the approach, the crew mistook Balleykelly Airfield (BKL) for LDY. BKL, a former Royal Air Force airfield used primarily to support British Army helicopter operations, is 5 nm (9 km) east-northeast of LDY and slightly north of the LDY Runway 26 localizer course. The airports have similar runway layouts, and the crew flew the aircraft toward Runway 26 at BKL.

The crew's navigation charts, obtained from a commercial vendor, did not show a runway diagram for BKL. The report noted that charts produced by another commercial vendor show a runway diagram for BKL with the notation: "Do not mistake Ballykelly apt for Londonderry-Eglinton."

"Not being aware that there was another airfield in the vicinity with a very similar layout and misbelieving the (correct) ILS glideslope and DME indications, the crew continued towards the only airfield they could see, firmly convinced that they were landing at LDY," the report said.

The crew told ATC, "The ILS isn't really giving us decent glide path information. We're [going to] make a visual approach from here. We're showing eight [DME], but it looks a bit less than that." The controller cleared the crew for a visual approach and told them to "report on a four-mile final."

The commander disconnected the autopilot and increased the aircraft's rate of descent. "The A320 crew then asked that, if they had to fly a missed approach, could they join the visual circuit downwind," the report said. "ATC informed them that it would be a right-hand circuit and added that there was also a rain shower approaching from the northwest." The crew, still believing that Runway 26 at BKL was their landing runway, decided that the aircraft was too high to be landed safely and informed ATC that they were going around and would enter the pattern on right downwind.

A railway line passes close to the approach threshold of Runway 26 at LDY, "and aircraft inbound to this runway are sequenced to avoid trains," the report said. ATC told the A320 crew to keep their pattern "reasonably tight" so that the aircraft could be landed before a train arrived in about eight minutes.

"Without changing configuration or pressing the go-around buttons on the thrust levers, and after having re-engaged the autopilot, the A320 crew started a descending 360-degree turn and repositioned onto the right base leg for a visual approach to Runway 26," the report said.

**"It was the wrong airport. You've landed at Ballykelly."**

The crew reported a two-mile final, and the LDY tower controller, who had the aircraft in sight, cleared the crew to land. The aircraft was 384 ft above ground level (AGL) when the terrain awareness and warning system (TAWS) generated a "GLIDESLOPE" warning and a "TERRAIN AHEAD" warning. "Due to the distracting nature of this warning, the copilot attempted to silence it by pressing the 'TERR OFF' button in the overhead panel," the report said.

About 30 seconds later, the controller told the crew to report their position. The crew replied, "We've just touched down." The controller said, "It was the wrong airport. You've landed at Ballykelly." The controller then told the crew to remain on the ground. The crew turned the aircraft around on the runway and shut down the engines. The passengers and baggage were transported to LDY by ground vehicles. The aircraft departed from BKL that evening with only a crew aboard.

## Abrupt Pull-Up Injures Flight Attendant

Canadair Challenger. No damage. One serious injury.

The airplane was on a fractional-ownership operation positioning flight from Chattanooga, Tennessee, U.S., to Augusta, Georgia, the night of May 21, 2005. ATC told the flight crew to expedite their climb through Flight Level 250 (approximately 25,000 ft), and the copilot, the pilot flying, adjusted the selected airspeed to 300 kt, apparently to increase the rate of climb. The pilot-in-command (PIC) then told the copilot to "get this thing climbing."

"At the same time, the PIC pulled back on the control column and disconnected the autopilot, and the nose of the airplane pitched up," said the U.S. National Transportation Safety Board (NTSB) report. "The PIC did not establish a positive transfer of the flight controls as required by company standard operating procedures."

The pilots then heard the flight attendant calling for help. "The PIC departed the flight deck and found the flight attendant on the floor in the aft part of the cabin with serious injuries," the report said. "The flight continued to the destination airport and landed without further incident."

## Vehicle Parked in Prohibited Ramp Area

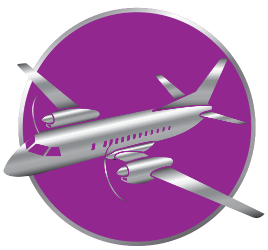
Boeing 737-400. Substantial damage. No injuries.

The airplane was being taxied to its assigned parking stand at London Heathrow Airport on Feb. 20, 2006, when the right wing struck a vehicle — a van — that was parked in a prohibited area. The wing tip was crushed, and the navigation and strobe lights were destroyed. None of the 95 occupants of the airplane or the van driver was injured. Damage to the vehicle was relatively minor, said the AAIB report.

"The member of the ground staff whose responsibility it was to ensure that the stand was unobstructed was unable to see the whole stand from his assigned position in the jetty [airbridge]," the report said. "Members of the ground staff who saw the potential conflict were unable to alert the pilots." The pilots did not see their hand signals, and none of the ground staff was near a button that can be used to illuminate an emergency-stop signal visible at the end of the stand.

The van driver had stopped the vehicle in the prohibited area, which was marked with hatched lines, to make way for other employees of the handling agent who were maneuvering baggage carts in the same area. "He kept the engine of the van running and, aware that the aircraft was approaching, intended to return to the non-hatched area as soon as the baggage trolleys were in place," the report said. "He was unable to do so before the aircraft hit the van."

The pilots were aware that the van had been parked incorrectly but did not believe that it would be an obstacle. "This would have been the case if the aircraft had been lined up on the stand centerline before entering the stand," the report said. "However, the commander, aware of the confined nature of the stand, made a tighter turn onto the stand than that indicated by the lead-in line painted on the ground and remained at all times to the right of the stand centerline."



## TURBOPROPS

### Hydraulic Fluid Leaks Into Cabin

British Airways ATP. Minor damage. No injuries.

Soon after the aircraft departed from Ronaldsway Airport on the Isle of Man for a scheduled flight to Liverpool, England, the evening of May 23, 2005, a hydraulic seal in the front left cabin door failed. "This allowed hydraulic fluid to escape [into the cabin] in the form of a fine mist, depleting the contents of the main hydraulic system," the AAIB report said.

The no. 2 cabin crewmember, who was seated in the forward section of the cabin, heard what she described as "a burst and then the sound of escaping gas" that smelled like turpentine and saw what she thought was smoke emerging from the door. She attempted unsuccessfully to use the public-address system to attract the attention of the no. 1, senior, cabin crewmember, who was seated in the rear of the cabin. She then used the interphone system to tell the commander, "I've got a bit of … smoky stuff coming through the door." The commander began to ask a question but was interrupted by the no. 1 cabin crewmember, who stated, "Smoke in the cabin."

The flight crew then received a visual and aural warning that the hydraulic-fluid quantity was at a low level. They began conducting, but did not complete, the "Low Hydraulic Quantity" checklist. The crew did not conduct the "Fire, Smoke or Fumes Within Fuselage" checklist, which calls in part for donning oxygen masks and smoke goggles.

The commander, the pilot monitoring, reported "a minor problem" to ATC and requested, and received, clearance to return to Ronaldsway Airport. The commander then told the controller, "We'd just like to make this a pan. We have reports of a little bit of smoke in the cabin. We have got a hydraulic-low-level warning on the system."

The misting intensified, and the cabin crew moved passengers seated in the forward section of the cabin to the rear of the cabin. The no. 1 cabin crewmember informed the commander that the smoke was so thick in the forward cabin section that visibility was impaired. Some passengers used airsickness bags and other materials as filters to aid their breathing. One passenger had trouble breathing and was administered oxygen.

Hydraulic fluid mist had begun to enter the flight deck. The commander selected the environmental conditioning system packs off, "the opposite action to that called for in the checklist," the report said. The commander told the controller, "We've got slightly more smoke in the cockpit now, so we'd like to make this into a mayday, please." The copilot asked the commander if the smoke might be related to the hydraulic system problem. The commander said that he did not know.

"The flight crew's nonadherence to SOPs [standard operating procedures] and associated checklists put the aircraft and its occupants at unnecessary increased risk from potential handling problems as well as risk of fire and prolonged exposure to hydraulic fluid mist," the report said.

The pilots acquired visual contact with the runway while conducting an ILS approach. Soon after the aircraft reached the decision altitude, a TAWS "TOO LOW, TERRAIN" warning and a "TOO LOW, FLAPS" warning were generated. The commander dismissed both warnings as false. "However, he then realized that the flaps had not been set for landing and that this latter warning was genuine," the report said. "The warnings ceased after flaps 20 was selected."

After landing, as the aircraft decelerated through 80 kt, the copilot transferred control to the commander, who had difficulty steering

**The no. 1 cabin crewmember said that some passengers were panicking and others were nauseous.**

the aircraft with the tiller. Recognizing that the nosewheel-steering system was not functioning, he used differential braking and asymmetric thrust to maneuver the aircraft onto a taxiway.

The no. 1 cabin crewmember said that some passengers were panicking and others were nauseous. The copilot asked the commander if they should shut down the engines. The commander replied that he intended to continue taxiing. Then, however, the controller said, "You might just as well shut down in that position there." The report said that the controller wanted aircraft rescue and fire fighting (ARFF) vehicles to catch up with the aircraft.

After shutting down the engines, the commander "realized there was a slippery substance on the flight deck floor and deduced that it was hydraulic fluid," the report said. "He inspected the area around the airstairs, concluding that the fluid had come from this region and that this was associated with the hydraulic fluid low level warning. The passengers left the aircraft via the forward vestibule and the airstairs, passing through the contaminated area." ARFF personnel assisted the evacuation.

None of the four crewmembers or 33 passengers was injured. "One passenger, who was asthmatic, was taken to a local hospital but later discharged as medical treatment was not considered necessary," the report said. The crew and passengers completed the flight to Liverpool in another aircraft.

The broken hydraulic seal was in an airstairs-retraction-line fitting. The line normally is not pressurized during flight. However, the plastic guard for the push-button switch used to retract the airstairs had been lifted beyond its 90-degree limit of movement. The upper edge of the guard that extends between its pivot points had contacted the switch and held it in place. The report said that after a 1989 incident involving an uncommanded airstairs retraction during preflight inspection of an ATP, balk strips had been attached to the plastic guards in ATPs to prevent them from being lifted beyond their normal range of movement. Traces of adhesive on the incident aircraft's plastic guard indicated that a balk strip "had been present at some stage and that [it] had most probably been broken off as a result of the guard being forced beyond the 90-degree position," the report said. In addition, the door safety microswitch plunger had become stuck in its retracted position, allowing electrical power to be routed to the door-retraction circuit. After investigators cleaned and adjusted the microswitch in accordance with the aircraft maintenance manual, it operated normally.

The report said that the combination of the jammed retraction switch and the stuck microswitch plunger allowed the hydraulic airstairs actuator-retraction line to remain pressurized. "The reason for the failure of the seal was not established but could have been the result of … insufficient assembly torque or degradation of the seal material," the report said.

## Runway Excursion Reflects Lack of CRM

Beech Super King Air B300. Substantial damage. No injuries.

The aircraft departed from Saint-Hubert, Quebec, Canada, for a flight to Saint-Georges with the two pilots and the company president aboard the morning of Dec. 1, 2004. About 10 minutes after takeoff, the PIC, the pilot monitoring, advised the Unicom operator at the Saint-Georges airport that the aircraft would arrive in about 20 minutes, said the report by the Transportation Safety Board of Canada.

The Unicom operator told the PIC that the winds were from the east at 4 kt and the altimeter setting was 29.65 in Hg. The airport did not have equipment or procedures for reporting other weather conditions. The Unicom operator then initiated snow-removal operations on Runway 06/24, which was 5,100 ft (1,556 m) long and 75 ft (23 m) wide.

The Montreal Center controller told the crew that current conditions in Quebec included a vertical visibility of 500 ft and a horizontal visibility of 1/2 mi (800 m) in snow. The controller then cleared the crew to conduct an approach to the Saint-Georges airport, which is in uncontrolled airspace.

While conducting a global positioning system (GPS) approach to Runway 06, the crew was told that the runway had been cleared of snow to a width of 36 ft (11 m). The aircraft was about 0.75 nm (1.39 km) from the runway threshold when the PIC told the copilot that he had the runway lights in sight and that there might be a snowplow on the runway. The report said that both altimeters were set to 29.55 in Hg, rather than the reported 29.65 in Hg, and thus indicated altitudes 100 ft lower than the aircraft's actual altitudes. The PIC determined that the aircraft was too high to be landed safely; he assumed control and began a go-around.

The pilots had not briefed the missed approach and did not follow the published missed approach procedure. Instead, the PIC flew the runway heading, "then followed a path that led [the aircraft] six minutes later to a point 18 nm [33 km] north of the runway," the report said. The pilots did not brief the second approach, a GPS approach to Runway 24. The PIC set the altitude selector to 1,100 ft — 200 ft below the published minimum descent altitude (MDA) — and the radio altimeter to 380 ft, the height above airport (HAA) at the MDA.

The report said that the weather conditions deteriorated significantly in heavy snow during the approach. The aircraft was 0.25 nm (0.46 km) from the airport when the copilot saw the runway to the right. "The [PIC], who could not see the runway, followed the copilot's directions," the report said. "The aircraft followed a zigzag path and flew over the [precision approach path indicator lights], the runway centerline and the right-side runway lights, then turned left again. The [PIC] saw the runway and landed."

The King Air likely was drifting left when it touched down 2,400 ft (732 m) from the approach threshold. The left main landing gear, then the nose landing gear struck a 12-in (30-cm) snow bank. The nose gear strut broke, and the aircraft turned left, overran the left side of the runway and came to a stop nose-down in a drainage ditch.

The report said that the PIC, who had about 4,500 flight hours, had little experience flying as a member of a crew before he was employed by the company in July 2004. Neither the PIC nor the copilot, who had about 1,200 flight hours, had received crew resource management (CRM) training, "which could explain their noncompliance with procedures and regulations," the report said.

## Unstabilized Approach Leads to CFIT

Mitsubishi MU-2B-60. Destroyed. One fatality.

The pilot was conducting an on-demand cargo flight from Salt Lake City to Centennial Airport near Denver the night of Aug. 4, 2005. Weather conditions included 2.5 mi (4,000 m) visibility in rain and mist, a broken ceiling varying in height from 600 ft to 1,300 ft and surface winds from 010 degrees at 8 kt, the NTSB report said.

The airplane was about 10 nm (19 km) from the airport about 0204 when the approach controller cleared the pilot for an ILS approach to Runway 35R and told him to establish radio communication with the tower controller. The tower controller cleared the pilot to land on Runway 35R.

Recorded ATC radar data indicate that the MU-2 was 774 ft below the glideslope when it crossed the final approach fix. The report said that the airplane tracked the localizer course but continued a controlled descent below the glideslope until it struck terrain about 4 nm (7 km) from the runway threshold at 0206.

**The airplane tracked the localizer course but continued a controlled descent below the glideslope until it struck terrain.**

NTSB said that the pilot's "failure to fly a stabilized instrument approach at night" was the probable cause of the controlled flight into terrain (CFIT) accident and that "inadequate design and function of the airport facility's minimum safe altitude warning (MSAW) system" were among the contributing factors.

The approach controller received visual and aural MSAW alerts for about five seconds when the MU-2 was 7.2 nm (13.3 km) from the airport and again when the airplane was 6.3 nm (11.7 km) from the airport. The approach controller did not inform the tower controller of the MSAW alerts because she believed, erroneously, that the tower controller also was receiving visual and aural alerts on the MU-2. The report said that she was not aware that, because of the MSAW system design, the tower controller would receive visual alerts but not aural alerts until the airplane was within 5 nm (9 km) of the airport (*ASW*, 2/07, p. 33).

The tower controller apparently did not see the visual MSAW alerts on his radar display when the MU-2 was 7.2 nm and 6.3 nm from the airport. "A tower controller does not utilize a radar display as a primary resource for managing air traffic," the report said.

The tower controller received an aural MSAW alert when the MU-2 was 5 nm from the airport and immediately told the pilot to "check altitude … you appear to be well below the glideslope." There was no response from the pilot, and the airplane struck terrain a few seconds later.

## PISTON AIRPLANES

### Icing, Turbulence Cause Loss of Control

Cessna T310R. Destroyed. One fatality.

The airplane was in cruise flight at 16,000 ft near Heber City, Utah, U.S., the morning of April 17, 2006, when manifold pressure in the left engine decreased due to induction-system icing. The pilot requested a lower altitude and was cleared by ATC to descend to 14,000 ft, said the NTSB report. No further radio transmissions were received from the pilot, and ATC radar contact was lost when the airplane descended below 11,400 ft. NTSB determined that the pilot likely lost control of the airplane.

"The wreckage was located [at 9,350 ft] in mountainous, down-sloping, snow-covered, forested terrain," the report said. "Based on area forecasts, PIREPS [pilot reports] and weather advisories, the accident airplane most likely encountered moderate to severe turbulence and moderate to severe mixed icing during the final few minutes before the accident."

### Broken Bolt Fouls Nose Landing Gear

Beech B58 Baron. Substantial damage. No injuries.

The pilot said that he completed the landing checks during a visual approach to Runway 27 at Guernsey (Channel Islands, U.K.) Airport the morning of July 4, 2006. After a normal touchdown, the pilot heard a loud bang as the nosewheel was lowered onto the runway, said the AAIB report. The landing gear warning horn then sounded, and the gear-unsafe warning light illuminated.

"Up elevator and go-around power were both applied, and during the subsequent go-around, it could be seen in the mirror on the left engine cowling that the nose leg was swinging free and unlocked," the report said. "A hold was carried out to the south of the airport, where a partial retraction, followed by gear extension using the manual emergency system, was carried out. The nose leg remained in the same position throughout this procedure."

The pilot then conducted another approach to Runway 17. When the main landing gear touched down, he selected the engine fuel/air mixture levers to "CUT OFF" and selected the magnetos to "OFF." Both propellers, the engine mounts and the bottom of the forward fuselage were damaged during the landing.

"Subsequent examination of the aircraft by the repair company revealed that a bolt locating a drive rod operating the drag brace had sheared, thus affecting the geometry [of the nose landing gear]," the report said. "As a result, the normal overcentering action could not take place during the gear-extension phase, and the nose leg could not be locked down."

### Oil Pump Failure Prompts Forced Landing

Cessna P210N. Destroyed. One fatality, one serious injury.

Soon after departing from Amarillo, Texas, U.S., for a business flight the morning of July 19, 2006, the pilot told ATC that a cylinder had separated from the engine and that he needed to proceed to the nearest airport. The controller provided a heading toward an airport 7 nm (13 km) away and advised of landmarks that could help the pilot locate the runway, said the NTSB report.

Before reaching the airport, however, the pilot reported a total loss of power and that he was going to land the airplane on a field. The landing was conducted with a tail wind, and the airplane struck a barbed-wire fence, a tractor and a water well, came to a stop next to a large propane tank and began to burn. "As a result of the extreme heat associated with the post-impact fire, the tank's safety relief valve popped (as designed), which released propane vapors into the air," the report said. "These vapors caught on fire and added to the intensity of the fire." The passenger was seriously injured, and the pilot died of his injuries several days after the accident.

While examining the engine, investigators found a breach in the crankcase and signs of thermal distress on the crankshaft and connecting rods consistent with lack of lubrication. Disassembly of the oil pump revealed that the engine-driven gear shaft had fractured because of wear associated with the absence of support bushings. NTSB said that the probable cause of the accident was "the failure of maintenance personnel to install oil pump support bushings."

The engine had been operated 1,060 hours since overhaul in July 1998 and 460 hours since repairs were performed after a propeller strike in March 2000. The company had not retained, and was not required to retain, records for the overhaul or repairs. "As a result, it could not be determined when/who had last disassembled/reassembled the pump," the report said.

## HELICOPTERS

### Wrong Performance Chart Used for Takeoff

Bell 206L. Substantial damage. Six minor injuries.

The helicopter was near its maximum gross weight, and density altitude was about 10,200 ft when the pilot attempted to take off from a remote landing zone about 60 nm (111 km) southeast of Vernal, Utah, U.S., for a charter flight on June 15, 2006. The NTSB report said that the pilot had consulted performance data in the "Hover Ceiling In Ground Effect" chart, which indicated that the helicopter could safely depart.

"Because he was taking off over uneven, sloping, brush-covered terrain, he should have used the 'Hover Ceiling Out of Ground Effect' chart, which indicated the helicopter did not have the performance to safely depart the landing zone," the report said.

After lifting off and transitioning into forward flight, the pilot increased power and applied right anti-torque control to climb above brush on rising terrain. "When he applied the right anti-torque pedal, the helicopter's heading rotated about 45 degrees to the right, but it did not climb any higher," the report said. The pilot attempted a precautionary landing on a road, but a loss of tail rotor effectiveness occurred. The helicopter spun once, descended, struck the ground in a nose-low attitude and rolled onto its side.

### Sightseeing Flight Ends in River

Agusta-Bell 412. Destroyed. One fatality, three serious injuries, one minor injury.

The pilot was scheduled to conduct a post-maintenance positioning flight in the commercial helicopter from Seville, Spain, to Malaga the morning of Nov. 14, 2004. He invited four acquaintances to accompany him on a 30-minute local flight before he began the positioning flight, said the report by the Spanish Civil Aviation Accident and Incident Investigation Commission.

After departing from Seville's La Cartuja Heliport, the pilot flew the helicopter 100 ft above a river on approach to Tablada Airport, about 2.5 nm (4.6 km) south of the heliport. Nearing the runway, the helicopter flew over a bridge and began a descent that continued for 10 seconds until it struck the water and sank. "Moments later, four of the occupants emerged to the surface and were picked up by a boat downstream from the crash site," the report said. "A fifth person [a passenger] remained underwater."

The report said that before the accident occurred, the pilot might have been distracted by his passengers and by paragliding activity at the airport, and that he likely became spatially disoriented while flying the helicopter low over the "glassy" — still and featureless — surface of the river. ●

## Preliminary Reports

| Date | Location | Aircraft Type | Aircraft Damage | Injuries |
|---|---|---|---|---|
| Jan. 1, 2007 | Makassar, Indonesia | Boeing 737-400 | destroyed | 102 fatal |
| The Adam Airlines flight was en route at 35,000 ft from Surabaya to Manado when ATC radar contact was lost about 60 nm (111 km) from Makassar. The airplane is believed to have crashed at sea. | | | | |
| Jan. 5, 2007 | Matabwe, Tanzania | Piper Chieftain | destroyed | 1 fatal, 1 serious, 9 minor |
| During a charter flight from Dar es Salaam, the pilot rejected the landing after the airplane touched down about halfway down the wet 2,300-ft (702-m) runway at Matabwe. The airplane struck trees beyond the end of the runway and caught fire. | | | | |
| Jan. 5, 2007 | Denver, Colorado, U.S. | Airbus A319 | none | none |
| The Frontier Airlines airplane was on final approach when the flight crew saw a Swearingen Metroliner on the runway. The crew initiated a go-around, and the A319 passed about 50 ft over the Key Lime Air Metroliner. Visibility was 1/2-mi (800-m) with blowing snow and mist. | | | | |
| Jan. 7, 2007 | Sandy Bay, Saskatchewan, Canada | Beech A100 King Air | NA | 1 fatal, 3 serious |
| The airplane was on an emergency medical services flight when it struck terrain during a nonprecision approach. The captain was killed; the first officer and two medical crewmembers were seriously injured. | | | | |
| Jan. 9, 2007 | Balad, Iraq | Antonov An-26B | destroyed | 34 fatal, 1 serious |
| During a charter flight from Adana, Turkey, the flight crew conducted a missed approach at Balad Air Base because of fog. On the second approach, the airplane struck terrain 2.5 km (1.4 nm) from the runway. | | | | |
| Jan. 9, 2007 | Guadalajara, Mexico | Learjet 24F | destroyed | 2 fatal |
| The airplane was on a night cargo flight from Laredo, Texas, U.S., when it struck a hill during descent 13 nm (24 km) from Miguel Hidal Airport. | | | | |
| Jan. 9, 2007 | Kenai, Alaska, U.S. | Cessna 207A | substantial | 1 fatal |
| The pilot ditched the airplane in Cook Inlet after the engine failed during a cargo flight. The airplane was found partially submerged in 50 ft of water. The pilot, who was not wearing flotation gear, was not found. | | | | |
| Jan. 12, 2007 | Van Nuys, California, U.S. | Cessna CitationJet | destroyed | 2 fatal |
| Soon after takeoff for a positioning flight to Long Beach, the crew requested and received clearance to return to the Van Nuys airport. Witnesses said that the left front baggage door was open. The airplane was about 200 ft AGL when it turned left, began to descend with the wings rocking, and then turned right before crashing on a street. | | | | |
| Jan. 13, 2007 | Valledupar, Colombia | Rockwell Commander 690A | destroyed | 4 fatal |
| Soon after the pilot reported technical problems to ATC, the airplane struck mountainous terrain. | | | | |
| Jan. 13, 2007 | Kuching, Malaysia | Boeing 737-200 | destroyed | 4 NA |
| The airplane was on a night cargo flight from Kuala Lumpur when it overran the side of the runway at Kuching. The left engine and main landing gear separated before the airplane came to a stop in a grassy field. | | | | |
| Jan. 15, 2007 | Adjuntas, Puerto Rico | Partenavia P68C | destroyed | 2 fatal |
| Nighttime visual meteorological conditions prevailed when the airplane, which was en route from Aguadilla to Ponce, struck trees and crashed on a mountain slope. | | | | |
| Jan. 17, 2007 | Nenana, Alaska, U.S. | Douglas DC-4 | destroyed | 2 none |
| The airplane was on a cargo flight from Fairbanks to Nixon Fork Mine when one engine caught fire. The flight crew diverted toward Nenana Airport but was forced to land the airplane on tundra 5 nm (9 km) from the airport. | | | | |
| Jan. 24, 2007 | Pau, France | Fokker 100 | substantial | 1 fatal, 54 none |
| During takeoff for a scheduled flight to Paris, one engine ingested birds and lost power. The airplane overran the 2,500-m (8,203-ft) runway, struck a truck on a road and came to a stop in a corn field. The truck driver was killed. | | | | |
| Jan. 24, 2007 | Butler, Pennsylvania, U.S. | Cessna Citation II | substantial | 2 serious, 2 none |
| During an air-ambulance flight from Winchester, Virginia, the airplane was landed long, overran the 4,800-ft (1,464-m) runway and struck the ILS localizer installation. The two medical crewmembers received minor 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.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