AeroSafety WORLD

COUNTING THE HOURS
Legislating pilot qualifications

HELICOPTER SAFETY PROGRESS
IHST midway to goal

SMS TOOLS
Corporate aviation's 12 steps

BEWARE OF AIRSTAIRS
Falling threat is real

CLOSE CALL OVER IRELAND

FALSE COURSE HAZARD

THE JOURNAL OF FLIGHT SAFETY FOUNDATION

SEPTEMBER 2010

BACK TO WHERE We Began

I hate to keep beating the same drum, but there is one issue on which I will make an exception. We are still running out of people to run this business, and we still have not figured out how to ensure safety while dealing with a shortage of qualified personnel. I started talking about this back in 2006, and I need to bring it up every now and then to remind everyone that the economic downturn is transient and the personnel shortfall is structural. I know people in the United States looking for a job are going to call me crazy, but the fundamentals have not changed.

Boeing ran the numbers again, and in mid-September reminded us that the industry will need to produce more than 1 million pilots and maintenance personnel over the next 20 years. That breaks down to 466,650 pilots and 596,500 maintenance personnel. Almost 40 percent of that number will be needed to handle growth in the Asia Pacific Region. Growth in other developing economies will account for another 20 percent of the demand for new professionals.

The more mature aviation markets in North America and Europe will see relatively little growth but will have a lot of older people to replace as they retire. Together, those regions will have to come up with about 450,000 new technical people.

Those are about the same numbers we heard several years ago, unchanged because they were never driven by interest rates and stock markets — they were driven by demographics. There are still about 2 billion people expected to enter the middle class over the next 20 years, and they will want to fly places. The only thing that has changed is that those kids have finished a couple more years of school. In the established aviation markets, demand for people was driven by retirement of the baby-boomers; I don't know about you, but I'm a few years older than when the recession began.

So, why do I think this is a safety problem? Because I keep seeing evidence that we don't have the systems and discipline required to face a sustained personnel shortage. During the last pilot shortage, the selection criteria went down and the training departments were over-taxed. As a result, a few years later, we are seeing accidents that should never happen. Just read a few of the recent headlines, or maybe review the accident report from Cameroon in August's *AeroSafety World* (*ASW*, 8/10, p. 24). If you think the Western world is immune, read the accident report on the Colgan Air crash near Buffalo, New York (*ASW*, 3/10, p. 20). It is clear we lack the systems to prevent hiring the wrong people, and to remove them when they can't perform. China just came face to face with one of these systemic weaknesses: After the most recent accident, investigators discovered that more than 200 pilots had falsified their qualifications. Anybody with three different colored pens and a free afternoon can still fill out a logbook.

Organizations that are focused on the next quarter's results must somehow find the time and energy to deal with these long-term challenges. Aviation can't go into this next era with rules written in the 1950s and record keeping that goes back to the technology of the quill pen.

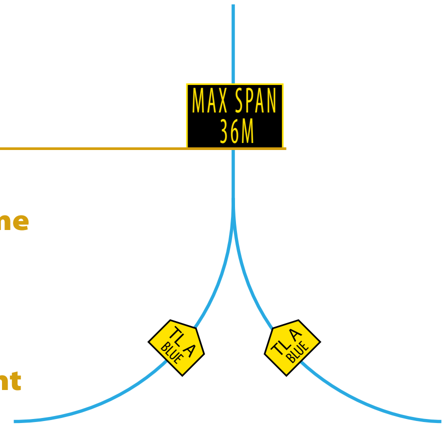
William R. Voss
President and CEO
Flight Safety Foundation

AeroSafetyWORLD

contents

September2010 Vol 5 Issue 8

features



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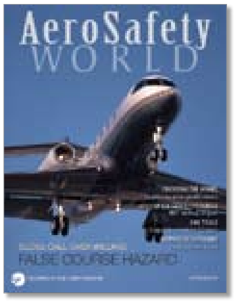

About the Cover
Cracked windshield,
then a false course approach.
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If you have an article proposal, manuscript or technical paper that you believe would make a useful contribution to the ongoing dialogue about aviation safety, we will be glad to consider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

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EQUIP FOR THE Future

Make no mistake, the effort to catapult air traffic control technology to a revolutionary and vastly more capable level in the United States and Europe is a very, very big deal, not only in terms of scope and cost but also in terms of the consequences of success or failure.

There is a staggering amount of work yet to be done, but in the United States there also has been an impressive amount of work completed, and the rate of implementation is accelerating. Clearly, the pressure is on to make the two systems, NextGen in the United States and Single European Sky ATM Research (SESAR) in Europe, highly harmonized, not perfect clones, but close enough to not get in the way.

A possibly overly simplistic explanation of the difference between the two automatic dependent surveillance-broadcast (ADS-B) modes that are the heart of this advance is this: ADS-B Out is the airplane signaling its global positioning system-derived position for the air traffic service provider to process as if it were advanced radar with fantastic coverage down to the ground; ADS-B In, on the other hand, is data flowing into the airplane from ground facilities and other aircraft.

To my mind, NextGen and SESAR are safety systems, even though their raison d'être is to cope with the crushing growth of operations expected in the next several decades, growth that surely will extend in short order to the increasingly prosperous developing world. But even at the lowest level of implementation — ADS-B Out as radar equivalent — the idea of controllers being able to monitor and accurately sequence precision approaches at remote airports is but one example of the many safety benefits, or advances such as the 4-D Weather Box, real-time weather data flowing into the aircraft in fairly early ADS-B In usage.

Money, however, is and will remain an obstacle. Much of the spending is the government's, and anyone in the United States tracking the ability of the Federal Aviation Administration to get its budget through Congress knows of the multiple built-in barriers in that process.

Users also will have to put up a fair chunk of cash to be part of the system. However, users are reluctant to equip their aircraft with even the well-defined ADS-B Out without proof that they're not just buying a new box lacking a net benefit for them.

Despite the safety arguments for buying into equipage, managers in today's economic climate — and legislators — must ask that question so they can explain why, in tight money times, they decided to spend billions to benefit a bunch of jet-setters.

To that end, the NextGen Advisory Committee, an industry-government group chaired by David Barger, chief executive officer of JetBlue and treasurer of Flight Safety Foundation, has been formed not only to keep development on an agreed path, but also to forge a consensus business case that details why this technology should be embraced.

Several years ago, Southwest Airlines was known to favor low-tech cockpits. Then came a fleetwide equipage with head-up displays, followed several years later by avionics for RNP (required navigation performance) operations. It has been said SWA went the latter route because the carrier believed it could save one minute per flight. This is the sort of vision managers need to develop today to see the payoffs on the other side of the expense.

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

Flow and Check or Do and Verify?

In the July *AeroSafety World* cover story [p. 12] on checklists and monitoring, the authors make the point that the use of "flow and check" procedures may increase the chance of pilots committing errors of omission.

They specifically state that, in at least one instance and presumably more, "both pilots tasked with the flow procedure did not do it or attended to only some of the flow items. As a result, most items were performed only while using the checklist, eliminating the protective redundancy designed into the flow and check procedure … ." They also argue that requiring pilots to "check things twice" in a short period of time (as I assume they feel is required in the flow and check procedure) is not a good way to ensure the item is actually accomplished.

Finally, they recommend that airlines eliminate excessive repetition of items on any flow and check procedure used.

The main disagreement I have with their thoughts on flow and check procedures is that they do not represent an attempt to get pilots to check the same thing twice at all. Having used flow and check from my very beginnings in military aviation to my current work as an MD-11 pilot, I have never been tasked to do a second check of the same item when, after completing the flow part of the checklist from memory, I have then referred to the actual checklist to confirm that I have accomplished all the applicable items.

Instead of an attempt to get pilots to "check things twice," I feel that flow and check is more "do and verify," and is very effective. True, there are times when I've forgotten one of the flow items. But that is discovered when I refer to the checklist and read through the items — verifying that my memory did not fail in recalling them all.

I would not like to revert to a situation where I was required to do a normal procedure, or an abnormal procedure that required immediate action to prevent the situation's becoming worse, while I accessed a checklist (cabin pressure loss comes to mind), solely by taking out the checklist, reading the first item, taking that action, reading the second item, taking that action, etc.

Thank you.

Alan Gurevich
Seattle

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

Write to J.A. Donoghue, director of publications, Flight Safety Foundation, 601 Madison St., Suite 300, Alexandria, VA 22314-1756 USA, or e-mail <donoghue@flightsafety.org>.

CALL FOR PAPERS ➤ 16th International Symposium on Aviation Psychology. Wright State University and Air Force Research Laboratory Human Effectiveness Directorate. Dayton, Ohio, U.S. Michael Vidulich, <isap2011@psych.wright.edu>, <www.wright.edu/isap/authorinfo/generalinformation/index.html>, +1 937.255.3769; Pamela Tsang, <isap2011@psych.wright.edu>, +1 937.775.2469. Deadline: Oct. 15.

SEPT. 14–16 ➤ Cabin Safety Workshop. U.S. Federal Aviation Administration Civil Aerospace Medical Institute. Oklahoma City, Oklahoma, U.S. Lawrence Paskoff, <lawrence.paskoff@faa.gov>, <www.faa.gov/data_research/research/med_humanfacs/aeromedical/cabinsafety/workshops>, +1 405.954.5523.

SEPT. 14–17 ➤ Wildlife Hazards and Aviation Training. AviAssist Foundation. Kilimanjaro Airport, Tanzania. Tom Kok, <tom.kok@aviassist.org>, <www.aviassist.org/pages/website_pages.php?pgid=6&CategoryID=33>.

SEPT. 15–16 ➤ Atlantic Conference on Eyjafjallajökull and Aviation. Keilir Aviation Academy. Keflavik, Iceland. <conferences@keilir.net>, <en.keilir.net/keilir/conferences/eyjafjallajokull>, +354 664 0160.

SEPT. 20-22 ➤ Wildlife Hazards and Aviation Master Class. AviAssist Foundation. Kilimanjaro Airport, Tanzania. Tom Kok, <tom.kok@aviassist.org>, <www.aviassist.org/pages/website_pages.php?pgid=6&CategoryID=33>.

SEPT. 20–23 ➤ Flight Data Monitoring and Flight Operational Quality Assurance in Commercial Aviation. Cranfield Safety and Accident Investigation. Cranford, Bedfordshire, England. Matthew Greaves, <m.j.greaves@cranfield.ac.uk>, +44 (0)1234 754243.

SEPT. 20–24 ➤ Accident/Incident/Hazard Investigation Training. Prism Training Solutions. Denver. John Darbo, <John.Darbo@argus.aero>, <www.aviationresearch.com>, +1 513.852.1057.

SEPT. 23–24 ➤ Safety Aspects of Air-Ground Communications (Challenges and Solutions). Flight Safety Foundation South East Europe–Middle East–Cyprus, Eurocontrol and International Federation of Air Traffic Controllers' Associations. Larnaka, Cyprus. <info@flightsafety-cy.com>, <www.flightsafety-cy.com>.

SEPT. 24–25 ➤ A Practical Approach to Safety Management Systems. Beyond Risk Management and Curt Lewis & Associates. Calgary, Alberta, Canada. Brendan Kapuscinski, <brendan@beyondriskmgmt.com>, <www.regonline.ca/builder/site/Default.aspx?eventid=867389>, +1 403.804.9745.

SEPT. 26–27 ➤ ICAO/McGill University Worldwide Conference and Exhibition: Air Transport: What Route to Sustainability? International Civil Aviation Organization and McGill University. Montreal. Maria Damico, <maria.damico@mcgill.ca>, <www.icao.int/ICAO-McGill2010>.

SEPT. 27–28 ➤ Quality Assurance and Auditing — A Practical Approach. Beyond Risk Management and Curt Lewis & Associates. Calgary, Alberta, Canada. Brendan Kapuscinski, <brendan@beyondriskmgmt.com>, <www.regonline.ca/builder/site/Default.aspx?eventid=867409>, +1 403.804.9745.

SEPT. 27–OCT. 1 ➤ Crew Resource Management Instructor Training Course. Integrated Team Solutions. London. <sales@aviationteamwork.com>, <www.aviationteamwork.com/instructor/details_atticus.asp?courseID=7>, +44 (0)7000 240 240.

SEPT. 28–29 ➤ Fourth European Flight Test Safety Workshop. Royal Aeronautical Society and Society of Flight Test Engineers. London. <raes@aerosociety.com>, <www.raes.org.uk/conference/indexconf.html>, +44 (0)20 7670 4300.

SEPT. 28–29 ➤ Second European Safety Management Symposium. Baines Simmons. London. Mary Lejeune, <mary.lejeune@bainessimmons.com>, <www.bainessimmons.com/symposium>, + 44(0) 1276 855 412.

OCT. 3–4 ➤ Helicopter Flight Data Monitoring Workshop. Global Helicopter Flight Data Monitoring Steering Group. Estoril, Portugal. Mike Pilgrim, <mike.pilgrim@chc.ca>, <www.helitechevents.com/Portugal>, +44 1224 846 151.

OCT. 5–6 ➤ AQD Customer Conference. Superstructure Group, AQD Safety and Risk Management. Barcelona. Alan Rutter, <alan.rutter@superstructuregroup.com>, <www.superstructuregroup.com>, +44 1342 302364.

OCT. 5–8 ➤ 21st Annual Meeting and Conference. Aircraft Rescue & Fire Fighting Working Group. Phoenix. <info@arffwg.org>, +1 817.409.1100.

OCT. 6–7 ➤ Introduction to Aviation SMS Workshop. ATC Vantage. Tampa, Florida, U.S. <info@atcvantage.com>, <atcvantage.com>, +1 727.410.4759.

OCT. 7–8 ➤ Managing Communications During an Aircraft Disaster. U.S. National Transportation Safety Board Training Center and Airports Council International–North America. Ashburn, Virginia, U.S. <TrainingCenter@ntsb.gov>, <www.ntsb.gov/tc/CourseInfo/PA302_2010.htm>, +1 571.223.3900.

OCT. 9–10 ➤ Executive Aviation Safety Symposium. University of Southern California Viterbi School of Engineering. Los Angeles. <viterbi.usc.edu/aviationexec>, +1 213.740.4488, 877.740.1336 (U.S. and Canada).

OCT. 11–12 ➤ 2nd Global Aviation Safety Conference for Humanitarian Air Service. World Food Programme, Aviation Safety Unit. Sharjah, United Arab Emirates. Samir Sajet, <samir.sajet@wfp.org>, <www.wfp.org>, +971 6 5574799.

OCT. 18 ➤ Airworthiness Surveyors Training. U.K. Civil Aviation Authority International. London Gatwick. Sandra Rigby, <training@caainternational.com>, <www.caainternational.com/site/cms/coursefinder.asp?chapter=134>, +44 (0)1293 573389.

OCT. 18–20 ➤ HFACS Workshop: Managing Human Error in Complex Systems. Wiegmann, Shappell & Associates. Amsterdam. <www.hfacs.com>, 800.320.0833.

OCT. 18–20 ➤ Basic HFACS/HFIX Training and Super-User Training. HFACS. Amsterdam. <www.hfacs.com/workshops/dates>, +1 386.295.2263.

OCT. 18–22 ➤ Occupational Safety and Health/Aviation Ground Safety for Managers. Embry-Riddle Aeronautical University. Daytona Beach, Florida, U.S. Sarah Ochs, <case@erau.edu>, <www.erau.edu/academic/ep-case.html>, +1 386.226.6928.

OCT. 18–22 ➤ IOSA Auditor Training. ARGUS PROS. Denver. <John.Darbo@argus.aero>, <www.pros-aviationservices.com/iat_training.htm>, +1 513.852.1057.

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

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

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

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

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Safety News

Fatigue-Fighting Proposals

The U.S. Federal Aviation Administration (FAA) has proposed a new rule to help prevent commercial pilots from flying while fatigued.

The proposal would establish new limitations for flight and duty time, and new rest requirements — all based on fatigue science, the FAA said.

"After years of debate, the aviation community is moving forward to give pilots the tools they need to manage fatigue and fly safely," said FAA Administrator Randy Babbitt, noting that updated rules are needed because of changes in the operations of the global aviation system.

The FAA said the proposed rule would establish a nine-hour "minimum opportunity for rest" before a duty period begins; current rules prescribe an eight-hour period.

The proposal also would "establish a new method for measuring a pilot's rest period so that the pilot can have the chance to receive at least eight hours of sleep during the rest period," the FAA said. "Cumulative fatigue would be addressed by placing weekly and 28-day limits on the amount of time a pilot may be assigned any type of duty. Additionally, 28-day and annual limits would be placed on flight time."

Under the proposed rules, air carriers could not assign pilots to work if they are fatigued; fatigued pilots also would be prohibited from accepting a work assignment.

"In addition," the FAA said, "a company employee who suspects a pilot of being too fatigued to perform his or her duties during flight would be able to report that information to the air carrier so that the air carrier could make a determination of whether or not the pilot is too fatigued to fly."

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The notice of proposed rule making, published in September, will be subject to public comment for 60 days. The FAA said it will issue a final rule by Aug. 1, 2011.

Pilot fatigue has been an issue for years, but the FAA designated it as a top priority after the Feb. 12, 2009, crash of a Colgan Air Bombardier Q400 during approach to Buffalo-Niagara International Airport in Buffalo, New York, U.S. All 49 people in the airplane and one person on the ground were killed, and the airplane was destroyed (*ASW*, 3/10, p. 20).

The U.S. National Transportation Safety Board said the probable cause of the crash was the captain's inappropriate response to a stick shaker activation, which resulted in an unrecoverable stall. Fatigue was cited as a likely factor, although accident investigators said they could not determine the extent to which the crew's performance was affected by fatigue.

Harmonized Pilot Licensing

The European Aviation Safety Agency has proposed regulatory changes to extend the same pilot licensing requirements to all states represented in the European Commission (EC).

The proposal was the subject of public comments from June 2008 until February 2009. It ultimately will be adopted by the EC, and will become law by April 2012.

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Category 1 for Nigeria

Nigeria has earned a Category 1 safety rating from the U.S. Federal Aviation Administration (FAA), which means that its civil aviation authority meets the safety standards set forth by the International Civil Aviation Organization.

The rating, awarded under the FAA International Aviation Safety Assessment (IASA) Program, followed a July review of Nigeria's civil aviation authority. Air carriers in countries with Category 1 status may apply to operate flights to and from the United States.

Adrian Pingstone/Wikimedia

Harold Demuren, director general of the Nigerian Civil Aviation Authority, led the agency in a multi-year effort to upgrade the country's aviation safety record. The effort began after a string of fatal accidents in 2006.

"Not only has the effort resulted in Nigeria becoming the first African country in decades to achieve a new Category 1 rating, it also greatly improved Nigeria's aviation safety record," Flight Safety Foundation President and CEO William R. Voss said.

New Magazine

The AviAssist Foundation — the regional affiliate of Flight Safety Foundation for East and Southern Africa — has published the first issue of *SafetyFocus*, its quarterly journal on African aviation safety.

The magazine is a spinoff of *AeroSafety World*, and more than 750 African aviation safety professionals "are now benefitting from the *ASW* wealth of articles," said Tom Kok, director of AviAssist.

"By reaching out for industry support in the form of advertising, we are making this information available largely for free," Kok said. "Access to safety information should not be limited by the bandwidth of your connection or your ability to pay."

Expanded Blacklist

The European Commission's list of airlines banned from operating in the European Union has been expanded to include Meridian Airways, registered in Ghana.

© Meridian Airways

The updated blacklist also placed restrictions on a second Ghanaian airline — Airlift International — which will be permitted to operate only one of its four aircraft into the European Union.

The list now includes nearly all carriers from 17 countries — although exceptions have been granted for 10 operators. In addition, the list bans five air carriers headquartered in other countries, and limits the operations of 10 additional carriers.

"We cannot afford any compromise in air safety," said Siim Kallas, European Commission vice president responsible for mobility and transport. "Where we have evidence that air carriers are not performing safe operations or where the regulatory authorities fail in their obligation to enforce the safety standards, we must act to … exclude any risks to safety."

Proposed Penalty

The U.S. Federal Aviation Administration (FAA) has proposed the largest civil penalty in agency history — $24.2 million — against American Airlines for allegedly failing to comply with an airworthiness directive calling for specific inspections of wiring on McDonnell Douglas MD-80s.

The FAA said that American "did not follow steps outlined in a 2006 airworthiness directive requiring operators to inspect wire bundles located in the wheel wells of MD-80 aircraft."

Under Airworthiness Directive (AD) 2006-15-15, operators were required to conduct "a general visual inspection by March 5, 2008, for chafing or signs of arcing of the wire bundle for the auxiliary hydraulic pump." Corrective actions also were prescribed.

The FAA said the actions required by the AD were intended to prevent wires near the auxiliary hydraulic pump from shorting or arcing, which could cause a loss of auxiliary hydraulic power or a wheel well fire. The AD also was intended to "reduce the potential of an ignition source adjacent to the fuel tanks, which, in combination with the flammable vapors, could result in a fuel tank explosion," the FAA said.

Renee Schwietzke/Wikimedia

The FAA said that it discovered the violations during March 25, 2008, inspections of two American Airlines MD-80s. In subsequent inspections, the FAA identified eight more MD-80s that did not comply with the AD. The airline began grounding all of its MD-80s on April 7, 2008, "to conduct new inspections and redo work as necessary," the FAA said.

The FAA concluded that American operated 286 of its MD-80s on a total of 14,278 passenger flights while the aircraft were not in compliance with regulations.

The airline has 30 days from its receipt of the penalty letter to respond to the FAA.

Quality Control

The in-flight shutdown of an engine on a Japan Air Commuter DHC-8 has prompted the Japan Transport Safety Board (JTSB) to recommend improved quality control in the production of an engine gear shaft.

The JTSB said that Transport Canada should take steps to ensure that Pratt & Whitney Canada (PWC), which manufactured the engine, makes "companywide efforts, including the management of the metal stock supplier and component manufacturer serving PWC, toward the improved quality control concerning the production of the RGB [reduction gearbox] helical input gear shaft."

In making its recommendation, the JTSB cited a March 25, 2009, incident in which the DHC-8 crew heard an "abnormal noise" after takeoff from Tanegashima Airport and noted instrument indications of an engine failure. They shut down the no. 1 engine and conducted an emergency landing at Kagoshima Airport.

© contri/Flickr

Fatigue failure of the RGB helical input gear shaft was "highly probable," according to the JTSB report on the incident.

The agency said that the incident should be "reassessed from the viewpoint of the safety of the entire aircraft, and safety improvement actions should be taken if the results of the reassessment indicate this to be necessary."

'Line Up and Wait'

Because of an official change in terminology, air traffic controllers at U.S. airports are about to begin telling pilots to "line up and wait" when it's time to taxi onto a runway to await takeoff clearance. The change takes effect Sept. 30.

The words "line up and wait" are prescribed by International Civil Aviation Organization guidelines and have been in use throughout the world. In the United States, however, controllers have used the phrase "position and hold."

The U.S. Federal Aviation Administration (FAA) said that a safety analysis performed by the agency's Air Traffic Organization Terminal Services found that using "line up and wait" would "eliminate confusion, particularly among pilots who also fly overseas, and further reduce the risk of runway incursions."

The FAA said that the complete instruction to pilots will include the aircraft call sign, the departure runway and "line up and wait."

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In Other News …

Regardless of regulatory requirements, all aircraft should be equipped with at least one portable **fire extinguisher** "in a place that is accessible to pilots," the Civil Aviation Safety Authority of Australia (CASA) says. The hand-held extinguishers should be "capable of controlled flow" and capable of being operated by a single person, CASA says. … The U.S. National Transportation Safety Board (NTSB) is repeating its recommendation that the U.S. Federal Aviation Administration require **separate seats** for all aircraft passengers, including children under age 2 who currently may be held on an adult's lap. These children "should be afforded the same level of protection as all other persons aboard air carrier airplanes," the NTSB said. … Nearly half of all fatal general aviation accidents result from **poor planning** and decision making by pilots, according to a study by the Australian Transport Safety Bureau. Among the examples are failure to reject a takeoff despite poor engine performance and failure to check weather forecasts.

Compiled and edited by Linda Werfelman.

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A new law calls for an increase in the minimum flight time required of pilots hired by U.S. air carriers.

Counting the Hours

BY LINDA WERFELMAN

A new law requiring pilots in U.S. Federal Aviation Regulations (FARs) Part 121 operations to have at least 1,500 flight hours might not have the safety-enhancing effects that its supporters had hoped for, some aviation safety specialists say.

Backers of the new law, however, say it will result in significant improvements in aviation safety.

Provisions of the Airline Safety and Federal Aviation Administration (FAA) Extension Act of 2010, signed into law by President Barack Obama on Aug. 1, will require Part 121 pilots to hold an airline transport pilot (ATP) certificate — which is issued only to those who have accumulated at least 1,500 flight hours and meet other specific criteria. The provision will take effect in August 2013.

However, the act also says that the FAA may allow "specific academic training courses … to be credited toward the total flight hours," if the FAA administrator has determined that these courses "will enhance safety more than requiring the pilot to fully comply with the flight hours requirement."

"It remains to be seen how that exception will be applied," said Flight Safety Foundation President and CEO William R. Voss. "Overall, I can certainly understand the intent of

the 1,500-hour minimum to ensure that the airlines are hiring pilots with more experience and sharper skills, but I'm not sure this new requirement is going to have the effect that was desired."

Instead, Voss said, airlines may be forced to bypass pilots who possess excellent flight skills but lack the flight time requirement established by the new law.

"Ideally, we should be better able to understand the skills that are needed and how to measure them," Voss said.

Dramatic Upgrade

Rep. James Oberstar, a Minnesota Democrat who chairs the U.S. House Committee on Transportation and Infrastructure, said the new law will "dramatically upgrade the training and experience necessary to be an airline pilot."

Obama signed the law as an FAA panel was considering public response to an advance notice of proposed rulemaking (ANPRM) on possible changes in regulations involving training and qualifications of commercially rated copilots in Part 121 operations.[1] In the ANPRM, published in February 2010, the FAA specifically requested comments in several areas, including:

- Should all Part 121 air carrier pilots be required to hold an ATP certificate?
- Should the FAA create a new endorsement for "second-in-command (SIC)" privileges in Part 121 operations?
- Should the FAA accept specific academic studies in lieu of some of the flight hours required before a pilot is issued an ATP certificate?
- Should required training include "operating experience in a crew environment, in icing conditions and at high-altitude operations?"

The aviation rulemaking committee (ARC) that reviewed comments generated by the ANPRM was expected to recommend in late September that the FAA increase the training required for new Part 121 copilots — and perhaps require them to obtain a type rating before being permitted to operate the controls while passengers are aboard their aircraft. The FAA currently requires only captains to possess type ratings; some large airlines, however, already require type ratings for copilots.

An FAA spokeswoman said the ARC's recommendations would "help [the FAA] comply with the recent safety bill and strengthen pilot experience." The ARC's recommendations will be used as the FAA drafts an NPRM dealing with pilot qualifications and training, she said.

The ANPRM was published in the aftermath of the fatal Feb. 12, 2009, crash of a Colgan Air Bombardier Q400 during approach to Buffalo Niagara (New York, U.S.) International Airport (*ASW*, 3/10, p. 20). All 49 people in the airplane and one person on the ground were killed in the accident and the airplane was destroyed.[2]

In the ANPRM, the FAA noted the first officer's experience level — when hired by Colgan, she had less than 1,500 flight hours, including six hours of actual instrument time and 86 hours of simulated instrument time, although by the time of the accident, she had accumulated 2,244 hours — and said that the crash "focused attention on whether a commercially rated copilot in Part 121 operations receives adequate training."

Considering Options

When the ANPRM was published in February 2010, FAA Administrator Randy Babbitt said in testimony before a congressional subcommittee that he did not believe "that simply raising … the total number of hours of flying time or experience without regard to the quality and nature of that time and experience is an appropriate method by which to improve a pilot's proficiency in commercial operations."

Instead, Babbitt said, the FAA planned to consider other options.

"For example, a newly certificated commercial pilot might be limited to certain activities until he or she could accumulate the type of experience deemed potentially necessary to serve as a first officer for an air carrier. We are looking at ways to enhance the existing process

'The U.S. pilot training and assessment system urgently needs an update.'

for pilot certification to identify discrete areas where an individual pilot receives and successfully completes training, thus establishing operational experience in areas such as the multi-pilot environment, exposure to icing, high altitude operations and other areas common to commercial air carrier operations. We view this option as being more targeted than merely increasing the number of total flight hours required because it will be obvious to the carrier what skills an individual pilot has."

In comments submitted in response to the ANPRM, pilot organizations and airlines agreed that the current requirements are in need of an overhaul and that simply increasing the minimum required flight time for new first officers could prove counterproductive.

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"The U.S. pilot training and assessment system urgently needs an update … especially in the field of multi-crew operations," said the International Air Transport Association (IATA), calling for creation of a special panel to "review current requirements and to include best practices from other parts of the world, especially Europe."

Not all members of a Part 121 air carrier crew should be required to hold an ATP, IATA said.

"For the SIC … it is sufficient to undergo a solid and structured training program that enables [him or her] to act safely as copilot in a multi-crew transport airplane environment in all regimes of flight," the organization added.

IATA endorsed a plan to introduce an "ATP–SIC" pilot certificate that, in most cases, would require applicants to have at least 750 flight hours.

The Air Line Pilots Association, International (ALPA), which represents 53,000 pilots who work for 38 airlines in North America, agreed that current pilot training regulations "have failed to keep pace with the dynamic airline industry."

The current regulations "were first published in an era in which common business practices, driven not by regulation but by the supply of pilots and equipment in use, dictated that low-time, commercial-certificated pilots could only get airline jobs flying small, slow, propeller-driven aircraft and as flight engineers on jet transports," ALPA said. "Pilots would traditionally fly several years and thousands of hours before even being given an opportunity to upgrade to first officers on high-performance jet transports. Today, it is not uncommon for new-hire pilots to be employed as first officers of high-altitude, high-performance aircraft carrying 50 or more passengers in highly complex Part 121 operations. This reality demands that airlines hire pilots with *more* knowledge and *greater* skills than the new-hire airline pilots of the past, but in fact, just the opposite is happening at some airlines."

ALPA endorsed creation of a new "restricted" ATP certificate for otherwise qualified pilots with fewer than 1,500 flight hours or for those younger than age 23. To be issued this new restricted ATP, pilots should have at least 750 flight hours, ALPA said.

Exam Revision?

JetBlue Airways said that all pilots in Part 121 operations should demonstrate the ATP knowledge requirements described in the FARs and pass the ATP written exam. The airline added, however, that the written exam is outdated and should be revised to "mirror the evolution of the industry."

"Fundamentally, JetBlue believes the correlation of knowledge and experience to a pilot's total flight time is unjustified," the airline said. "Our proposal centers on the *quality* — not *quantity* — of experience."

Any flight time requirement that might be intended as an indication of strong aeronautical knowledge and experience is "without basis, and is merely an unsound, arbitrary guess," JetBlue said.

The airline's written statement said that a pilot with a commercial certificate, an instrument rating, 500 flight hours and 250 hours performing the duties of pilot-in-command "would have a sufficient level of experience to operate as second-in-command" in a Part 121 operation, and therefore, those requirements should be imposed for an ATP-SIC certificate for pilots in FARs Part 121, 125 and 135 operations.

JetBlue also challenged the current requirement that ATP applicants must be at least 23 years old, noting that the airline "is not aware of any data that suggest that age is a contributing factor in successful and competent completion of the job functions required of a second-in-command."

No New Avenues

Continental Airlines endorsed the 750-hour minimum in the form of a "commercial transport certificate" for Part 121 SIC pilots, adding, "We envision this to be a full certification effort with detailed training requirements and formal knowledge and skills testing. We would expect it to be administered only by accredited aviation academic institutions or by AQP [advanced qualification program] qualified carriers."[3]

Continental said that a 1,500-hour minimum for all Part 121 pilots is "unrealistic," in part because of the limited opportunities for future pilots to accumulate flight time.

"Historically, commuter carriers (now regionals) have been the primary opportunity for a non-military pilot to gain experience," the airline said. "If regional airline hiring minimums are raised significantly, another avenue must replace it. There simply isn't one.

"The inference is made that a general aviation track pilot can achieve the required 1,500 hours of experience. The reality is that there is simply not enough general aviation activity to provide 1,500 hours of experience for each of the potential number of non-military pilots the industry will require."

Boeing, which endorsed "focused training" to produce well-qualified SIC pilots and argued against specifying a minimum flight hour requirement, estimated in mid-September that the commercial airplane industry in North America will need 97,350 new pilots over the next 20 years.

The company added, "Focused training in the form of targeted foundational training and education offers an alternative path to produce a well-qualified SIC in a Part 121 program. This is preferred in lieu of simply requiring more flight hours to meet the new requirement, which adds significant cost to obtain the minimum qualification without guaranteeing a commensurate safety enhancement."

In fact, Boeing cautioned, a move to increase the minimum flight hours might "adversely impact the flow of available pilots to support Part 121 operations and potentially negatively affect the quality as well, as pilots become more interested in acquiring flight time rather than ensuring the value of the experience."

Under the new law, the FAA has 36 months to issue a final rule spelling out exactly how the training requirements will be implemented. The ARC's input on the ANPRM will be considered in drafting a final rule.

FlightSafety International kindly provided access to simulators for ASW *photographer Chris Sorensen.*

Notes

1. FAA. "New Pilot Certification Requirements for Air Carrier Operations." *Federal Register*, Docket No. FAA-2010-0100. Feb. 8, 2010.
2. NTSB. Accident Report NTSB/AAR-10/01, *Loss of Control on Approach; Colgan Air, Inc., Operating as Continental Connection Flight 3407; Bombardier DHC-8-400, N200WQ; Clarence Center, New York, February 12, 2009*. The NTSB identified the probable cause as "the captain's inappropriate response to the activation of the stick shaker, which led to an aerodynamic stall from which the airplane did not recover."
3. Under an AQP, the FAA may approve what it considers "significant departures from traditional requirements" for Part 121 and Part 135 pilot training and checking, "subject to justification of an equivalent or better level of safety."

A business jet was in clouds when the pilots initiated a steep descent, following a spurious navigation signal toward high terrain.

False Localizer Signal

BY MARK LACAGNINA

The flight crew initiated an emergency return to an Irish airport after the Gulfstream IV-SP's windshield cracked on takeoff in instrument meteorological conditions. The aircraft was outside the localizer coverage area when the crew armed the autopilot approach mode. As a result, the autopilot captured a false localizer signal. The crew then deviated from the instructions they had received from air traffic control (ATC) and initiated a rapid descent while tracking the false signal. The aircraft was 702 ft above the ground and headed toward the highest mountains in the country when the crew responded to warnings from ATC and from the on-board enhanced ground-proximity warning system (EGPWS).

After climbing — and experiencing further navigational difficulties — the crew landed the GIV. Neither the pilots nor their lone passenger was injured, but damage to the aircraft was substantial, not only from the cracked windshield but from foreign object damage to the no. 1 engine that likely occurred after the aircraft was landed.

In its final report, the Irish Air Accident Investigation Unit (AAIU) said that the probable cause of the serious incident — which occurred at (County) Kerry Airport (EIKY) in Killarney the morning of July 13, 2009 — was that "the crew suffered a serious loss of navigational and situational awareness while attempting to return to EIKY following a windshield fracture encountered shortly after takeoff." The report said that the following were contributing factors:

- "The crew made a number of rushed and inappropriate decisions during the flight, thus displaying poor crew resource management;
- "The first officer's lack of recent flying hours is likely to have contributed to his loss of navigational and situational awareness;
- "A false localizer signal was received due to the approach mode

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being armed while the aircraft was outside the specific localizer coverage sector;

- "The captain commenced a descent without having a valid ILS [instrument landing system] signal and without cross-checking other available navigational aids; [and,]
- "The situational awareness of the controller in Kerry Tower was compromised by erroneous position reports from the crew and noncompliance with his instructions, as well as a lack of direct radar information."

Trouble on Rotation

The GIV, built in 1999, was operated in the United States until it was registered by a private company in India in 2008. The crew for the incident flight, with an intended destination of London Luton Airport, comprised a contract pilot serving as captain and a company pilot serving as first officer.

The captain, 45, held a U.S. airline transport pilot certificate and an authorization by the Directorate General of Civil Aviation in India to fly GIVs. He had 12,500 flight hours, including 2,600 hours in Gulfstreams, with 1,027 hours in GIV-SPs.

The first officer, 38, held commercial certificates issued by India and by the United States. He had 3,200 flight hours, including 200 hours in GIVs.

The reported weather conditions at Kerry Airport included calm winds, 8,000 m (5 mi) visibility in rain, scattered clouds at 1,000 ft and a broken ceiling at 1,400 ft, and there was convective activity in the vicinity of the airport.

The windshield cracked shortly after the aircraft was rotated for takeoff from Runway 08 at 0806 local time. The captain, the pilot flying, told investigators that he then noticed abnormally high readings on the left-engine vibration monitor. He said that he momentarily retarded the left thrust lever to idle, in accordance with quick reference handbook guidance, and the indicated engine vibration level returned to normal. All other engine parameters also were normal.

The captain was initiating a right turn to a southeasterly heading, in compliance with the standard instrument departure procedure (SID), when the first officer radioed, "Sir, we have a cracked windshield. We're leveling off at three thousand. We'd like to come back to Kerry." The control tower at Kerry Airport was not equipped with radar, and the airport traffic controller asked for a position report. The first officer erroneously replied that the aircraft was 35 nm [65 km] southeast of the airport. The report said that he likely mistook the indicated distance to Cork, the next navigational fix on the SID, for the distance from Kerry. The GIV actually was about 10 nm [19 km] southeast of the airport (Figure 1, p. 18).

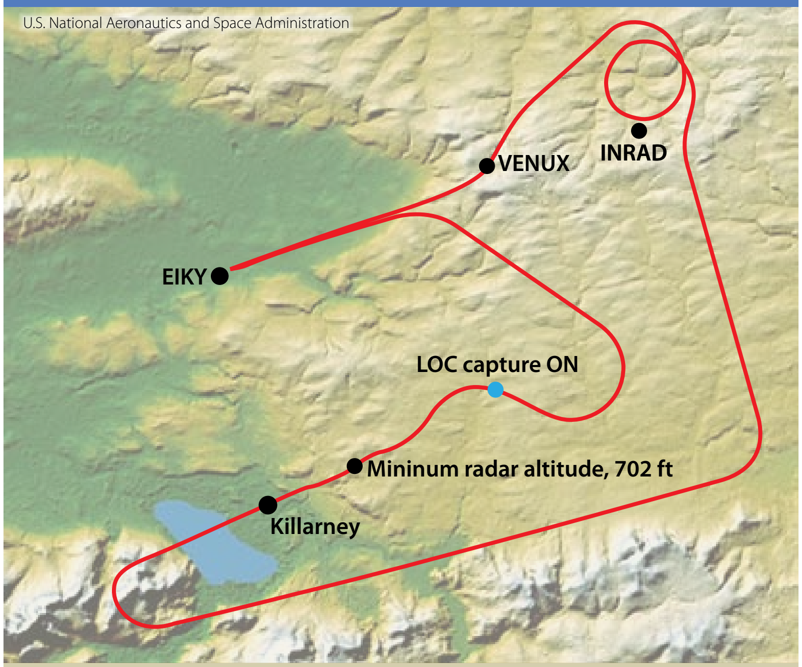
The controller asked the crew if they would prefer to navigate to INRAD, an intermediate fix for the ILS approach to Runway 26 — the only precision approach procedure available at the airport — or to navigate directly back to the airport and establish the aircraft outbound on the ILS. The first officer replied, "OK, confirm. Call you overhead at three thousand."

The first officer entered the airport waypoint in the flight management system (FMS), and the aircraft, which was being flown with the autopilot engaged, made a 180-degree turn and began to fly a northwesterly heading back to the airport.

Electrical arcing caused the GIV's windshield to crack on takeoff.

Irish Air Accident Investigation Unit

Flight Path

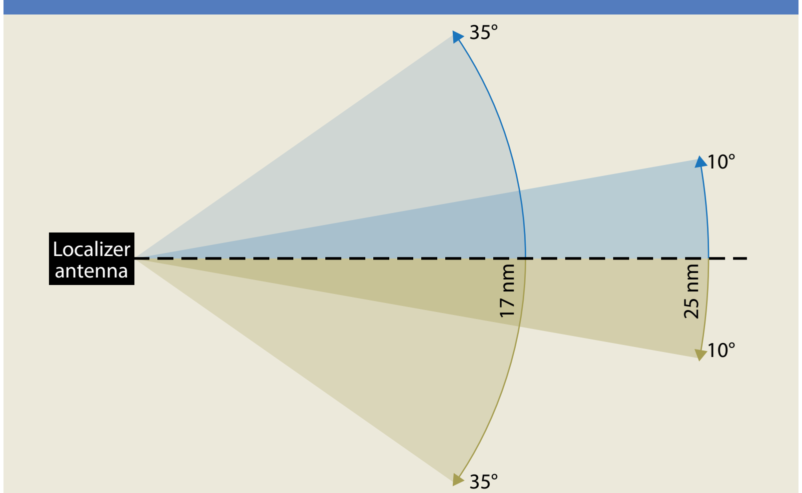


EIKY = Kerry Airport; LOC = localizer

Source: Irish Air Accident Investigation Unit

Figure 1

Localizer Coverage Area



Source: Irish Air Accident Investigation Unit, Susan Reed

Figure 2

At 0810, the controller again asked for a position report, and the first officer responded, "Ah, we're turning inbound now; one zero miles inbound." The controller asked him to confirm that the aircraft was inbound on the localizer, and the first officer said, "Turning back on the localizer now; one … correction, niner miles inbound now." The controller then cleared the crew to conduct the ILS approach.

Confusion Reigns

The autopilot, which was maintaining the selected altitude of 3,000 ft, commanded a left turn to a southwesterly heading after capturing the false localizer signal. The first officer announced that the course deviation indicators were "alive" and told the captain to begin a descent. The captain disengaged the autopilot and "commenced descent, in cloud on a track approximately parallel to the ILS but 6 nm [11 km] south of it," the report said.

The localizer coverage area, as specified by the International Civil Aviation Organization, extends to a maximum of 35 degrees of the localizer centerline (Figure 2). The aircraft was at an angle of 43 degrees from the centerline when it intercepted the false localizer signal. Such signals — also called "false courses" — are normal byproducts of ILS signal generation and are created at various angles outside the coverage area.[1] False localizer and glideslope signals also can be generated inside the coverage area during ILS maintenance and testing.

At 0812, the tower controller requested another position report. The first officer replied, "Coming up on the localizer, ah, seven DME" — that is, 7 nm [13 km] from distance measuring equipment located near the approach threshold of Runway 26.

The report said that the tower controller should have realized that the crew's position reports were inconsistent and inaccurate, and that they had deviated from his instructions. The controller later told investigators that he recognized the crew was under intense pressure and that he did not believe it was prudent to challenge them about their noncompliance with his instructions.

Both navigation displays were in the weather radar map mode. The report said that if at least one of the displays had been in the EGPWS map mode, the pilots might have realized that they were heading toward terrain rising above 3,000 ft. "It is fortunate that the descent was made over ground that was relatively low-lying in comparison to much of the terrain in the vicinity of EIKY," the report said.

'Climb Immediately'

Likely believing that he needed to capture the glideslope from above, the captain established a descent rate of 1,300 fpm and then called for the landing gear to be extended and the flaps to be extended 20 degrees.

At 0812, a Shannon Center radar controller, who was monitoring the flight but was not in radio communication with the crew, phoned the tower controller and told him that the GIV was about six miles south of the localizer at 1,600 ft. The radar controller said, "Climb him now, please."

The tower controller advised the crew of their position and said, "Climb immediately to 3,500 ft." About the same time, the EGPWS generated an alert that the GIV was at a radio altitude of 800 ft.

The aircraft was in a climb when the tower controller handed off the flight to a Shannon Center controller, who instructed the crew to climb to 5,000 ft and issued a heading of 090 degrees at 0815. About six minutes later, the controller issued a heading of 350 degrees, a vector toward the localizer course.

The first officer, who had flown only 1.4 hours in the preceding 28 days, had difficulty in programming the FMS for the ILS approach. He initially entered an approach to Runway 26 at London Luton.

At 0823, the Shannon controller told the crew to turn left, navigate directly to VENUX (the ILS final approach point), establish the aircraft inbound on the localizer and descend to 3,300 ft when ready. (The glideslope intercept altitude was 3,000 ft.)

"However, the aircraft did not turn left toward VENUX or descend but maintained the heading of 350 [degrees]," the report said. "As it passed through the localizer, it commenced a right turn onto a heading of 010 [degrees]. This was followed by a left-hand orbit to the north of the localizer."

At 0826, the crew reported that they were having problems with the FMS and requested clearance to maintain their current position. The controller cleared the crew to circle, provided the ILS approach frequency and offered radar vectors to the final approach course. The crew accepted the offer, flew the ILS approach and landed the aircraft at 0834.

Ground Runs

Later that morning, the crew taxied the aircraft to an unused taxiway and performed a ground run of the left engine that included a series of accelerations and decelerations. AAIU inspectors arrived at Kerry Airport the next day. Their initial examination of the aircraft revealed that the left engine, a Rolls-Royce Tay 611-8, had received severe foreign object damage and required replacement. "Many of the fan blades had V-shaped nicks in their leading edges while a boroscopic examination of the forward stages of the compressor showed significant blade damage," the report said.

The captain told investigators that the company's "senior management" had instructed him to perform the engine ground run to determine whether a ferry flight to a maintenance base was possible. The company "stated categorically" that no such instruction was issued, the report said.

The report said that the engine damage, which was exacerbated by the ground run, was not related to the windshield damage — the windshield had remained intact, and no fragments had been released. Laboratory analyses indicated that the left engine had ingested a round low-carbon-steel object with a diameter of about 25 mm (1 in) after the aircraft was landed.

The report said that, despite the captain's recollection of substantial engine vibration after lift-off, recorded flight data showed no significant vibration and that "the engine operated in a normal manner throughout the flight." The data, however, showed indications of compressor stalls shortly before the engine was shut down and later during the ground runs.

Investigators determined that the outer ply of the windshield had cracked because of electrical arcing between a heating system bus bar and the anti-icing film covering the inner surface of the outer ply. "The electrical arcing resulted when moisture ingress was absorbed by the interlayer and caused degradation of the bus bar at the bottom forward corner of the windshield," the report said.

Based on the findings of the investigation, the AAIU recommended that the Irish Aviation Authority (IAA) consider installing ATC radar equipment at Kerry Airport. The report noted that the IAA in November 2009 issued an aeronautical information circular warning pilots about the hazards of receiving false localizer signals outside the localizer coverage area.

This article is based on AAIU Synoptic Report No. 2010-012. The full report is available at <aaiu.ie/AAIUviewitem.asp?id=12639&lang=ENG&loc=1652>.

Note

1. FSF Editorial Staff. "Erroneous ILS Indications Pose Risk of Controlled Flight Into Terrain." *Flight Safety Digest* Volume 21 (July 2002).

IASS

FSF 63rd Annual International Air Safety Seminar

Preliminary Agenda

Tuesday, November 2

0900–1200	FSF International Advisory Committee (IAC) Meeting
1000–1700	**Registration**
1000–1500	FSF Board of Governors Meeting
1700–1800	Chairmen and Speakers Meeting for Wednesday presentations
1830–1930	**Opening Reception in Exhibit Hall**

Wednesday, November 3

0730–1700	**Registration**
0730–0830	**Continental Breakfast in Exhibit Hall**

Welcome and Seminar Opening

0830–0930 Ho Ching-sheng (Danny C. Ho), executive vice president, Safety and Security Division, EVA Air, and chairman, FSF IAC

William R. Voss, president and CEO, Flight Safety Foundation

Keynote Address — David McMillan, director general, Eurocontrol

Italian Host Committee

Award Presentations

0930–1000 **Refreshments in Exhibit Hall**

Session I Global Update

Session Chairman: Bill Bozin, vice president, safety and technical affairs, Airbus Americas, and member, FSF Board of Governors

1000–1030 "2010: The Year in Review" — James M. Burin, director of technical programs, Flight Safety Foundation

1030–1100 Hon. Debbie Hersman, chairman, U.S. National Transportation Safety Board

1100–1200 "Implementing the Global Aviation Safety Roadmap Worldwide: An Update" — Bill Bozin, vice president, safety and technical affairs, Airbus Americas

"Commercial Aviation Safety Team (CAST), International Update" — Glenn Michael, manager, international operations, CAST, U.S. Federal Aviation Administration (FAA)

"European Commercial Aviation Safety Team (ECAST) — John Vincent, head, safety analysis and research, European Aviation Safety Agency (EASA)

1200–1230 Questions and Answers

1230–1400 **Lunch**

Session II Professionalism/Training

Session Chairman: H. Keith Hagy, director, Engineering and Air Safety Department, Air Line Pilots Association, International (ALPA)

1400–1430 "Professionalism in Aviation: Approaches to Ensuring Excellence in Pilot and Air Traffic Controllers' Performance" — Roger Cox, senior air safety investigator, U.S. National Transportation Safety Board (NTSB)

1430–1500 "Building Tomorrow's Professional Pilot Starts Today" — Charles Hogeman, chairman, Human Factors and Training Group, ALPA Executive Air Safety Committee

1500–1530 **Refreshments in Exhibit Hall**

1530–1600 "Advanced Crew Competency Concepts for Pilot Training" — Barbara Holder, associate technical fellow/lead scientist, The Boeing Co.

1600–1630 "Aviation Safety: A Gap Analysis for Aviation English" — Elizabeth Mathews, director, Elizabeth Mathews and Associates

1630–1700 "Closing the Gap Between Accident Investigation and Training" — Mike Poole, executive director and chief investigator, CAE Flightscape

1700–1730 Questions and Answers

1745–1815 Chairmen and Speakers Meeting for Thursday presentations

Thursday, November 4

0730–1700	**Registration**
0730–0830	**Continental Breakfast in Exhibit Hall**

Session III Operational Issues

Session Chairman: Capt. Mauro Schiro, aviation safety consultant, technical task force, Fondazione 8 Ottobre 2001

0830–0900 "Operational Use of Flight Path Management Systems" — Kathy Abbott, chief scientist and technical advisor, flight deck human factors, FAA

0900–0930	"Departure Flight Into Terrain (D-FIT)" — Stewart Schreckengast, associate professor, Aviation Technology Department, Purdue University
0930–1000	"Go-Around Decision and Maneuver: How to Make It Safer" — Capt. Bertrand de Courville, corporate safety manager, Air France
1000–1030	**Refreshments in Exhibit Hall**
1030–1130	"Stall Training, Approach-to-Stall Training, Impending-Stall Training" — Capt. David Carbaugh, chief pilot, flight technical and safety, Boeing Commercial Airplanes
	"Stall Recovery Procedure" — Claude LeLaie, senior vice president, product safety officer, Airbus S.A.S.
	"Best Practices Relating to Stall and Stick Pusher Training" — Capt. David McKenney, human factors and training group, ALPA
1130–1200	Questions and Answers
1200–1330	**Lunch**

Session IV Safety Management Systems

Session Chairman: Capt. George H. Snyder, MBA, president and CEO, GHS Aviation Group

1330–1400	"Measuring Safety" — David Mawdsley, aviation safety advisor, Superstructure Group
1400–1430	"Safety Culture in Air Traffic Management: A European Perspective" — Andrew Kilner, deputy lead, safety development, Eurocontrol
1430–1500	"Implementation of SMS in the Aviation Industry: Challenge and Success" — Peter Müller, safety analyst, Federal Office of Civil Aviation (FOCA)
1500–1530	**Refreshments in Exhibit Hall**
1530–1600	"Integration Risk Management: The Practical Approach for an Effective SMS" — Eddie Rogan, aviation solutions director, Superstructure Group
1600–1630	"Safety by Design, an SMS Success Story" — Philippe Pilloud, head of safety risk management, easyJet
1630–1700	Questions and Answers
1715–1815	Chairmen and Speakers Meeting for Friday presentations

Friday, November 5

0730–1700	**Registration**
0730–0830	**Continental Breakfast in Exhibit Hall**

Session V Current Challenges

Session Chairman: Robert MacIntosh, chief advisor for international safety affairs, NTSB

0830–0900	"Volcanic Ash and Flight Safety: Spring 2010 in Europe" — Capt. Ed Pooley, principal consultant, The Air Safety Consultancy
0900–0930	"Influencing Safety Priorities: The Effect of the Media" — Kimberly Pyle, safety communications liaison, and Robert Tarter, Office of Safety Air Traffic Organizer, FAA
0930–1000	"Degradation of Professional Piloting Skills"— Capt. Michael Gillen, integration team project manager, United Airlines
1000–1030	**Refreshments in Exhibit Hall**
1030–1100	"What's It All About? GNSS, GBAS, SBAS, GLS, etc." — James E. Terpstra, senior vice president–retired, Jeppesen; executive aviation consultant
1100–1130	To be determined
1130–1200	Questions and Answers
1200–1330	**Lunch**

Session VI Managing Risk

Session Chairman: Capt. Bill Curtis, Air Canada, and Presage Human Factors Risk Management Group

1330–1400	"Runway Incursions" — Massimo Garbini, director general, ENAV (Italian Company for Air Navigation Services)
1400–1430	"Altitude Capture Enhancement to Prevent TCAS RAs" — Paule Botargues, multi-program project leader–autoflight system, Airbus S.A.S.
1430–1500	**Refreshments in Exhibit Hall**
1500–1530	"Designing and Implementing a Fatigue Risk Management System (FRMS)" — Peter Simpson, manager air safety, deputy head of corporate safety, Cathay Pacific Airways
1530–1600	"The Effects of Workload on Flight Crew Fatigue" — Capt. Kristjof Tritschler, flight safety manager, Germanwings, City University London, DLR
1600–1630	"Integrated Fatigue Modeling in Crew Rostering and Operations" — Suresh Rangan, technical principal, technology, FedEx Services
1630–1700	Questions and Answers
1700	Seminar Closing

Efforts of the International Helicopter Safety Team seem to be producing results.

IHST Nears Mid-Point

BY DOUGLAS W. NELMS

In 2005, the global civil helicopter accident rate was at 9.4 per 100,000 flight hours; for the United States, with a little more than 14,000 civil helicopters — 41 percent of the world's total — the rate was 9.1 per 100,000 flight hours. These rates had held fairly level over the preceding five years, and this lack of progress was judged to be unacceptable.

In September of that year, the members of the International Helicopter Safety Symposium (IHSS) met in Montreal and formed the International Helicopter Safety Team (IHST), taking on the goal of reducing civil helicopter accidents by 80 percent within 10 years. The IHST program was based on the U.S. Commercial Aviation Safety Team (CAST) (*ASW*, 1/08, p. 26), a government-industry group focused on airline safety. While the two programs are now fairly similar, the biggest difference between CAST and IHST is that CAST currently bases its research on fatal accidents, while IHST considers all helicopter accidents.

In February 2006, IHST was officially launched. In November 2006, the European Helicopter Safety Team (EHEST) was formed as the European component of the IHST.

As of May 2010, approaching the halfway point toward the IHST goal, helicopter accidents worldwide had dropped to 5.4 per 100,000 flight hours, while U.S. accidents dropped to 3.5 (Figure 1).

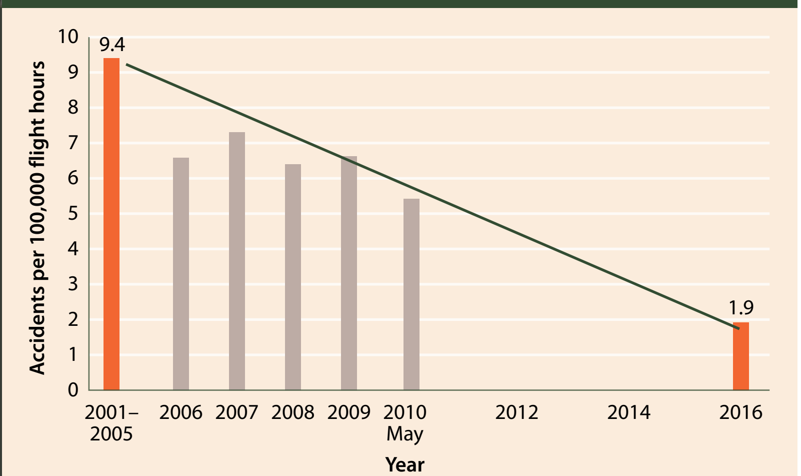
The relationship between the IHST's efforts and the drop in accidents is, as yet, unproven, said Matt Zuccaro, president of the Helicopter Association International (HAI) and co-chairman of the IHST.

"We can't say there is a direct correlation, but we can't ignore the trend. The simple fact that we are out there aggressively promoting a safety culture has created an industrywide heightened awareness for safety."

There is, he said, no "silver bullet" to enhance helicopter safety. "It is the culture and actual mentality of the operators in the industry that is changing dramatically," Zuccaro said. There is a commitment to safety, an economic commitment, a philosophical commitment: "Everybody from the owner of the company through the management team down to the pilot and maintenance and the support staffs are all in the same mindset of preventing accidents and being safety-aware."

Zuccaro also noted that as part of the awareness program, it is critically important that the end user, the client, be educated as to what the safety initiatives are, why the industry is promoting this program, why operational procedures are being changed and why something a helicopter operator did yesterday to satisfy the client may not be appropriate today based on new information obtained through the study of aircraft data, sorted by mission type (Figure 2, p. 24).

IHST Review of Worldwide Helicopter Accidents



IHST = International Helicopter Safety Team

Note: Data are through May 2010.

Source: Helicopter Association International

Figure 1

J.A. Donoghue

Zuccaro

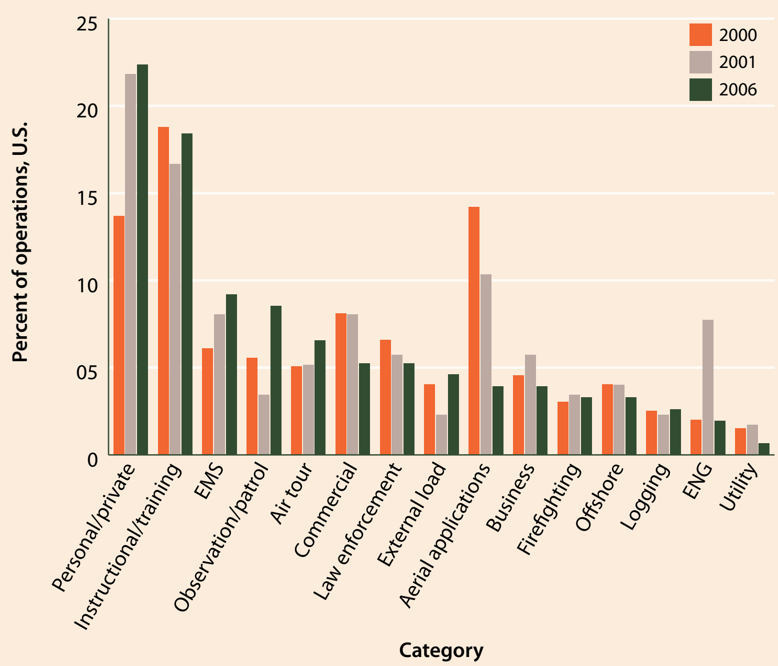
To develop an overall safety strategy, each region's IHST has created sub-teams, the joint helicopter safety analysis teams (JHSATs) to study and analyze hundreds of reports of helicopter accidents and incidents, and the joint helicopter safety implementation teams (JHSITs) to turn the analyses into recommendations to prevent accidents.

JHSAT studies have been completed by the North American and European teams. Additional regional teams are now collecting data worldwide to increase the range of information under study.

Canada, Brazil, India and Australia weren't fully on board the IHST program until 2007, Middle East nations and Japan did not start their regional JHSAT teams until 2009, and Russia kicked off its program this year.

The JHSAT phase, the analysis, is the leading edge of the IHST initiative, the engine that will drive down the accident rate "through introducing intervention strategies," according to Duncan Trapp, EHEST Communications

Helicopter Mission Comparisons

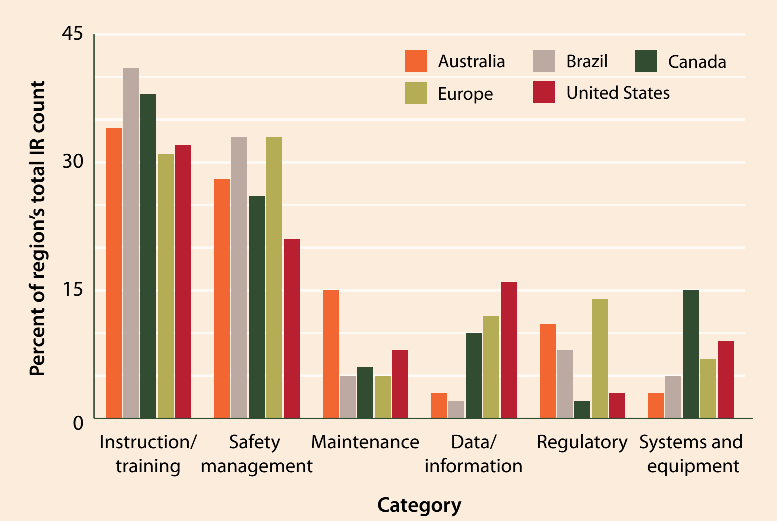


EMS = emergency medical services; ENG = electronic news gathering

Source: Helicopter Association International

Figure 2

IHST Intervention Recommendation by Region



IHST = International Helicopter Safety Team; IR = intervention recommendation

Source: Helicopter Association International

Figure 3

Sub-group leader and the safety and regulatory manager for CHC Helicopter—European Operations (Figure 3).

A major step to improved safety in the helicopter industry is the development of safety management systems (SMS) by individual operators, with IHST and EHEST working through their members to produce tool kits providing the road maps for meeting safety standards. Although not a required program for operators, SMS is expected to become a regulatory requirement for commercial helicopter operators in the United States and Europe.

To that end, the IHST initiative seeks to provide free, easy-to-use guidance material to get operators to adopt the processes and principles that are best practices elsewhere, and has created an SMS tool kit which is available as a download from the HAI website <www.rotor.com>.

JHSIT has created two other tool kits, the Helicopter Training Toolkit and the Helicopter Flight Data Monitoring Toolkit. In June, the EHEST started developing a helicopter maintenance tool kit.

Trapp said the next step is to move the SMS and other tool kit programs to the smaller operator, generally with five or fewer helicopters. "They are perhaps not best placed to help themselves because they are tight on funds, tight on resources, and tight on people and time," he said, so this new effort takes the program to the smaller operators on their own turf.

Zuccaro noted that implementation of the recommendations put out by JHSAT has "a cultural, philosophical approach to it. We have to market the tool kits and establish mentor programs to implement them."

To do that in the United States, the Federal Aviation Administration (FAA) and HAI have developed a joint program, providing mission-specific pilot-safety forums throughout the country. "Right now, almost all pilot safety forums, and even the certificated flight instructor (CFI) renewal programs, are fixed wing–oriented," Zuccaro said. "So we are going to go out and start a whole new set of pilot safety forums."

Continued on p. 26

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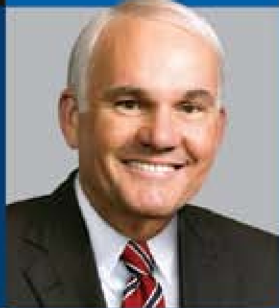

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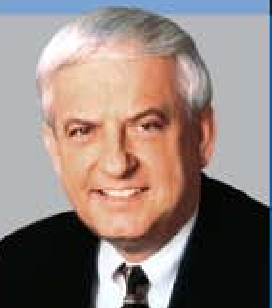

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FlightSafety international

New Initiatives

The worldwide helicopter industry is linking its International Helicopter Safety Team (IHST) program to two initiatives that are organizationally separate from the IHST but are key program elements.

The first initiative promotes the use of flight data monitoring devices, providing information useful in predictive and reactive (accident investigation) safety programs. The second is the International Standards–Business Aircraft Operations (Helicopter Edition), or IS-BAO (HE), an accreditation program to assist operators in developing a "best practices" safety program.

Flight Data Monitoring

In the perfect universe in which none of us live, helicopters would have the same types of flight data recorders and cockpit voice recorders that airlines use. However, the cost and size of these units puts them beyond the reach of most helicopter operators.

As a result, the industry is looking for low-cost, low-weight helicopter flight data monitors (HFDMs) that can provide data similar to those from the airlines' "black boxes" and quick access recorders (*ASW*, 8/10, p. 28). The light helicopter community is using the term "flight data monitors" for its hardware to differentiate it from the more complex flight data recorders.

FDM analyses provide the information needed for both predictive and reactive safety efforts, HAI President Matt Zuccaro said. The question is, he said, "How can you fix what you don't know?" These safety data can be used to make long-term safety improvements, to aid investigations into incidents and accidents, and to add accuracy to discrepancy reports. Knowing more about what happens in flight will help improve training programs and fleet operation standards.

The Global HFDM Steering Group was formed last April, with the goal of sharing "information with the intent of making HFDM easy for [all] operators to implement." The steering group is co-chaired by Mike Pilgrim, a captain and FDM adviser for CHC Helicopters' European Operations, and Joseph Syslo Sr., manager–aviation safety for American Eurocopter, and includes 70 individuals from 48 organizations worldwide.

Syslo said that the steering group set up three sub-organizations which deal with technical aspects; operational aspects; and a combination of communication, legal concerns and related matters.

The FAA says it is working to lessen barriers to operators' efforts to install FDMs on their aircraft. "We're seeing a lot of emphasis put on [installing] fairly low-cost recording devices on a voluntary basis," said FAA's Mark Schilling, IHST co-chair. "The FAA has been very active in making it easy for people to put these devices on their aircraft, particularly helicopters. What we did was to come up with some policy out of the Rotorcraft Directorate that allows these devices to be installed with very little rigor as far as what normally would go into an STC [supplemental type certificate]. We said that [FDMs] are non-operationally required safety-enhancing equipment. So if the equipment doesn't affect the operation of the aircraft when it fails, let's go ahead and get it installed."

Somen Chowdhury, a member of the IHST executive committee and manager, international research, Bell Helicopter Textron, Canada, noted that in some countries, these recording devices are required. "But some national regulators such as the FAA don't want to mandate them," he said. "So IHST is taking is an educational approach. We are going to put in a very simplistic system, with hardware nearly developed that will record the voice and instruments without intruding into the current certified system. It will not go into the wiring system at all. Once you touch that, you have to re-certify the whole thing."

Most helicopter manufacturers are working on finding FDMs for their aircraft. Lindsay Cunningham, senior accident investigator for American Eurocopter, said the company is putting the Appareo Systems Vision 1000 on the AS-350. The system, developed jointly by Eurocopter and Appareo Systems, is a cockpit imaging and flight data monitoring device wrapped into a single unit to provide voice and video data, with a global positioning system that captures location. The cockpit imaging device takes photos of the instrument panel, flight controls and partial exterior views at four frames per second. It contains inertial sensors that include nano-gyros and accelerometers to record basic flight parametric data.

In the event of an accident, investigators can zoom in on the gauges "and look at individual frames as necessary to determine what happened," Cunningham said.

Beyond accident investigation, however, "we want it available for training, flight testing, data monitoring, all of these uses that we hadn't even anticipated," American Eurocopter's Syslo said.

"One of the biggest issues coming out of JHSAT was the lack of data … in the investigative reporting [of accidents] and the proactive use of data to stop accidents," Cunningham said. "The industry is running up against this brick wall. We know what is causing most of the accidents, but we've reached the point where we don't have the data to support it 100 percent. So people aren't spending the money to move that forward." The FDM will provide the data to allow both proactive and reactive data collection.

The system costs about $7,500, not including installation, and weighs only 300 g (0.66 lb). It comes with a secure digital (SD) data card that can be taken out and put into a laptop that can transmit information about any flight to a data management system. Syslo noted that organizations offering a monitoring service for about $500 a year will log the information as it comes in and provide it to the customer to look for trends.

Cunningham added that "the system is light enough and low cost enough that you could put it on a Robinson R-22." She also noted that American Eurocopter President and CEO Marc Paganini said the company will install the Vision 1000 system on all new production Eurocopter aircraft as an STC becomes available for each model.

"That's where the some [manufacturers] are going … making it standard equipment," Cunningham said.

IS-BAO (HE)

International helicopter organizations have signed an agreement to create a new code of best practices for helicopter safety, basing it on the fixed-wing corporate aviation International Standard for Business Aircraft Operations (IS-BAO).

The new IS-BAO Helicopter Edition, or IS-BAO (HE), will provide a road map for helicopter operators to meet the new standards and audits to achieve a certificate of registration.

The agreement was ratified at the ILA Berlin Air Show last June, signed by the European Helicopter Association, Helicopter Association International (HAI), British Helicopter Association and the International Business Aviation Council. The agreement will allow the formation of a steering committee responsible for developing international standards for operations, maintenance, training and related issues. It will also provide linkage to the regulations and recommended practices specified by the International Civil Aviation Organization and to national aviation regulations, the association said.

Duncan Trapp, safety and regulatory manager, CHC Helicopter—European operations and communications sub-group leader for the European Helicopter Safety Team, said that IS-BAO (HE) is being rolled out around the world as a recognized standard with no planned differences between countries. "The aim is to set a baseline standard that said if you've done all [the standardization work] and get IS-BAO (HE) recognition, then you've covered to a good level all the requirements in terms of safe operations."

HAI President Matt Zuccaro said that a working group is being established "to look at the foundation document of IS-BAO, the accreditation document, and come up with a helicopter addition to address helicopter operators who want to be IS-BAO accredited. That will be the basis of the HAI accreditation program."

HAI will actually be part of two accreditation programs, its own and that of IS-BAO (HE). "We will be an agent of IS-BAO," Zuccaro said. "We will be able to get [the helicopter operators] to the program and walk them through the process. If you want to be HAI-accredited, we are going to send out one of our auditors who will be trained to do IS-BAO. So it will be a one-shot deal."

The difference between the HAI accreditation program and IS-BAO (HE) is that "ours is IS-BAO plus mission-specific," Zuccaro said. "If you conduct ENG [electronic news gathering], we're certifying you to IS-BAO standards that we are going to develop for the helicopter world, and we are also going to certify that you meet the mission-specific standards that we have established for your ENG mission. Just to have an accreditation program for a helicopter operator is not really realistic or a true evaluation of the operator. All the different missions that helicopters fly have different criteria requirements, operating environments, different risks."

— DWN

Sue Gardner, IHST program manager and a special assistant in the FAA's Flight Standards General Aviation and Commercial Division, said that the FAA Safety Team (FAAST), along with working with HAI to present regional educational programs, is developing products that are available through <www.faasafety.gov>, webinars or pamphlets, "focused on helicopter safety, targeting very specific initiatives that we need to address… that is the best way to reach that small operator," Gardner said. "They will have a daytime meeting focused on helicopter operators, and then an evening meeting that is specific to the individual helicopter pilot and flight instructor. We are also working with an industry organization on developing a master CFI program specific to helicopters."

Gardner also noted that FAA is working with the IHST to make its programs as bureaucracy-free as possible. "Our goal is to try to encourage voluntary compliance, and we've been pretty successful so far," she said. The FAA has worked closely with IHST on the introduction of the tool kits, particularly in the training area, focusing on voluntary adoption. However, one area that is in the regulatory realm, yet is non-intrusive, is initial qualification training, specifically the knowledge test questions and practical test standards, where FAA is working with JHSAT recommendations.

For specific information on the organizational makeup of IHST, go to <www.ihst.org>.

Even when modern flight deck equipment with moving maps is available, and even with multilateration[1] and automatic dependent surveillance–broadcast out supporting air traffic control (ATC), safely navigating an aircraft on the ground is still a critical issue.

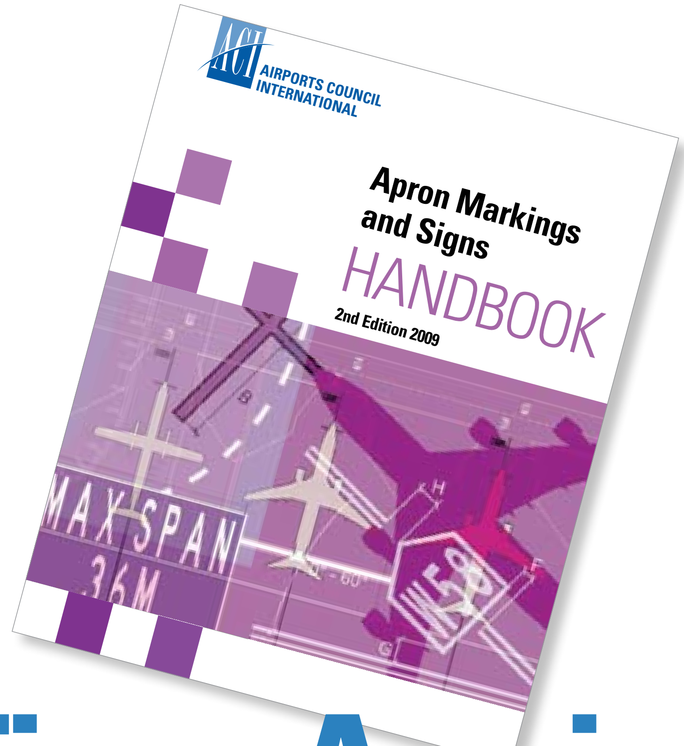
Airports are committed to providing sufficient navigation aids to maintain safety at the required level. In addition to lighting systems and the support of controllers, surface markings are of great importance, especially in adverse weather or critical lighting conditions.

Major efforts have been made over the years by the International Civil Aviation Organization (ICAO) to develop standards for visual aids to improve safety for moving aircraft on the ground.

Requirements for visual aids such as lighting, markings and signs can be found in ICAO Annex 14, *Aerodromes*, and ICAO Doc 9157, *Aerodrome Design Manual*, Part 4 (Visual Aids). Those documents have detailed specifications for visual aids on runways and taxiways, but few details can be found for aprons (ramps) — for example, markings for aircraft parking stands.

In the absence of precise rules, airports have developed different markings. Despite some harmonization within a country or group of countries, pilots may be confronted with different apron markings almost every time they fly. These markings may differ in shape, size, content and color.

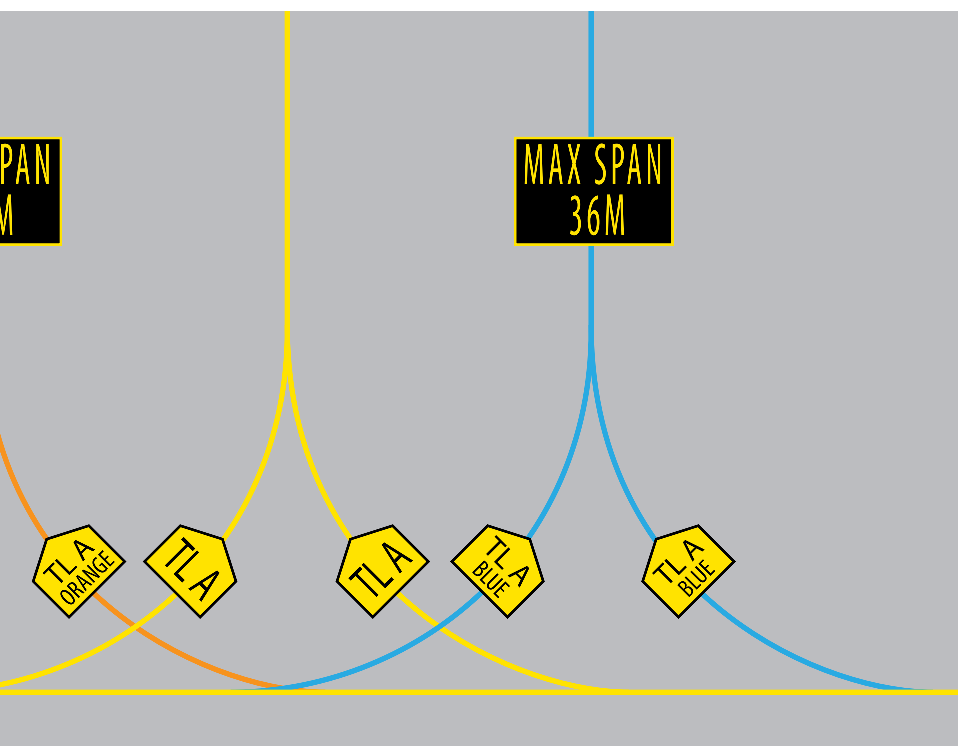
Airports Council International (ACI) has recognized this problem and published in 2001 its first *Apron Surface Markings and Signs* handbook. This handbook has been acknowledged by ICAO, in the remark that "additional guidance on apron markings is given in the ACI/IATA [International Air Transport Association] *Apron Markings and Signs Handbook*, which gives



A new edition of the airport surface markings and signs handbook furthers standardization among airports.

BY GERHARD GRUBER

Marking Time Again



examples of current best practices," included in ICAO Doc 9157, Part 4, 2.1.2.

The first edition of this handbook made a significant contribution to safer apron environments, by fostering greater uniformity in the markings and signs provided by airport operators at airports worldwide. Since then, best practices have continued to evolve, and increasingly complex apron management requires more detailed regulations.

Therefore, the ACI Safety and Technical Standing Committee determined that the first edition needed to be revised and requested the work to be done by the ACI Operational Safety Subcommittee.

Within that committee, Vienna International Airport took the lead to redesign the handbook. In particular, the author and his team, Oliver Russ and Dietmar Schreiber, created the text and graphics and coordinated several drafts with

Above, new "alternative aircraft stand" taxi lane markings. Below, old "stand direction" marking.

ACI before extensive industry consultation and request for comments began.

Comprehensive coordination with ICAO was performed via the Visual Aids Working Group of the Aerodromes Panel, where ACI was represented by Jean-Noel Massot of Aéroports de Paris.

The second edition of the handbook was published in 2009 and sent to more than 1,600 ACI member airports in 179 countries.

It has been significantly improved compared to the first edition, now including more markings and their exact dimensions. It is also the first time that markings are shown in any worldwide publication for alternative aircraft stand taxi lanes. Such markings allow operations on an apron taxi lane by either two code-letter C airplanes or one code-letter E or F airplane.[2] This has been applied and found to be both effective and safe at a number of airports.

The handbook is intended for planners of apron areas, ground staff working on aprons, air traffic controllers, apron controllers and pilots.

The change of surface markings and signs from an old system to the new specification cannot be completed overnight. Depending on size of the airport or budget, it will be done step by step.

In Vienna we took several opportunities to introduce the new specifications, including the construction of new aprons, a scheduled repainting and a complete change of the stand numbering system. Using these opportunities minimized the cost of the project and completed the change of markings within one year.

The author has been involved in developing adequate surface markings for many years. Even before the publication of the first ACI handbook, experiments with various colors, shapes and sizes were made at Vienna International Airport in coordination with airports in neighboring countries.

The author's activity as a pilot on worldwide routes has been of great assistance in this task. Not a single flight takes place without the author having the camera ready to document both good and bad marking examples.

Over the years, more than 1,000 photos have been taken, which were beneficial in developing the revised handbook.

Gerhard Gruber has worked for Vienna International Airport for 36 years, and has been the manager of airport operations since 1989. He has represented the airport at ACI since the organization's foundation in 1991. Gruber is an active airline transport pilot holding type ratings for the Dassault Falcon 900 and the Bombardier CRJ and Challenger 605, and celebrates his 40th year of flying this month.

Notes

1. Multilateration is a system in which the location of an object is determined by computing the time difference of arrival of a signal from that object to three or more receivers, or simultaneously from three or more transmitters to a receiver in the object.

2. Code-letter C airplanes have a wingspan up to but not including 36 m (118 ft); code-letter E airplanes have a wingspan up to but not including 65 m (213 ft); code-letter F airplanes have a wingspan up to but not including 80 m (262 ft). The reference codes are contained in ICAO Annex 14, Table 1-1.

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Twelve steps to implementing a safety management system.

BY JOHN SHEEHAN

SMS Tools for Corporate Aviation

Now that the International Civil Aviation Organization (ICAO) has made it mandatory for international operators of large and turbojet-powered aircraft to "establish and maintain a safety management system (SMS) appropriate to the size and complexity of the operation" after Nov. 18, 2010, implementation of the system is in full swing. We at the International Business Aviation Council (IBAC) are pleased to note the great response by corporate operators around the world, especially those who choose to comply with this mandate through International Standard for Business Aircraft Operations (IS-BAO) registration.

But experience has shown that both grasping the SMS concept and implementing it are not particularly easy tasks for corporate operators. The fully integrated approach to safety and the diversity of missions and wide range of flight department compositions make a "one-size-fits-all" approach to SMS impossible. As a consequence, IBAC over the years has provided increasingly detailed implementation guidance for SMS, culminating with the *SMS Toolkit* in 2009.

The *SMS Toolkit* was developed by a working group comprising members of the IBAC staff and participants from a number of IBAC's 15 member associations to assist noncommercial fixed- and rotary-wing aircraft operators, on-demand charter operators and aerial work interests in developing and implementing safety management systems that meet the ICAO standards and recommended practices, as well as the requirements of major aviation regulatory authorities.

The tool kit consists of a 57-page hard copy *SMS Tools* booklet that provides a step-by-step process to develop and implement an SMS, a compact disc that contains an electronic copy of the booklet, and 18 tools and six reference documents in electronic format. There are also hyperlinks to numerous other related sources. Other aids to SMS implementation are also included.

Why an SMS?

Most corporate and charter operators are aware of the existence of SMS, but all may not fully appreciate the rationale for its use and the advantages it brings to an operator. Most operators practice some form of overall safety management, especially if they have an up-to-date flight operations manual that contains policies, standards and procedures that directly apply to their operation. What is missing is the integration of these elements into a system of interlocking policies and procedures that considers all elements in concert.

More important, an SMS forces an operator to actively identify potential hazards, analyze them and create measures that will minimize the risks involved with the hazards. Further, the system provides for participation of all members of the flight operation in the SMS; teamwork is a welcome result of this action in most operations. The concept of constant improvement through a series of regular reviews of the operation's activities and compliance with its own standards completes the action loop of hazard identification and mitigation, active risk assessment, managing organizational and environmental change, internal evaluation and program revision.

The resulting advantages — the ability to actively measure and mitigate operational and organizational risks, better management practices, increased customer confidence, loss prevention, preferred insurance rates, and a fully integrated team within the flight operation — provide a rewarding return on the investment of the time and effort to implement and maintain an SMS.

The naysayers who contend that their seat-of-the-pants brand of safety management is just fine without the advantages of an SMS should ask the questions: Really, how safe is my operation? How can I know how safe it is if I have no means of measuring the risks we encounter on a daily basis?

SMS in Brief

The ICAO definition of SMS is "a systematic approach to managing safety, including the necessary organization, structures, accountabilities, policies and procedures."

IBAC defines SMS as "the systematic and comprehensive process for the proactive management of safety risks that integrates the management of operations and technical systems with financial and human resource management." This definition goes a bit beyond the more fundamental ICAO definition, but IBAC believes that the concepts of *risks*, *comprehensiveness*, *proactiveness* and *integration* are very important. The most important advantages of an SMS over conventional, more fragmented safety programs are the full integration of supporting programs and the ability to measure the degree of risk exposure.

The component parts of an SMS include methods of creating and sustaining safety through:

- Policies and objectives;
- Risk management processes;
- Assurance elements (Is it getting done?); and,
- Education and promotion within the organization.


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The basic formula for achieving these objectives is to:

- Identify hazards;
- Assess and measure risks created by the hazards;
- Eliminate the hazards or reduce risks to an acceptable level;
- Track and evaluate safety management activities for effectiveness; and,
- Modify safety management activities as required.

Implementing an SMS

A comprehensive implementation plan must be employed to assure that the resulting SMS meets all program goals and objectives. Not starting with a detailed plan is like launching on an international flight without flight planning.

An effective plan will ensure that:

- Management is committed to its success;
- Required resources are allocated;
- Responsibilities are assigned;
- Milestones are established and tracked;
- Existing policies, programs, systems and procedures are integrated with the new elements; and,
- Linkages are maintained.

Not ensuring that the first item on this list is truly present will jeopardize the success of any SMS. Without the boss's support, making it work will be difficult.

Like other means of treating addictions, IBAC advocates the following 12-step SMS implementation program; the addiction we are trying to treat is reliance on weak or poorly integrated safety programs:

1. *Study the SMS concept.* Read as much as possible on the subject to gain a comprehensive understanding of what the program is supposed to accomplish, how the parts fit together and what level of effort is required for success. Talking to others who have instituted an SMS in your type of operation will prove quite useful.
2. *Obtain senior management commitment.* This means "selling" the flight department manager/chief pilot on the merits of the program. But, whoever runs the flight department must also gain the support of corporate executives at the highest levels for the program to work.

Corporate SMS Resources

More information about the **International Business Aviation Council** (IBAC) *SMS Toolkit* is available on the council's "Safety Management" Web page at <www.ibac.org/safety-management>. The page also provides links to the IBAC "Safety Management Library," "Safety Management System (SMS) Information Library" and the International Standard for Business Aircraft Operators (IS-BAO) program Web page.

Vital information for an SMS is available in the recently updated **Flight Safety Foundation** (FSF) *Approach-and-Landing Accident Reduction (ALAR) Tool Kit*, a multimedia resource on compact disc for aviation safety professionals working to prevent the leading causes of fatalities: approach-and-landing accidents, including those involving controlled flight into terrain (CFIT). Information about the FSF *ALAR Tool Kit* is available at <flightsafety.org/current-safety-initiatives/approach-and-landing-accident-reduction-alar>.

Information about developing an emergency response plan — an integral element of any SMS — is available from the **National Business Aviation Association** at <nbaa.org> and from the **European Business Aviation Association** at <www.ebaa.org>.

The **International Civil Aviation Organization** (ICAO) *Safety Management Manual*, a 290-page document that provides a wealth of information about establishing and operating an SMS, is available at <www.icao.int/fsix/_Library/SMM-9859_1ed_en.pdf>.

Links to a variety of information and tools, including the *Fatigue Risk Management (FRMS) Toolbox*, are available on the **Transport Canada** "Safety Management Systems (SMS)" Web page at <www.tc.gc.ca/eng/civilaviation/standards/sms-menu-618.htm>.

The **U.K. Civil Aviation Authority** *Safety Management Systems — Guidance to Organisations* is available at <www.caa.co.uk/default.aspx?catid=872&pagetype=90&pageid=9953>. This Web page includes links to a variety of other SMS materials, including a document titled *SMS Guidance for Small Non-Complex Organisations*.

A sample of government and commercial resources for SMS design and implementation is available from the **U.S. Federal Aviation Administration** (FAA) "Safety Management System Reference Library" at <www.faa.gov/about/initiatives/sms/reference_library/>. The resources include the FAA's *SMS Implementation Guide* and *SMS Assurance Guide*.

— JS

Management personnel at all levels must stay actively involved.

3. *Establish an SMS team.* A project leader and representatives of the pilots, flight schedulers and maintenance personnel are essential. This is truly a team effort; without a development team, there may not be overall buy-in from the entire organization. Many organizations also find that improved overall teamwork within the organization is a consequence of implementing an SMS.
4. *Conduct a gap analysis.* This means taking one of the SMS checklists (see "Corporate SMS Resources," p. 35) and conducting an internal audit of the organization to see what you already have that meets the criteria for an SMS. The deficiencies noted will provide a road map for your implementation program.
5. *Conduct initial hazard identification and risk assessment, and develop a safety risk profile.* This aspect asks key department personnel to identify the "standard" hazards they face on a daily basis and how they handle them. It also asks what other hazards they may face based on the variety of operations they perform. Information on how to accomplish this also is available from the resources listed in the sidebar to this article. The IBAC *SMS Tools* booklet is a good starting point.
6. *Develop safety management strategies and safety assurance processes.* This means that the organization must have a well-integrated plan to implement, sustain and measure the overall SMS effort. Measuring the relative risk involved with hazards is one of the most important features of the SMS concept and should be exploited. It relies heavily on checklists and processes to ensure compliance.
7. *Identify safety accountabilities.* This determines who is in charge of the overall SMS program and, more important, who is in charge of each element of the program. Without designating a responsible individual for each program task, the likelihood of getting all the tasks done may be in doubt. And, don't forget to designate a due date or time interval for each required action.
8. *Develop an ongoing hazard identification and tracking system and risk assessment procedures.* This is a key feature of the program. The success of an SMS depends on a constant flow of information regarding actual and anticipated hazards and methods for dealing with them. Each primary document listed in the sidebar to this article contains one or more methods for accomplishing this critical element of the program.
9. *Develop an emergency response plan.* While we hope that no person or aircraft within the organization will ever be involved in an incident or accident, having a plan for dealing with the many consequences of such an event is essential. Without it, the operator's response to an incident or accident is often chaotic and confusing. It is essential to align the flight operation's activities with those of the main company or client to ensure a comprehensive response.
10. *Amend programs, procedures and documents as required.* This is the feedback loop for the SMS. Once hazards and consequent risks are identified, how they are handled should be incorporated into the program to ensure that similar events will not reoccur.
11. *Conduct staff training and education.* Without training and constant hazard and risk education, the SMS probably will not be effective and might not even survive. Again, this is a team effort, and the team must be kept in the loop. If they don't see both activity and results from the program, it will be less effective.
12. *Track and evaluate safety management activities.* This aspect provides answers to questions such as: "How are we doing? Are we achieving our goals and objectives? Are we becoming more risk-aware? What can we do better?"

Continuing Process

The 12 steps described in this article form a *process*, one that will permit your organization to recognize potential hazards; evaluate and mitigate the related risks; and measure progress and effectiveness. The result should not be just another manual designed to meet a requirement imposed by someone else. A well-developed and integrated SMS is a continuing *process* designed to reduce the risks faced by your organization to the lowest possible levels commensurate with your type of operation.

Ideally, practicing the process will lead to a positive change in the organization's safety culture. Even better, the process will lead to a more effective, efficient and productive organization.

John Sheehan is IBAC's audit manager and founder and president of Professional Aviation, an aviation safety consulting firm. This article was adapted from his presentation to the 2010 Corporate Aviation Safety Seminar, held in Tucson, Arizona, U.S., by Flight Safety Foundation and the National Business Aviation Association.

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A small child's fall reminds adults of the need for close supervision and reveals inadequate updates to operators.

Airstair Vigilance

BY WAYNE ROSENKRANS

A 3-year-old girl's fall from the forward integral airstair of a Ryanair Boeing 737-800 — an approximate height of 8.5 to 9.0 ft (2.6 to 2.7 m) — has prompted the U.K. Air Accidents Investigation Branch (AAIB) to issue several safety recommendations, including one for airstair modification. She was released from a hospital after a 24-hour assessment and treatment of minor injuries.

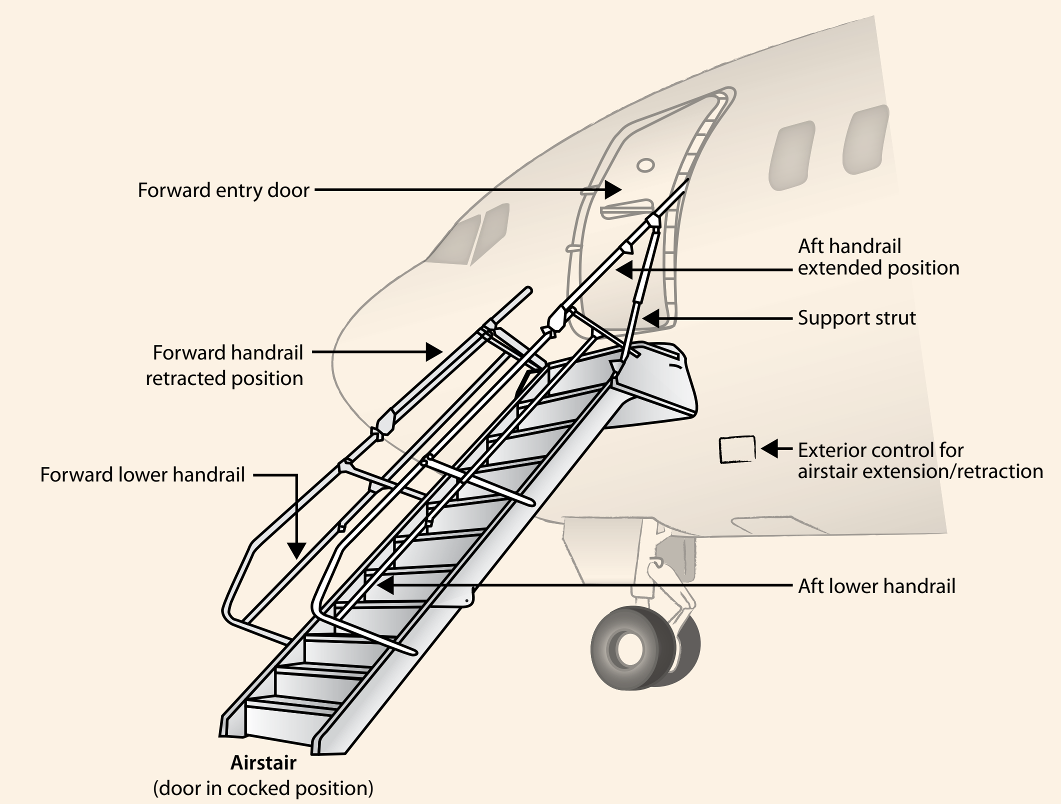
The child had climbed the airstair to the upper platform followed by her mother, who was carrying a younger sibling and a carry-on bag. "Due to her mother's lack of a free hand, the child climbed the airstair unassisted, but she held onto the lower handrail," the report said. "When [the girl] reached the top of the stairs, she turned towards her mother, leaned backwards and fell through the gap between the extendable handrail and the top of the airstair, onto the hardstanding [ramp pavement] below." Other passengers also were on the airstair at the time.

The incident occurred at 1225 local time on July 17, 2009, at London Stansted Airport, the AAIB report said. The airplane was manufactured in 2005 and certificated to applicable European standards.

This integral airstair (Figure 1, p. 38) primarily was used to facilitate routine boarding and disembarkation in place of portable ground-based steps or an airbridge, and safe operation depended on a combination of barriers, procedures and warnings on placards. "These airstairs include an integral two-rung handrail on either side," the report said. "These [handrails] rise into position during deployment of the stairs, but due to the geometric restrictions imposed by the retraction mechanism design, they do not extend to the fuselage side.

"In order to bridge the gap between the top of the handrails and the fuselage, a manually extendable handrail is fitted to each of the integral rails. After deployment of the airstair, these are

Forward Integral Airstair on Boeing 737s



FAA = U.S. Federal Aviation Administration

Notes: The upper handrail extensions, when secured to the inside of the door opening, are designed to provide a continuous support from the ground to the airplane cabin. However, an FAA special airworthiness information bulletin (SAIB NM-07-47) in September 2006 advised 737-series owners and operators of four occurrences in which, during the process of disembarking or entering the airplane, unattended small children fell through or over the handrails or lost their balance and fell from the airstair.

Source: U.K. Air Accidents Investigation Branch; FAA

Figure 1

extended and secured to points in the entry door frame. Each extendable rail is supported by a strut extending from the side rail of the airstair."

Previous Child Falls

Four similar incidents involving small children had prompted the U.S. Federal Aviation Administration (FAA) in September 2007 to issue advisory information to all current owners and operators of 737s. This comprised a special airworthiness information bulletin,[1] calling for the incorporation of the latest safety advice and advances from a service bulletin developed by Boeing Commercial Airplanes,[2] and another developed by Monogram Systems, the manufacturer of the airstair.[3]

"These bulletins required warning placards to be added to the risers of the airstair steps and the aircraft door apertures, together with the addition of anti-skid material to the top platform and the side rails," the report said. "The [Boeing bulletin] also highlighted the fact that Boeing had revised the flight attendant manual for the 737 series of aircraft, to include a warning regarding the need for operators to pay particular attention to passengers boarding [or deplaning] with small children or [passengers] with special needs." The AAIB report cited a paragraph from this template for operators, which says, in part, "Small children on airstairs should be attended by an adult or responsible person."[4]

Investigation of the 2009 incident, however, found no process in place for operators to receive amendments to these type-specific cabin safety recommendations. "The flight attendant manual received by the operator with its first Boeing 737-800 was issued on 28 September 1998," the report said.

Investigators noted that, at the time of the incident, implementation of the most current airstair safety improvements recommended by Boeing and the airstair manufacturer was incomplete. "The airstair … had the warning placards on the risers and anti-slip material installed in accordance with [the] Monogram Systems [service bulletin], but the door aperture placards, detailed in [the] Boeing [service bulletin], had not yet been applied," the report said.

Small children require close supervision because of limitations of the geometry of the rails. "When deployed, the left and right extendable handrails are intended to provide protection against people falling sideways off the upper section of the airstair," the report said. "While these handrails appear to provide adequate protection for adults, a gap exists between the handrail and the airstair platform which is large enough to allow a small child to pass through it and fall onto the [ramp pavement] below."

According to procedures in Ryanair's safety equipment and procedures manual (SEP), three of four flight attendants are assigned to maintain positions by the forward and rear doors, and near overwing exits for the duration of boarding. "However, during boarding, the ability of the cabin crewmember at the forward doors to identify those passengers requiring assistance, while they are ascending or descending the airstair, is limited," the report noted, citing a provision from the SEP, which says, "Passengers accompanying young children should be instructed to hold their hands when descending the stairs and on the ramp."[5] The report did not mention the positioning of the flight attendants in the 2009 incident.

Other Airlines

AAIB observers also looked beyond the airline involved to assess supervision of small children on the 737 forward integral airstair. "In 95 percent of cases, during disembarkation, passengers traveling with several small children and hand baggage received no assistance from either cabin crew or ground staff," the report said. "However, ground [staff] and cabin crew provided assistance in 78 percent of cases when single passengers accompanied by small children were allowed to pre-board the aircraft." The 2009 pre-boarding incident was an exception: Neither the cabin crew nor the ground staff provided assistance, according to the AAIB.

"When portable ground-based steps or the aircraft's integral airstair were used, an adult boarding or disembarking with 'carry-on' baggage, which could not easily be placed over the shoulder, and a small child, found themselves, in certain situations, in a position where neither hand was available to provide support during the ascent or descent. This situation was further complicated when an adult was accompanied by more than one small child and 'carry-on' baggage, as some of the children had to negotiate the steps with little assistance from the adult."

Mitigation Measures

The AAIB said that Ryanair also analyzed this incident and instituted measures to reduce the risk. "As a result, the operator raised a modification which introduces a roller-tensioned, high-visibility tape between the door aperture and the extendable handrail strut," the report said. "After approval by the relevant airworthiness authorities, this modification will be embodied on the operator's fleet as a matter of priority."

The AAIB recommended that:

- "Boeing establish a process to inform the operators of all Boeing commercial aircraft of changes to the relevant flight attendant manual;
- "Ryanair review their current passenger boarding and disembarking procedures so that assistance is made available to passengers accompanied by children, and those with special needs; [and,]
- "Boeing review the design of the Boeing 737 forward airstair with the intention of adding a removable barrier to minimize the possibility of a child falling through the gap between the extendable handrail and its upper platform."

The report explained the analytical basis of each safety recommendation. "The lack of an amendment service for the Boeing 737 flight attendant manual … applies to all of the Boeing commercial aircraft product line," the AAIB noted. "In this case … the operator would have been aware that some changes had been made to the manual upon receipt of [the FAA special airworthiness information bulletin]."

Investigators concluded that the absence of a barrier that specifically protects small children also should be addressed. "The gap between the extendable handrail and the upper platform of the Boeing 737 airstair represents a hazard to small children boarding or disembarking the aircraft," the report said. "Four previous events resulted in [amended guidance or safety bulletins that] do not provide physical protection against a child falling through the gap. The modification proposed by the operator provides a significant visual cue to the lack of a rigid barrier in this area, but provides only a limited physical protection against falling."

This article is based on AAIB Bulletin 8/2010, EI-DLJ, EW/C2009/07/08, *published in August 2010.*

Notes

1. FAA. Special Airworthiness Information Bulletin NM-07-47. September 2007.
2. Boeing. Service Bulletin 737-52-1157.
3. Monogram Systems. Service Bulletin 870700-52-2130.
4. Boeing Commercial Airplanes. *Boeing Flight Attendant Manual,* page 7.10.34. October 29, 2008.
5. Ryanair. *SEP Manual,* Section 2.4.13.5.

Left: Graham Rochat, Flight Safety Foundation BARS technical manager.
Right: Bob Godden, Executive Airlines quality manager (Essendon).

Advancing the new BARS program

Setting a New Standard

Flight Safety Foundation has begun delivering training courses that advance implementation of the Basic Aviation Risk Standard (BARS) that will improve aviation safety in the global resources sector, or in any organization around the globe that uses contracted aviation services (*ASW*, 3/10, p.14).

Lead aviation safety auditors from Australia, South Africa and the United Kingdom this month became the first auditor group to complete the Foundation's new training program, qualifying them to conduct BARS audits of aviation service providers.

Aviation contractors have been subjected to multiple audits every year to satisfy the safety requirements of each company they serve in the resources industry sector. The single BARS audit will take the place of these multiple audits as other members of the BARS program share the results.

"The BARS auditing system will ensure audits are carried out consistently across the industry and will ultimately mean fewer audits for individual aircraft operators," said South African aviation safety specialist, Mike Litson, founder and CEO of Litson & Associates. In addition, the BARS audit will be much more comprehensive, conducted by aviation safety auditors accredited by the Flight Safety Foundation (FSF).

Litson hosted the first BARS Auditor Accreditation course at his well-equipped training facility in Cape Town, South Africa. During the two-day course, 11 experienced auditors received intensive training on how to apply the new risk-based auditing system to companies in the unique resources sector environment. "Every one of my own aviation advisers attended this course and it made sense to show my support to the BARS program by offering my facilities," he said.

"Word of mouth about this course is flying around our aviation community, and it's a privilege to be involved with something the industry is so excited and passionate about."

The first two Aviation Coordinator Courses were held in Perth and Brisbane, Australia, in August and September. More than 30 resource company employees from companies including BHP Billiton, Harmony Gold, MMG, Newcrest Mining and Newmont Mining were trained on how to use the new standard to identify possible threats and risks and to minimize those threats.

Additional courses will be held in Africa, Australia, Canada, Guinea, Indonesia and South Africa in coming months.

To find out more, contact the BARS program office: +61 1300 557 162 or fox@flightsafety.org

The Flight Safety Foundation's BARS program is the first focusing specifically on aviation safety for the resources sector by creating:

- A new risk-based international aviation standard
- A new auditing program tailored to the standard
- A range of aviation safety training programs
- Global safety data analysis program

VALID CONCERNS

BY WAYNE ROSENKRANS

Auditors urge quicker upgrades of U.S. safety data analysis to discover national risk trends.

Methods for identifying unexpected risks in the Next Generation Air Transportation System (NextGen) should be enhanced without delay as part of implementing the safety management system (SMS) of the U.S. Federal Aviation Administration (FAA), says an independent review. If upgrades to safety data collection and analysis fall behind the pace of NextGen advances, says the report by the U.S. Government Accountability Office (GAO), national-level risk analyses could be based on insufficient or untrustworthy information.

"A senior FAA official [said] that although safety assessments had been conducted on individual NextGen technologies, until the agency has finalized [the National Level System Safety Assessment] modeling project, it cannot begin systemwide assessments of the safety of NextGen technologies and procedures that are already being deployed, including 700 new navigational procedures that had been deployed as of October 2009," the report said. "Because some NextGen changes are already taking place, it is urgent that FAA move with all deliberate speed to advance its analytical capability … model the impact of NextGen changes on the National Airspace System [NAS] and manage any risks emerging from these changes."

The International Civil Aviation Organization, U.S. agencies responsible for aviation safety and counterparts in other countries — such as the Confidential Human Factors Incident Reporting Programme (CHIRP) in the United Kingdom — now consider data-driven analysis to be indispensable in accident prevention by revealing accident/incident precursors and emerging risks. This especially includes data reported voluntarily by aviation professionals.

"As part of SMS, FAA plans to analyze data proactively … to model the impact of proposed changes in procedures and technologies on the safety of the NAS [and to identify safety vulnerabilities and mitigating measures]," the report noted. "Currently, FAA assesses risks for specific NextGen procedures and technologies, but cannot model the risks across the NAS in a comprehensive manner. … FAA is also developing a plan for managing data under SMS, but the plan does not fully address data, analysis or staffing requirements."

The GAO performance audit from August 2008 through May 2010 comprised a review of 13 aviation safety databases maintained by the FAA, the National Aeronautics and Space Administration (NASA), the National Transportation Safety Board (NTSB) and the Department of Agriculture (National Wildlife Strike Database), and interviews with 10 subject matter specialists in aviation safety and/or safety data collection and analysis.

Safety specialists at the FAA have contended that statistically valid samples from subsets of all airlines and industry sectors adequately reflect risks in the entire NAS and enable effective risk management. GAO reviewers disagreed, arguing for an expansion of data collection to better monitor safety trends in some sectors and urging tighter data quality standards (Table 1).

"FAA has access to some voluntarily reported data, which are important for SMS, but not all [air] carriers and aviation personnel participate in FAA's voluntary reporting programs," the report said. "While FAA has some information on reasons for nonparticipation and has taken some steps to promote greater participation, it lacks carrier-specific information on why air carriers are not participating."

Reliable Sources

The report found a number of appropriate controls over data quality in the 13 databases, but for several of them cited inadequate routine review of data by a manager before data are added to a database. Correcting this weakness is a critical aspect of ensuring that data are "reliable (complete and accurate) and valid (measure what is intended)," the report said. Overall, the four government agencies' oversight of their safety data was consistent with GAO standards for

Data Quality Control for U.S. Aviation Safety Databases

	Database											
Quality Characteristic	AIDS	ASRS	FOQA	ATOS	NMACS	NTSB	OEDS	PDS	SDRS	VDRP	VPDS	Wildlife
Managers review data before they are entered into the data system.	○	●	○	○	○	◐	○	◐	◐	◐	◐	●
Reconciliations are performed to verify the data's completeness.	●	○	●	◐	◐	●	◐	○	◐	◐	◐	●
Data entry processes are designed to enhance accuracy.	○	◐	●	○	○	●	○	○	○	◐	○	●
Procedures are in place to validate and edit data to help ensure that accurate data are entered into electronic system.	◐	◐	●	◐	◐	●	◐	◐	●	◐	◐	◐
Procedures are in place to help ensure that erroneous data are identified, reported and corrected.	●	●	◐	◐	◐	●	◐	◐	◐	◐	●	◐

○ Not present ◐ Present to some extent ● Fully present

AIDS = FAA Accident/Incident Data System, 1978; ASAP = FAA-industry Aviation Safety Action Program, 1997; ASRS = NASA Aviation Safety Reporting System, 1987; ATOS = FAA Air Transportation Oversight System, 1998; FAA = U.S. Federal Aviation Administration; FOQA = FAA Flight Operational Quality Assurance Program, 1995; GAO = U.S. Government Accountability Office; NASA = U.S. National Aeronautics and Space Administration; NMACS = FAA Near Midair Collision System, 1987; NTSB - U.S. National Transportation Safety Board; OEDS = FAA Operational Error/Deviation System, 1985; SDRS = FAA Service Difficulty Reports, 1986; USDA = U.S. Department of Agriculture; VDRP = FAA Voluntary Disclosure Reporting Program, 1990; VPDS = FAA Vehicle Pedestrian Deviation System, 1988; Wildlife = FAA-USDA National Wildlife Strike Database, 1990

Note: Data controls for proprietary data generated by airline ASAPs were not assessed because they were not made available for review by the GAO. Data completeness refers to the accuracy with which data entered into a database have been compiled or processed, not to the scope of the data. Years indicate when the database was established.

Source: U.S. Government Accountability Office

Table 1

identifying, reporting and correcting erroneous data. Practices examined included checks of reliability, including whether "data are complete and accurate, measure intended safety concerns, and are useful for their intended oversight purposes."

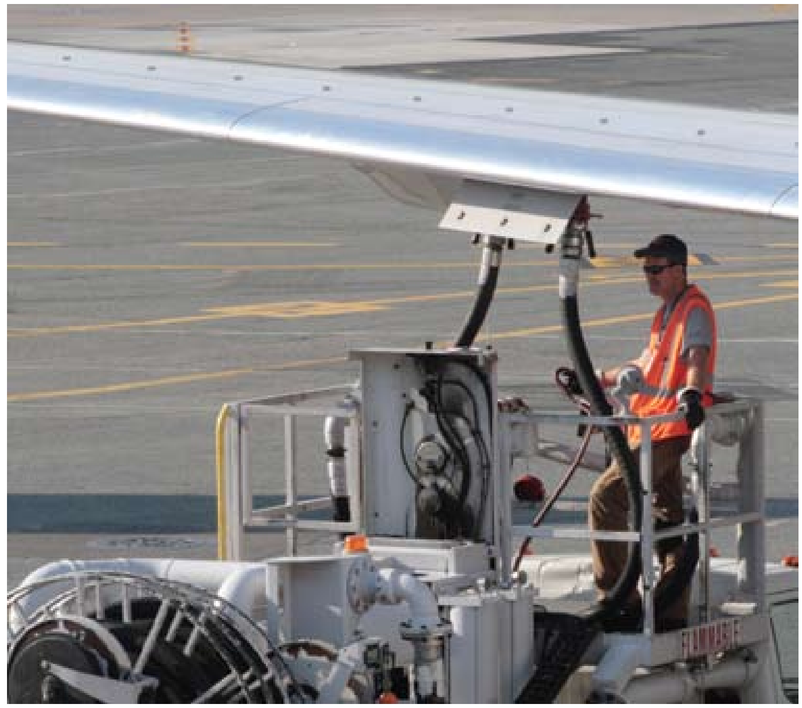
In addition to issuing policies and quality control standards for safety data processing, the FAA has used techniques such as cross-referencing internal and external databases to check reliability and validity, and facilitated communication among analysts from these government agencies to identify, share and correct discrepancies, the report said.

As an example of a NextGen side effect that should be identifiable through national-level data analysis, the report cited NextGen approach procedures that enable increased rates of landings — designed to reduce airspace congestion and fuel consumption — but that also could generate greater airport surface congestion and risk of taxiway collisions.

"FAA is in the process of designing tools that will allow it to model the changes," the report said. "To do so, it has begun to develop a baseline of current conditions [from fusion of operational data] and then expects to analyze how NextGen changes will affect those conditions, according to a senior FAA official."

SMS and ASIAS

Some organizations within the FAA have attained SMS initial operating capability or have made significant progress toward that status, but the GAO expressed concerns about the pace during the past two years. "FAA's goal is for the Office of Aviation Safety to have initial operating capabilities in place for SMS by the end of [September] 2010 … these initial operating capabilities include training employees and defining how to apply SMS to the agency's overall oversight activities," the report said, noting that the FAA Air Traffic Organization issued an implementation plan, introduced a manual that guides SMS-related daily activities of its personnel and attained initial operating capability in March. The FAA Office of Airports and FAA Office of Aviation Safety, however, were at earlier stages of the implementation process.



J.A. Donoghue

Another GAO observation about NextGen concerned the FAA Aviation Safety Information Analysis and Sharing (ASIAS) program — a government-industry program that conducts NAS-scale data fusion and analysis (*ASW,* 5/08, p. 25, and 8/09, p. 32) — which had not finalized its draft plan for operations for a period ending in 2022, a time frame similar to that for NextGen implementation (*ASW,* 4/10, p. 30).

"While FAA has issued agencywide guidance on implementing SMS and has some efforts such as ASIAS under way, it does not have a way to measure, or specific times to indicate, full implementation," the report said. FAA officials and GAO reviewers agreed that full SMS and ASIAS implementation will take years, but disagreed about how best to manage this process.

Both organizations also recognized that the amount of time and work required for data analysis have been difficult to project. For automated high-volume searching, coding, integration, interpretation and analysis of narrative data, the FAA had to develop an ASIAS-specific text-mining process. "FAA has efforts under way to address two key [ASIAS] challenges: … Data are not coded to permit electronic integration, analysis and sharing [and] data from two voluntary reporting

Increased rates of landings could generate greater airport surface congestion and risk of taxiway collisions.

programs lack identifying details needed for some types of analysis, and … do not remain available for long-term analysis," the report said. Coding disparities in the original definitions, event identifiers and classifications also have complicated the integration of quantitative and qualitative/narrative data.

ASAPs and FOQA

Participants in aviation safety action programs (ASAPs) and flight operational quality assurance (FOQA) programs adhere to rules for maintaining confidentiality and trust through data de-identification processes and, with a few exceptions, protections against public disclosure or disciplinary action by the FAA or an employer for operational errors. The NTSB told GAO reviewers that — in numerous investigations of serious incidents and accidents — FOQA data alone had not revealed any precursor. As opportunities emerge for data integration, however, a conflict among safety objectives can arise.

This year, the MITRE Corp., which aggregates and analyzes the data from 28 ASIAS-participant air carriers with FOQA programs and from 13 of these carriers with ASAPs, began quarterly briefings of the ASIAS Executive Board on work in progress, including provision of industry benchmarks enabling comparisons of individual airline performance to aggregate performance. In total, 73 U.S. airlines have one or more ASAPs and 36 have FOQA programs.

"Details of reported incidents are redacted from ASAP and FOQA data before an FAA contractor analyzes the data," the report noted. "These details include the date, time and flight number, and the names of the carrier or individuals involved. … Additionally, ASAP and FOQA data are retained for only three years. Without identifying details and without maintaining data for longer periods, opportunities for some analyses are limited."

One accepted workaround for this conflict of safety objectives is case-by-case permission from the ASIAS Executive Board, which represents industry and government, for MITRE to perform "a specific, defined analysis [directed study] and to use data with the identifying details needed for that particular analysis," the report said.

Similar problems surface in comparing other sources with NASA's Aviation Safety Reporting System (ASRS) reports. "While FAA's contractor loses access to ASAP reports after three years, about 62 percent of ASAP reports appear in ASRS, along with other reports voluntarily submitted by industry personnel, according to a NASA official," the report said.

The GAO also contrasted NASA's reluctance to comment on individual ASRS or ASAP reports with the CHIRP practice of advisory board review and comment on lessons learned from selected reports. "NASA noted that, in the past, it had an ASRS advisory committee that had provided a forum for FAA and industry to discuss corrective action," the GAO report said. "The agency acknowledged the need to re-establish this committee."

Reviewers found that despite adhering to data quality standards, processes for intake of ASAP and ASRS reports have limited control over completeness or accuracy of the content. "Voluntarily reported data are subjective and are not always accompanied by supporting documentation, such as statistics, measurements or other quantifiable information related to the reported events," the report said. Distortions, omissions and errors may not imply failures or bad intentions of the reporter, however. Factors that influence completeness and accuracy include "the reporter's experience, visibility conditions, the duration of the event, and any trauma experienced by the reporter," the report added.

Missing Denominator

For decades, the availability of exposure data to calculate rates of accident/incident occurrence — such as number of fatal accidents per million departures — has been a key to monitoring airline safety trends, the report said. "FAA's ability to monitor and manage risk for certain industry sectors, such as general aviation, air ambulance operators and air cargo carriers, is limited by incomplete data," the report said. "[FAA] does not collect actual flight activity data for smaller air carriers that provide on-demand service, such as [air cargo,] air taxis and air ambulances, and general aviation operators. …

"Without data on the number of flights or flight hours, FAA and the air ambulance industry are unable to determine whether the increased number of accidents has resulted in an increased accident rate, or whether it is a reflection of growth in the industry. … Lack of operations data for small cargo carriers makes it difficult for FAA to prioritize risks and better target safety improvements and oversight to the areas of highest risk."

The report also cited new or reiterated NTSB proposals for FAA safety data enhancement, including needs for "new approaches to data analysis rather than simply combining existing data sources into an analysis program" and mandatory reports from airlines on a wider scope of aircraft airworthiness and maintenance-related events.

This article is based on the May 2010 GAO report no. GAO-10-414, "Improved Data Quality and Analysis Capabilities Are Needed as FAA Plans a Risk-based Approach to Safety Oversight," available at <www.gao.gov/new.items/d10414.pdf>.

Departure from THE NORM

The pilot flew the R44 low and slow on the Western Australia sightseeing flight.

@ Chris Sorensen Photography

BY LINDA WERFELMAN

The pilot of a Robinson Helicopter R44 Raven had deviated from the regular scenic tour route in a mountainous area of Western Australia and was flying slow and close to the ground when the helicopter crashed, killing the pilot and all three passengers, the Australian Transport Safety Bureau (ATSB) says.

The ATSB, in its final report on the accident, identified the departure from the "regular scenic flight track, speed and profile" as a contributing safety factor in the Sept. 14, 2008, crash.

Other factors were that the "out-of-ground-effect[1] hover performance of the helicopter was likely to have been marginal" and that the "high level of engine power required to sustain a hover in the local conditions either was not available or was not fully utilized by the pilot, resulting in the sequential development of an uncommanded descent, overpitching,[2] significant main rotor RPM decay, a high rate of descent and collision with terrain," the report said.

The accident helicopter was one of four R44s that were flown on sightseeing flights from a sub-base at the Purnululu Aircraft Landing Area (ALA) at the southwestern tip of the Bungle Bungle mountain range in Purnululu National Park, 250 km (135 nm) south of Kununurra, Western Australia.

The morning of the accident, the helicopter was flown by other pilots on three sightseeing flights. At the same time, the accident pilot flew another R44.

Around 1230 local time, the pilot and his three passengers boarded the accident helicopter for what was to be an 18-minute flight. The pilot designated a search and rescue time — SARTIME, or the time at which search and rescue was to begin if there was no contact from the pilot — of 1250.

At 1250, when the helicopter had not returned to the ALA, other company pilots tried unsuccessfully to contact the helicopter by radio and then searched in another of the company's helicopters. The pilot who initiated the search saw smoke northeast of the ALA, and when he flew toward it, he found the wreckage of the accident helicopter.

A digital camera recovered from the wreckage contained images taken by one of the passengers that showed that around 1245, the helicopter left the regular route and traveled south, toward an area of distinctive rock formations.

"The helicopter's speed and height, as derived from this sequence of images, was not consistent with the standard scenic flight parameters," the report said. The last image was taken when the helicopter was about 80 m (262 ft) from a rock face and about 100 ft above the level of the accident site.

R44 Endorsement

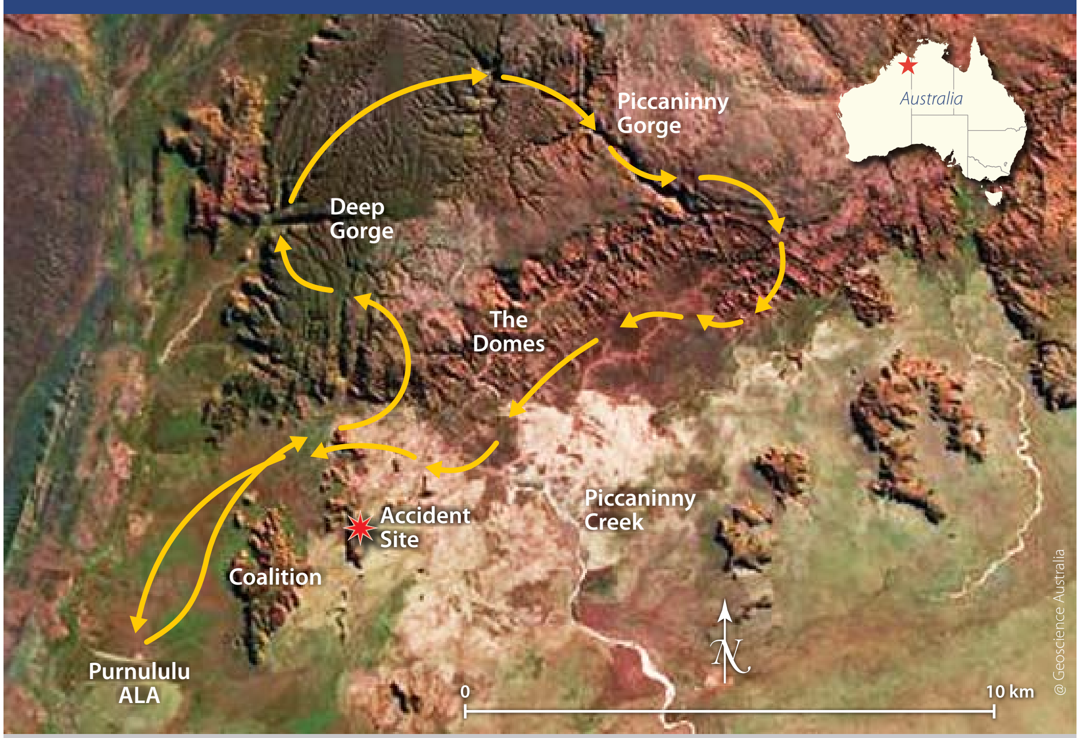
The accident pilot received a commercial pilot license in 2002. He flew sporadically for several years, until he began refresher training with the operator in August 2007. That training consisted of flight in an R44, and in operations in confined areas, power limitations, autorotation and "a check of the pilot's understanding of overpitching." In January 2008, he received an endorsement for R44s and was certified for satisfactory completion of a flight review.

In May 2008, he began conducting scenic flights in the Bungle Bungle area on a regular basis, and at the time of the accident, he had accumulated 477 flight hours in helicopters, including 346 hours in R44s. He held a Class 1 medical certificate, and there was no indication of any physiological problem that might have contributed to the accident, the report said.

On July 14, 2008, he underwent a standard 180-day flight check, including autorotation, low-level maneuvering and confined-area training, as well as ground training. The report on the flight check noted that "confined areas need[ed] more work," but there were no details.

The helicopter was manufactured in 2006 in the United States

Intended Route of Accident Flight



ALA = aircraft landing area

Source: Australian Transport Safety Bureau

Figure 1

and registered the same year in Australia. Its total time in service was 1,533 hours. The engine — a Lycoming 0-540-FIB5 — was new when it was installed at the factory and was top-overhauled at about 823 hours total time.

A 100-hour inspection was conducted Aug. 20, 2008, about 76 hours before the accident, and the last recorded maintenance was performed Aug. 29, when new bearings were installed in the main rotor hub, along with a subsequent adjustment of system components.

The pilot on the flight before the accident flight said that the helicopter had performed well. The helicopter apparently was refueled, with fuel from the operator's fuel storage facility, after that flight, but documentation was not available, the report said.

The helicopter's weight for the accident flight was within limits.

Weather at the accident site was described as hot, cloudless and dry, with light winds. The nearest site for recorded hourly observations was about 100 km (62 mi) to the southwest, where surface winds were from the southwest to southeast at less than 5 kt, with gusts to 10 kt, and the temperature was 35 degrees C (95 degrees F). Moderate thermal turbulence was considered likely below 9,000 ft.

The wreckage was found in a flat site at the base of a rocky, upsloping area. The helicopter was "seriously damaged" by the impact and a subsequent fire, the report said, noting that it had struck the ground upright, with the right skid low and at a high vertical speed but little or no forward speed.

An examination of the engine revealed no anomalies, other than damage from the impact and the fire.

Specific Route

The company operations manual allowed flight at altitudes below 500 ft in specific circumstances — but those circumstances did not include during sightseeing flights over the Bungle Bungles.

"While the operations manual section regarding scenic flights over the Bungle Bungles did not provide specific operational parameters, a number of pilots stated that they were generally trained to follow a specified route," the report said. "Altitude was varied during flight to maintain a minimum of 500 ft above ground level [AGL] while maintaining about 80 kt indicated airspeed."

The operator said that pilots who flew over the Bungle Bungles were "selected, trained and checked to the standard required to safely conduct those flights."

Another section of the operations manual discussed aerial photography, describing it as an "extremely demanding" operation and noting that a pilot engaged in such a mission should have a "thorough understanding of the limitations of the helicopter when operating out of ground effect at high gross weights, low indicated airspeeds and out of wind."

Australian Civil Aviation Safety Authority (CASA) standards, outlined in the *Day VFR Syllabus — Helicopters*, do not discuss the risks of an out-of-ground-effect (OGE) hover, or of avoiding, and recovering from, low-rotor RPM. Nevertheless, the aeronautical knowledge syllabus says pilots should understand the power available/power required curves, as well as overpitching. The flight training syllabus includes "avoidance of the manufacturer's height velocity (H-V) diagram avoid area in hovering flight"; confirmation of helicopter performance, including power checks as applicable, when landing in a confined area; [and] execution of limited power takeoff, approach and landing."

Neither the *Flight Instructor's Manual — Helicopter*, published by CASA and the Civil Aviation Authority of New Zealand, nor the civil aviation advisory publication about flight reviews presented specific guidance about OGE hover, the report said.

Pilot Survey

As part of the accident investigation, eight experienced helicopter pilots were questioned about their understanding of slow OGE flight.

"Overall," the report said, "the participants did not perceive that there were significant deficiencies in the generic pre-license training

Pilots who flew over the Bungle Bungles were 'selected, trained and checked to the standard required to safely conduct those flights.'

requirements. There was general agreement … that pre-license training was 'basic training' and was conducted in a relatively benign environment that was inherently limited in its capacity to prepare pilots for all possible helicopter operating environments. …

"There was also general agreement that the Robinson R22 and R44 helicopters, with their relatively low inertia rotor system, engine governor, throttle correlation system and derated engines, were different [from] other piston-engine helicopters. It was reported that pilots flying the R22 and R44 were not always aware of the applicable engine power limits and did not always adhere to those limits."

'Most Likely Scenario'

Investigators were unable to determine whether the engine was rotating at impact but concluded that the unsuitability of the accident site for landing after an engine failure, along with the availability of more suitable sites nearby, indicate that if there had been an engine failure, it "had not occurred from the cruise height and speed applicable to the anticipated scenic flight profile."

The report said it was most likely that, "at slow speed or the hover, the engine power required exceeded the engine power available or selected, with a consequent descent. The pilot probably responded instinctively by raising the collective lever, which further increased main rotor drag and therefore the power required, leading to main rotor RPM decay (overpitching), a low rotor RPM warning and an increased descent rate."

By departing from the usual scenic flight profile, the pilot "negated the operator's risk control for those flights not to be conducted below 500 ft above ground level," the report said, adding that, by slowing to an OGE hover, the pilot "committed to a more difficult maneuver than that intended by the operator for the scenic flight. Had the operator been aware of the pilot's intent, the informal requirement for the senior pilot at the operator's Kununurra base to be involved in the tasking of a suitable pilot may have meant that the flight did not occur or that a different pilot was involved."

The report noted that the U.S. Federal Aviation Administration (FAA) has ordered additional pilot knowledge and safety training requirements for pilots of R22s and R44s, specifically to address the "insidious and critical nature" of low main-rotor RPM; when the report was written, no such requirements existed for flight training in Australia.

Safety Actions

On Sept. 19, 2008, five days after the accident, the operator's chief executive officer issued a memo to remind pilots of the company's policy about authorization of flights and that "it was unnecessary to operate any helicopter within the height-velocity avoid area during routine charter and scenic flights," the report said. They also were told not to operate below 50 kt while flying in cruise below 1,000 ft AGL on sightseeing flights, and not to deviate from published scenic flight paths, except in an emergency or "as deemed necessary by the pilot-in-command." Any deviation under those circumstances was to be reported to the chief pilot.

The operator also ordered check flights with all pilots before the start of each tourist season, along with follow-up check flights; took steps intended to ensure that pilots were aware of Robinson Helicopter Co. Safety Notice SN-34, which discussed the hazards of low, slow flight; and established a Web-based safety-reporting system for communicating operational requirements.

CASA said after the accident that it would review initial and recurrent pilot training requirements — action that the ATSB said "could be expected … [to] address the safety issue" identified in the accident report.

The ATSB also issued Safety Advisory Notice SAN AO-2008-062-SAN-098 to draw operators' attention to "the potential lack of assurance that informal operator supervisory and experience-based policy, procedures and practices minimize the risk of their pilots operating outside the individual pilot's level of competence. Operators are encouraged to consider the safety implications of this safety issue and take action where considered appropriate."

This report is based on ATSB Transport Safety Report AO-2008-062, Collision With Terrain, 6 km NE of Purnululu ALA, Western Australia, 14 September 2008, VH-RIO, Robinson Helicopter Company R44 Raven.

Notes

1. Flight in ground effect usually occurs when a helicopter is less than one rotor diameter above the surface, the ATSB report said, citing the FAA's *Rotorcraft Flying Handbook*. At this height, helicopters require less power to hover because of "the cushioning effect created by the main rotor downwash striking the ground." Operations conducted above that height are said to be "out of ground effect." In an R44, the rotor diameter is 33 ft (10 m).

2. The report describes "overpitching" this way:

   If a pilot selects a high collective setting that, in the prevailing conditions, produces rotor drag greater than the available engine power, the main rotor RPM will decrease below the governed RPM of between 101 and 102 percent. That situation is termed overpitching, and can develop into a critical condition known as blade stall.

BY RICK DARBY

Turnaround Story

Risk also lurks *between* flights.

Ground operations accidents and incidents were dominated by one causal factor — failure to comply with clearances — according to a study conducted by the Australian Transport Safety Bureau (ATSB) of occurrences at Australian airports, 1998–2008.[1,2] The occurrences occurred most frequently on taxiways, at the gate and during pushback.

Ground operations accidents and incidents — called "occurrences" by the ATSB — are rarely spectacular enough to make headlines in the popular press. Nevertheless, they represent a risk significant enough that Flight Safety Foundation targeted them in its Ground Accident Prevention program. Based on data from the International Air Transport Association, the Foundation estimates the injury rate at nine per 1,000 departures. According to the *Boeing Statistical Summary of Commercial Jet Aviation Accidents* (*ASW*, 8/10, p. 48), two accidents claimed the lives of ground workers in 2009: On May 19, at Miami, a cargo loader fell from a ladder to the ramp; on Dec. 21, a deicer fell from the bucket to the ramp.

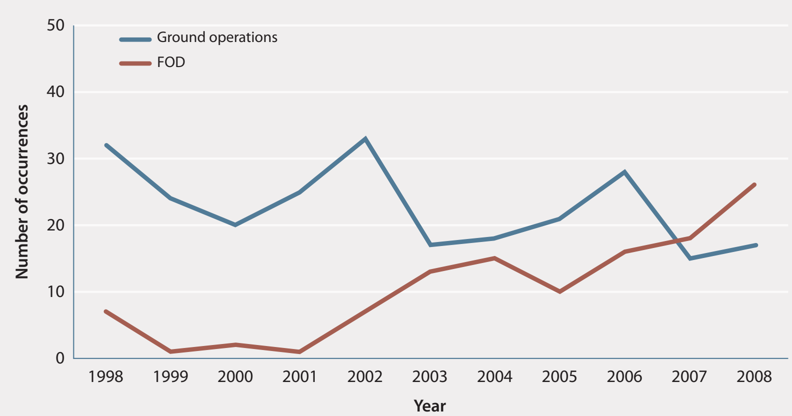
"Ground operations are potentially one of the most dangerous areas of aircraft operation," the report says. "They include any services necessary to manage an aircraft's arrival and departure from an airport. Commercial aviation generally operates on small profit margins, and short aircraft turnaround times are critical for airline efficiency. … In some circumstances, ground operations do not go as planned or as required, resulting in safety occurrences which are the focus of this report."

The number of ground operations workers involved in airliner turnaround is usually larger than that of crewmembers for the flight. Their various tasks must be performed according to clear rules and guidelines to avoid conflicting with aircraft, including moving aircraft other than those being serviced.

Of the 398 ground occurrences reported in the study period, about 71 percent were associated with ground operations and the rest with foreign object debris (FOD), the report says. FOD occurrences increased notably during the study period (Figure 1). Ground operations occurrences trended slightly down, with peaks in 2002 and 2006; the report has no explanation for the increases in those years.

During the study period, there were 282 ground operations occurrences. Those on a taxiway, at the gate or during pushback accounted for 34 percent, 28 percent and 26 percent of the total, respectively, for a combined 88 percent of occurrences.

Occurrences, Australian Airports, 1998–2008



FOD = foreign object debris

Note: Airports are those serving high-capacity aircraft.

Source: Australian Transport Safety Bureau

Figure 1

Six types of ground operations occurrences represented about 75 percent of the total. "Failure to comply with a clearance," at 28 percent of the total, was most common type, representing more than double the next highest type, "collision or contact with an aircraft by a vehicle," 13 percent of the total.

More than three-quarters of the ground operations occurrences had no "consequential events," the report says. About 20 percent of the total ground operations occurrences were related to ground crew collision with a stationary aircraft, and about 2 percent involved aircraft collision with an object on the ground. Fewer than 1 percent required passenger disembarkation.

The report analyzes the categories of occurrences according to whether they took place on taxiways, at or approaching the gate, or during pushback (Figure 2).

"About 77 percent of taxiway occurrences involved a deviation by vehicles from a surface movement controller clearance (not a runway incursion)," the report says (Figure 3). Such failures, the report says, included using an incorrect taxiway; failing to stop at a taxiway holding point; failing to stay on the surface-movement control frequency; and failing to seek a clearance.

"The occurrences where vehicles nearly collided with aircraft involved a range of vehicles, including cars belonging to the Australian Customs and Border Protection Service, catering trucks, tugs and fuel trucks," the report says.

Near collisions between aircraft on the ground were "infrequent, but potentially serious," the report says, adding that "separation standards apply to aircraft in the air, but there are no specific separation standards on taxiways — much the same as cars on the road."

In those near collisions, "some aircraft were taxiing at a high groundspeed, in one case estimated to be 30 kt; there are no speed limits for taxiing aircraft."

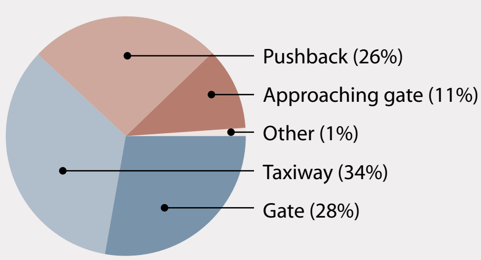
Gate occurrences, the second-most-frequent type of ground operations occurrences, were analyzed according to three subcategories: approaching the gate, at the gate and pushback.

The most commonly reported subcategory of approach-to-gate occurrences was "near-collision with aircraft by vehicle" (Figure 4). "These occurrences required immediate braking action by the flight crew or vehicle driver in order to avoid a collision," the report says. "Occasionally, cabin crew were injured during these events, as they were out of their seats preparing for arrival; the act of sudden braking threw them off balance."

The second-most commonly reported occurrence in the approach-to-gate subcategory was "ground equipment/obstacle clearance." Generally, this meant a vehicle operating outside its prescribed clearance area as an aircraft approached the gate.

Occurrences at the gate most often involved actual collision or contact — rather than near-collision — by a vehicle and an aircraft (Figure 5). The report says that this subcategory was probably under-reported, because the ATSB only learns of accidents and incidents while an

Ground Operations Occurrence Types, Australian Airports, 1998–2008

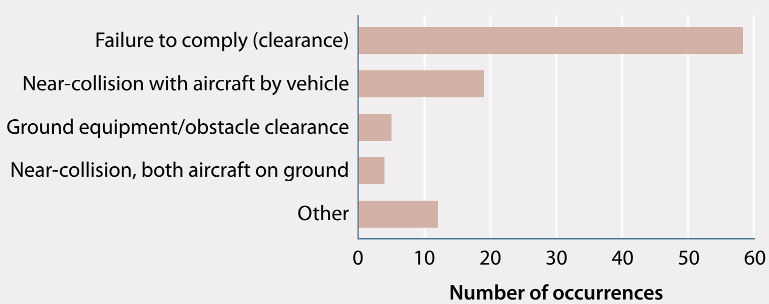


Note: Airports are those serving high-capacity aircraft.

Source: Australian Transport Safety Bureau

Figure 2

Taxiway Occurrences, Australian Airports, 1998–2008

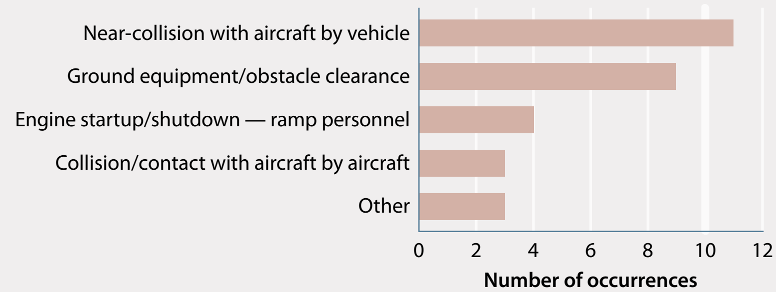


Note: Airports are those serving high-capacity aircraft. Occurrences in the "Other" category involved a vehicle that was parked in the instrument landing system critical area when weather was below minimums; vehicles on perimeter roads operating contrary to traffic lights used to stop vehicles when aircraft land (two occurrences); and a large aircraft making a 180-degree turn, damaging lighting and pavement.

Source: Australian Transport Safety Bureau

Figure 3

Approach-to-Gate Occurrences, Australian Airports, 1998–2008

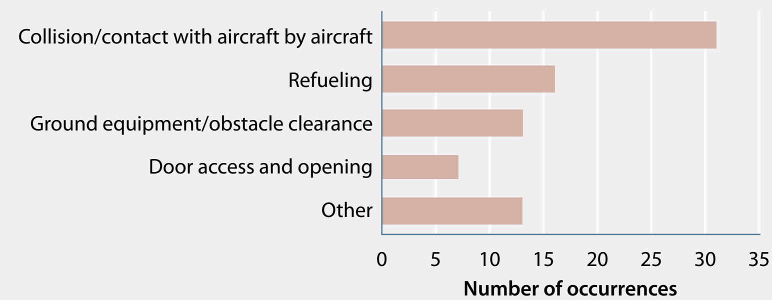


Notes: Airports are those serving high-capacity aircraft. Occurrences in the "Other" category involved disembarking passengers; flight crew taxi techniques; and ground crew approaching the aircraft engines before the aircraft had stopped.

Source: Australian Transport Safety Bureau

Figure 4

Gate Occurrences, Australian Airports, 1998–2008



Note: Airports are those serving high-capacity aircraft. "Other" occurrences involved wind forcing an aircraft away from the gate; an aircraft collision with infrastructure; operating a vehicle without a clearance; and aircraft parking clearance and congestion.

Source: Australian Transport Safety Bureau

Figure 5

aircraft is being prepared for takeoff or before disembarkation of passengers and crewmembers.

"Damage occurred in 45 percent of reported occurrences where the aircraft was at the gate," the report says. "Most of the damage came from vehicles, but three occurrences involved ground equipment collisions and [another] involved an aircraft rolling and striking a terminal wall."

Among vehicles colliding with aircraft at the gate, the most common were cargo or container loaders; mobile stairs; and catering trucks (Table 1, p. 52). Of collisions at the gate, "about 50 percent occurred as the vehicle or object was being driven up to, or away from, a door," the report says. "Approximately 23 percent of vehicle or object collisions involved contact with a wing, horizontal stabilizer or engine. …

"It is interesting to note that airlines using predominantly hand-push vehicles for loading and unloading of luggage and passengers appear to have fewer ground operations occurrences involving damage. Use of motorized vehicles around aircraft cannot be totally eliminated, as pallet container and catering trucks must continue to lift heavy items into the cargo hold of an aircraft."

Pushback occurrences, the third-most frequently reported category in ground operations, were identified as those occurring during the time between connection of a tug or PPU and the time an aircraft taxies under its own power. "Commonly, pushback might involve up to four ground personnel, including a tug or PPU driver, a dispatcher and possible observers," the report says.

Pushback involves a strict sequence. "This includes connecting the push unit [tug], releasing the aircraft brakes, pushing the aircraft back onto the taxiway and disconnecting the push unit," the report says. "A clear line of communication is required at all times between flight and ground crew. With PPU [power push units] and tug towbar pushes, a large amount of energy is exerted on the aircraft nose or main landing gear to provide enough inertia to move the aircraft. Sometimes these components fail, and this poses a significant risk to the tug unit and driver, as the driver is usually positioned under the aircraft."

Four subcategories dominated, in total accounting for about 80 percent of pushback occurrences: tug or PPU connection and breakage; failure to comply with pushback clearance procedures; inadvertent aircraft door opening; and collision with aircraft by a vehicle (Figure 6, p. 52).

Occurrences involving tug or PPU connections and breakages consisted of events such as pushback begun with the airbridge still connected; pushback begun without inserting the aircraft steering lockout pin; premature disconnection, resulting in the aircraft rolling forward or backward; and using an incorrectly configured tug for the aircraft, causing the tug roof to strike the aircraft fuselage.

FOD occurrences, which increased from seven in 1998 to 26 in 2008 — a 271 percent jump — were "most frequently reported during the busiest hours of operation at most airports in Australia, between 7 a.m. and 7 p.m.," the report says.

"FOD comes from many sources. Material sometimes falls from aircraft, maintenance vehicles and aircraft handling equipment onto runways, taxiways and the airport aprons [ramps]. In the case of aircraft, the physical stresses exerted during takeoff and landing place high loads and vibrations on tires, engines (reverse thrust) and landing gear components, which can cause poorly secured components to loosen and separate."

The most common form of FOD reported — about 25 percent of the FOD occurrences — was aircraft components, the report says.

"In terms of high-capacity aircraft, components making up the engine reverse-thrust assemblies were most commonly reported and included blocker doors, door assembly pins and bolts, bushes, and plates," the report says. "Less commonly reported FOD items from aircraft were landing gear doors, de-laminated material from flaps and control surfaces, struts and landing lights. Most of these components were found on the runway strip rather than on or near taxiways and airport aprons."

Tools or equipment accounted for about 19 percent of FOD occurrences. "The reports showed [that] a variety of tools and equipment were found on runway strips, taxiways and aprons, including screwdrivers, a 15-L [4-gal] can of paint, spanners and wrenches, a torch [flashlight], wire, a headset and rags."

About 11 percent of reported FOD occurrences damaged airframes, wheels or engines. Four FOD occurrences occurred during takeoff, with one resulting in engine ingestion of the FOD and a return to the gate, and three tire blowouts entailing a rejected takeoff and return to the gate.

"FOD occurrences leading to aircraft damage occurred not only on the runway strip, but on taxiways and the aerodrome gate," the report says. "Nine of the 116 occurrences … occurred on the aerodrome apron and 12 occurred on taxiways. Examples of foreign objects found on aprons and taxiways included a box, paper and plastic sheets, which are all capable of being ingested into an engine."

Vehicle Types Causing Damage, Australian Airports, 1998–2008

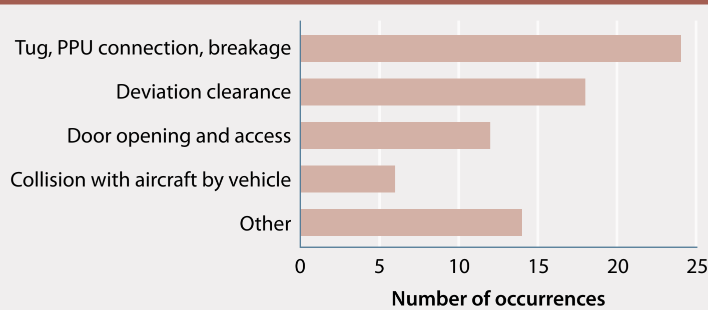
Vehicle Causing Damage	Number	Percent
Cargo or container loader	8	24.2
Mobile stairs	8	24.2
Catering truck	4	12.1
Airbridge	3	9.1
Passenger lifter	3	9.1
Belt loader	3	9.1
Tug	2	6.1
Baggage trolley	1	1.3
Fuel truck	1	1.3
Total	**33**	**100.0**

Note: Airports are those serving high-capacity aircraft.

Source: Australian Transport Safety Bureau

Table 1

Pushback Occurrences, Australian Airports, 1998–2008



PPU = power push unit

Note: Airports are those serving high-capacity aircraft. "Other" occurrences included near aircraft-aircraft collisions; near vehicle-aircraft collisions, where pushback was stopped to avoid a collision; flight crew monitoring lapses, including making sure the aircraft dispatcher was disconnected before starting to taxi; and ground crewmembers being close to an operating aircraft engine.

Source: Australian Transport Safety Bureau

Figure 6

Notes

1. ATSB. *Ground Operations Occurrences at Australian Airports 1998 to 2008.* ATSB Transport Safety Report, Aviation Research and Analysis AR-2009-042. June 2010. Available via the Internet at <*www.atsb.gov.au/media/1529837/ar2009042.pdf*>.

2. The data are for airports that accommodate high-capacity aircraft, those with a maximum payload greater than 4,200 kg (9,259 lb) or more than 38 seats.

   Occurrences are divided between *ground operations occurrences* and *foreign object debris* (FOD). Ground operations occurrences are defined as "operations involving aircraft handling, and operations on the airport apron and taxiways, as well as movements around the aerodrome."

   FOD occurrences are defined as "any object found in an inappropriate location that — as a result of being in that location — can damage equipment or injure crew, passengers or airport personnel."

Inside Air France 447

An unofficial investigative team tries to reconstruct the fatal accident.

VIDEO

Documentary Speculation

Crash of Flight 447

Written and directed by Kenny Scott. To be broadcast in the United States on the Public Broadcasting System, Oct. 26, 2010.

The camera takes us inside the cockpit of Air France (AF) Flight 447, an Airbus A330 flying from Rio de Janeiro to Paris on June 1, 2009. It is night, 35,000 ft over the Atlantic Ocean, three hours into the flight. One of the pilots calmly makes a position report to Brazil air traffic control.

A thunderstorm appears on the weather radar display. The captain illuminates the "fasten seat belt" sign for the passengers and issues a brief announcement notifying them to expect turbulence. He then plans a course deviation. So far, everything is routine. After that, nothing is. What the narrator calls "an incredible chain of events" begins.

We are not, of course, peering into the actual AF 447 cockpit on that night, but a dramatic re-creation in a flight simulation training device. The illusion of being with the pilots on that flight, which crashed into the ocean with a loss of all 228 people aboard, is intercut with analysis of the event.

No final accident report has been issued by the French Bureau d'Enquêtes et d'Analyses (BEA). The investigation has been hampered by the inability, so far, to recover the flight data recorder and the cockpit voice recorder from the accident airplane.

This program is based on the tentative findings of its own unofficial investigative team, which did not have access to the recovered parts of the A330 but was able to look at photographs of the parts. Team members included Martin Alder, a captain and training pilot for Airbus airplanes; John Cox, a former airline captain who is now chief executive officer, Safety Operating Systems, and an *AeroSafety World* contributor ("No Smoking in the Cockpit," 1/09, p. 31); John K. Williams, a weather expert; Jim Wildey, a structural engineer; and Tony Cable, a former aviation accident investigator.

A series of visual annunciations to the pilots that began with "ADVISORY CABIN VERTICAL SPEED" were transmitted automatically by the A330's datalink aircraft communications addressing and reporting system (ACARS) and recorded. A cascade of system failures followed.

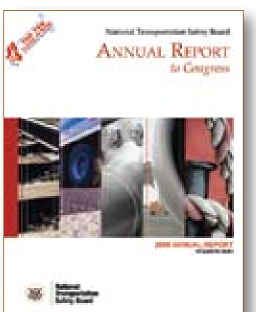
The team believes that the initial failure was due to the icing of all the pitot tubes, as preliminary BEA investigative reports and speculation have suggested. Why could that have happened, since pitot tubes are heated to withstand cold and storms at altitude? They suggest that the pitot tubes fell victim to supercooled liquid water — "instant ice," as one of them says. Their search of previous incident reports reveals 32 failed pitot tube events in A330s or A340s in the previous six years, including about one a week in the two months preceding the AF 447 accident.

Their accident scenario is based on informed speculation and may not coincide with findings of the eventual final report of the official investigating agencies.

The team speculates that the airplane entered a powerful thunderstorm that was hidden from their radar display by a nearer, smaller storm. Assuming the pitot tubes malfunctioned, there was no airspeed data for either the autopilot or the crewmembers to use. The automatic flight systems disengaged and the pilots took manual control.

"When things go very wrong, the last line of defense is the aviator," Cox says.

The pilots tried to maintain the necessary pitch and engine power to keep the airplane from stalling, the team suggests, but in the end they were defeated by the lack of critical airspeed data. "If Flight 447 speeds up or slows down by as little as 10 kt, it could suffer a … stall," the narrator says. The crew's attention may also have been distracted from the thrust settings by the many fault warnings they were receiving.



Cable finds support in the record of earlier incidents for the theory that the thrust setting selected became unsafe. The narrator says, "In 10 previous incidents of pitot probe failure, the crew fails to immediately control thrust. … In five cases, crews don't take control of thrust [until] more than 60 seconds [have elapsed]. For Flight 447, that would mean rapid deceleration and the risk of a sudden stall."

The team surmises that inhibition of lift because of airflow detachment from the wings resulted in a rapidly descending aircraft, possibly accompanied by a severe roll — "more like a fighter jet than a passenger airliner," the narrator says. "Most airline pilots have limited experience dealing with this type of event [loss of control in flight]."

Cable says, "In recent years, the single biggest cause of accidents has become loss of control. … It has raised the question about whether the situation is actually being made worse by the increasing automation, whereby crews don't get a great deal of opportunity to manually fly the aircraft."

However, the narrator adds, "Without [retrieving] the 'black' boxes and their vital data, there can be no definitive proof."

The program's production values are outstanding, using computer graphics imagery to demonstrate pitot tube icing, control surface changes, pitch and roll, and other characteristics. The simulator re-creation of the heightened workload in the cockpit when one system after another failed — accompanied by audio alerts and flashing and multi-colored visual annunicators — realistically conveys the extremely stressful flight deck environment. The simulator motion and hand-held camera movements mimic the heaving "office" the flight crew was working in once the crisis began. The pace of the cutting between shots offers a visual analogue of the increasing urgency that unfolded before the pilots.

An empathetic viewer cannot help experiencing uncomfortable moments.

— Rick Darby

REPORTS

A Status Report From NTSB

U.S. National Transportation Safety Board Annual Report to Congress: 2009 Annual Report

U.S. National Transportation Safety Board (NTSB). Report no. NTSB/SPC-10/01. July 2010. 187 pp.

The NTSB issued 138 aviation safety recommendations in 2009, the report says. Of those, as of the publication date, 42 recommendations were closed in "acceptable" status, and 22 in "unacceptable" status. Responses to the others are pending.

Issues that were added to the "Most Wanted Safety Recommendations" for Aviation in February 2010 urge the U.S. Federal Aviation Administration to "improve oversight of pilot proficiency" and "reduce accidents and incidents caused by human fatigue."

For pilot proficiency, the "issue areas" include asking the FAA to evaluate prior flight check failures for pilot applicants before hiring, and "provide training and additional oversight that considers full performance histories for flight crewmembers demonstrating pilot deficiencies." The fatigue recommendations "address fatigue [risk] management systems, which constitute a complement to, but not a substitute for, regulations to prevent fatigue."

In addition to the six major aviation accident investigation launches and 178 accident investigation launches handled by regional investigators, the board participated in 10 investigations outside the United States. The latter involved accidents in Canada, China, Italy, Jamaica, Japan, the Netherlands, Rwanda, the United Arab Emirates and Uganda. It is also a party to the investigation of Air France Flight 447.

The report listed "key challenges" the board faces in accomplishing its mission.

"In order to conduct thorough accident investigations, NTSB investigators must stay abreast of the latest technology employed in the aviation industry, such as composite materials, satellite navigation systems, flight recorders and flight control software," the report says. "Even when free training is available, travel and per diem costs can be significant. The office's challenge is to identify the available resources and manpower to obtain training in these areas. Another challenge is the difficulty in scheduling training due to the number of accidents and limited number of investigators."

The board commented on "significant outcomes and achievements." They included the following:

- "In 2009, the Office of Aviation Safety held four public hearings. To put that accomplishment in perspective, over the past 10 years, the average number of public hearings was less than one per year, and never have more than two public hearings been held in a year"; and,
- "The Office of Aviation Safety [completed] the Colgan Air accident [*ASW*, 3/10, p. 20] investigation in less than one year. It will be the first time in over 15 years that a major investigation with a public hearing has been completed in less than a year."

— *Rick Darby*

WEB SITES

On Ice

"Recommendations for De-Icing/Anti-Icing Aeroplanes on the Ground," <files.aea.be/Downloads/AEA_Deicing_v25_revb.pdf>

The 25th edition, dated August 2010, of "Recommendations for De-Icing/Anti-Icing Aeroplanes on the Ground" has been released by the Association of European Airlines (AEA).

The document was prepared by the AEA's Deicing/Anti-icing Working Group of airline specialists from the deicing/anti-icing field, including the following member airlines: Adria Airways, Air France, Austrian Airlines, bmi, British Airways, Finnair, KLM, Lufthansa, SAS and Virgin Atlantic.

Topics covered in detail are deicing/anti-icing methods with fluids; deicing methods with infrared technology; deicing methods with forced air; a quality assurance program; local frost prevention in cold-soaked wing areas; off-gate deicing/anti-icing procedures; and standardized training.

Editorial, technical and operational changes from the previous edition of the document appear in the introduction. A noteworthy change is that the "AEA Working Group has decided not to use two different holdover time tables for metallic and composite structures. Instead, we have added an indication to all holdover time tables that the given figures are applicable to metallic and composite surfaces." Another change is: "For holdover time purposes, treat snow pellets [and snow grains] as snow."

Application and holdover times are published in seven tables by fluid type and weather condition. A list of reference documents, samples of quality assurance checklists and reports, and a glossary of terminology complete the recommendations document.

A sub-working group consisting of the AEA member airlines bmi, British Airways, Finnair, Lufthansa and SAS addressed training issues. The group prepared standardized training guidelines in a separate document, "AEA Training Recommendations and Background Information for De-Icing/Anti-icing Aeroplanes on the Ground," 7th edition, August 2010. The 195-page guide is available at <files.aea.be/Downloads/AEA_TrainingMan_Ed7.pdf>.

Both documents may be read online or downloaded at no cost.

— *Patricia Setze*

Gateways to Safety Culture

Corporate Aviation Solutions, <www.casolution.com/index.html>

Corporate Aviation Solutions says on its Web site that it provides products and services to "promote and support safety management systems [SMS] for aviation." In addition to descriptions of its products and services, the organization has posted a number of free documents.

The *SMS Template* is a 26-page guide to developing and implementing an SMS that includes "the current industry standard for a corporate flight department safety program." The guide identifies the minimum elements or processes of a corporate SMS needed to report an incident, analyze each hazard to determine the risk level, mitigate the hazard, evaluate the effect of the corrective action and document the complete process. The guide also identifies processes and plans for a more complete safety program. References, sample presentations, sample forms and reporting documents, an example of a risk matrix for determining the level of risk for a particular hazard, and more are included.

There are lists, with Internet links, of International Civil Aviation Organization (ICAO) SMS training standardization course presentations and other relevant ICAO documents and manuals in English, French and Spanish.

Transport Canada has provided James Reason's checklist for scoring a company's safety culture.

A copy of Flight Safety Foundation's (FSF's) *Approach-and-landing Risk Reduction Guide* checklist is available on the Web site. The FSF Approach-and-landing Accident Reduction (ALAR) Task Force designed the guide as part of the Foundation's *ALAR Tool Kit*. The guide is presented as a questionnaire to help pilots, dispatchers and schedulers evaluate specific operations and improve awareness of associated risks.

There is a link to a Web site, <www.safetyskills.com>, where readers can access free online safety training courses on a variety of topics, such as fire safety and slips and falls.

Last, Corporate Aviation Solutions has identified a number of U.S. Occupational Safety and Health Administration (OSHA) documents of importance to corporate aviation. The "Corporate Aviation Plans and Programs for OSHA Compliance" document addresses OSHA safety standards in the workplace. There are Internet links to free OSHA information, presentations and other resources for workplace safety and OSHA compliance on many topics, from equipment use to record keeping.

Two additional links are to free training programs and training materials. One is provided by OSHA's OSHAcademy; the other is provided by Oklahoma State University's Environmental Health and Safety Online Training.

— *Patricia Setze*

Fumbled Numbers

Calculations using the A340's landing weight, rather than its takeoff weight, led to a 'sluggish' departure.

BY MARK LACAGNINA

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

JETS

Late Change Disrupted Preflight

Airbus A340-600. No damage. No injuries.

The pilot flying noticed that the A340's acceleration was slower than it should have been for the takeoff from London Heathrow Airport, but he did not believe that it was particularly abnormal. "He described the rotation as 'slightly sluggish and nose heavy' and noticed that after rotation, the aircraft settled at a speed below V_{LS} [the lowest selectable speed providing an appropriate margin above the stall speed], which prompted him to reduce the aircraft pitch attitude in order to accelerate," said the report on the Dec. 12, 2009, incident by the U.K. Air Accidents Investigation Branch (AAIB).

The climb rate, 500 to 600 fpm, also was sluggish. "The flaps were retracted on schedule, and the aircraft continued its climb," the report said. "At no time was full takeoff thrust selected. Later in the climb, the crew looked again at the TODC [takeoff data calculation] and realized their error." They had used the estimated *landing* weight of the aircraft, rather than its takeoff weight, to calculate takeoff performance and reference speeds.

Following the sluggish departure, the A340, which had 282 passengers and 16 crewmembers aboard, was flown to the destination without further incident. Nevertheless, the AAIB determined that the flight crew's faulty calculations and the aircraft's sluggish departure constituted a serious incident that occurred despite the aircraft operator's "robust" standard operating procedures (SOPs) for calculating and cross-checking takeoff performance.

"The operator used a system whereby the aircraft's takeoff performance would be calculated off-aircraft," the report said. The system involved preflight transfer of data between the flight crew and a centralized computer via the aircraft communications addressing and reporting system (ACARS). As part of the procedure, the crew would send the aircraft's takeoff weight to the computer, along with a request for a takeoff data calculation, while completing the loadsheet and initializing the aircraft's multifunction control and display unit.

"The SOPs required the loadsheet procedures to be led by the commander and checked by the copilot, and the TODC procedures to be led by the copilot and checked by the commander," the report said. "Nine independent cross-checks were built into the procedures, including a requirement for the actual takeoff weight to be written on the TODC printout alongside the takeoff weight used for the calculation to provide a gross error check."

In this case, however, the flight crew's preflight preparations were disrupted by a late change to the A340's zero fuel weight, and the procedures involved in completing the loadsheet and calculating takeoff performance were conducted out of order. The report said that the disruption of the preflight procedures, plus time pressure on the crew, likely were factors when the crew inadvertently included the aircraft's expected landing weight of 236.0 tonnes (519,200 lb), rather than its actual takeoff weight of 322.5 tonnes (709,500 lb), in their takeoff data calculation request. Noting that the expected landing weight, 236.0 tonnes, was within the normal range of takeoff weights for the smaller A340-300 model that the crew also flew, the report said, "The operator considered that this might have been why the crew was not alerted to the error."

The report also said that the cross-checks conducted by the crew were not effective in detecting the error. Based on the erroneous takeoff weight provided by the crew, the centralized computer calculated a rotation speed, V_R, of 143 kt and a takeoff safety speed, V_2, of 151 kt. The correct values for the aircraft's actual takeoff weight were about 15 kt higher: 157 kt for V_R and 167 kt for V_2. The flexible thrust setting provided for the takeoff also was lower than it should have been.

The operator subsequently initiated a review of its loadsheet and takeoff performance calculation procedures. However, the report said, "Adding more cross-checks to the SOPs would probably complicate the procedures with no guarantee that a recurrence of a similar event would be prevented. The pre-departure phase of a flight is a dynamic environment where time pressure and interruptions can create conditions where diligent crews can perform robust procedures incorrectly."

The AAIB repeated recommendations for takeoff performance monitoring systems.

Based on its investigations of this incident and a previous incident involving a takeoff performance calculation error (*ASW*, 12/09–1/10, p. 58), the AAIB repeated recommendations that the European Aviation Safety Agency develop specifications for takeoff performance monitoring systems that would alert flight crews of inadequate performance for the aircraft configuration and airport conditions, and that the agency require the systems aboard transport category aircraft.

Tail Strike Prompts Turnaround

Boeing 737-800. Minor damage. No injuries.

The flight crew felt a "bump" when the tail skid assembly grazed the runway during rotation for takeoff from Dublin (Ireland) Airport the morning of Sept. 11, 2008. They completed the "After Takeoff" checklist, and the commander transferred control to the copilot so that he could assess the situation. "This assessment took some time," said the incident report by the Irish Air Accident Investigation Unit. Noting that the crew continued the climb, the report said that it would have been more appropriate to level at a safe low altitude, in part to prevent the cabin from pressurizing while troubleshooting the problem.

The commander contacted a cabin service attendant who confirmed that a tail strike had occurred. He then resumed control of the aircraft, leveled at 12,000 ft and called for the "Tailstrike on Takeoff" non-normal checklist, which required depressurizing the cabin due to possible structural damage. "As the aircraft was not above 14,000 ft, the passenger oxygen system did not deploy automatically," the report said. The cabin service supervisor told the flight crew that the passenger oxygen masks had not deployed, and the crew attempted to deploy the masks manually. However, three passenger service units did not open and release the nine masks they housed.

The flight crew declared an emergency and received clearance to return to Dublin. They landed the 737 without further incident after being airborne for 21 minutes. After a visual inspection by airport fire services personnel, the aircraft was taxied to a stand, where all 148 passengers disembarked. One passenger requested and received medical assistance, but none of the passengers required hospitalization, the report said.

Damage from the tail strike was confined to scrapes on the tail skid assembly shoe, and the aircraft remained serviceable. The report noted that, because of their longer fuselages, the 737-800 and -900 are more susceptible to tail strikes than earlier models. Another factor that increased the tail strike risk was the aft loading of the incident aircraft. While the aircraft was being prepared for the flight, the outbound passengers had boarded through the rear doors and had taken mostly rear seats while an inbound passenger in a wheelchair was assisted in disembarking through a front exit. The report noted, however, that the aircraft was within center-of-gravity limits.

Investigators were unable to determine why the three passenger service units (PSUs) had failed to open. "The manufacturer has had few reports of PSU compartment doors not deploying correctly during decompression events," the report said. "Usually, these are confined to a single PSU. … One known cause is an incorrectly stowed oxygen mask." Noting that a PSU compartment door can be opened by inserting a small pointed object into one of the holes adjacent to the door-test stop, the report said that some passengers tried to open the doors by striking them with their fists. Cabin service specialists moved the affected passengers to seats with deployed oxygen masks.

The report said that many passengers had become anxious and upset during the incident. "Depressurization normally produces a mist due to condensation. This, coupled with the unusual odor of the chemical oxygen generators functioning, can be alarming to passengers."

Four-Engine Flameout on Landing

British Aerospace 146-200. No damage. No injuries.

After the aircraft touched down on the runway at George, South Africa, the morning of March 19, 2009, the no. 1 engine flamed out and the no. 3 engine spooled down to a "hung" state, in which high-pressure rotor speed stabilized below the normal ground idle speed. The flight crew taxied the aircraft to the apron and noticed, after shut-down, that the thrust modulation system (TMS) lights for the no. 1 and no. 3 engines remained illuminated, which was not normal, said the report by the South African Civil Aviation Authority.

The crew reported the problem with the TMS — which trims, or synchronizes, engine speeds — to company maintenance personnel, who then performed unspecified maintenance. "After the maintenance was completed, the flight crew performed engine ground runs to satisfy themselves of the serviceability status," the report said. "All four engines started normally, and the engine runs were done up to maximum takeoff power (MTOP) without experiencing any further abnormalities. … The captain also simulated an approach and landing scenario by running the engines up to MTOP and selecting the TMS to synchronize but at the same time also retarding the thrust levers. The TMS was assessed as operating normally."

The aircraft was released to service, and 19 passengers boarded for the return flight to Cape Town, 400 km (216 nm) east of George. En route, the captain noticed that the no. 2 engine TMS was not functioning properly. When the thrust levers were set to flight idle on downwind at Cape Town, the no. 2 engine high-pressure rotor speed (N_2) stabilized at 50 percent, while the other three engines settled at the normal 60 percent. When ground idle was selected shortly after touchdown, all four engines flamed out. "The aircraft had enough momentum to roll forward on the runway and vacated onto a taxiway," the report said.

Maintenance personnel advised the captain to restart the engines and taxi the BAe 146 to the apron. "The captain restarted the engines and saw them spooling up to 17 percent, only," the report said. "According to the captain, it appeared as though there was no fuel flow to the engines." He shut them down and had the aircraft towed to the apron, where the passengers disembarked normally.

'According to the captain, it appeared as though there was no fuel flow to the engines.'

Investigators found that another flight crew had reported the TMS as faulty after a flight two days earlier. Maintenance personnel decided to defer the defect and temporarily deactivate the TMS according to provisions of the minimum equipment list (MEL). They pulled the three primary circuit breakers, as required to deactivate the system, but also pulled the four TMS actuator-centering circuit breakers, which was specifically prohibited by the aircraft maintenance manual.

Before the incident flight, the TMS computer and control-display unit were replaced, the three primary circuit breakers were reset, and the deferred defect was cleared from the MEL. However, the four actuator-centering circuit breakers were not reset during this maintenance or during the subsequent maintenance performed at George. As a result, when the TMS disengaged automatically, as designed, during final approach, any actuators that had been retracted by the system did not automatically center, causing the engines to run down below normal speed when ground idle was selected.

Collision With a Tractor

Cessna Citation 550. Substantial damage. No injuries.

The airport traffic controller cleared the Citation flight crew to land when the airplane was about 8 nm (15 km) from the runway at Reading, Pennsylvania, U.S., the afternoon of Aug. 3, 2008. The controller then cleared the operator of a tractor with retractable "batwing" mowing attachments to cross the 6,350-ft (1,935-m) active runway at an intersection about 2,600 ft (792 m) from the approach threshold, said the report by the U.S. National Transportation Safety Board (NTSB).

The controller, who was coordinating both ground and local aircraft operations, then turned his attention to an aircraft that was being taxied to its hangar, and he did not see the Citation touch down or the tractor begin crossing the runway from left to right, as viewed from the approach end.

As the tractor neared the intersection, the mowing attachment on its left side began to drop. "The operator grabbed the control lever to raise the wing to the 'up' position and looked to the left to ensure it was latched," the report said. "As he looked [away from the approach end of the runway], the tractor proceeded onto the runway." The operator told investigators that he saw a "white blur" as the tractor's front window was smashed.

The Citation had touched down about 1,000 ft (305 m) from the approach threshold. The captain said that he saw the tractor enter the runway and steered right in an unsuccessful attempt to avoid it. The airplane had decelerated to about 80 kt when its left wing struck the tractor, which was slightly left of the runway centerline. About 10 ft (3 m) of the wing separated during the collision. Neither the pilots nor the tractor operator was injured.

The report said that the probable cause of the accident was "the air traffic controller's failure to properly monitor the runway environment" and that a contributing factor was "the tractor operator's failure to scan the active runway prior to crossing."

The report also noted that "Federal Aviation Administration publications do not adequately address the need for ground vehicle operators to visually confirm that active runways/approaches are clear prior to crossing [a runway] with air traffic control authorization."

TURBOPROPS

Prop Start Lock Overlooked

Cessna 441. Substantial damage. No injuries.

Surface winds were variable at 3 kt when the pilot initiated a takeoff from a 5,000-ft (1,524-m) runway at Thurgood Marshall Airport in Baltimore the afternoon of Aug. 20, 2008. The pilot said that the airplane began drifting left as it accelerated, and he increased power from the left engine to compensate. The 441 continued drifting left, and the pilot rejected the takeoff when the left main landing gear rolled off the edge of the runway.

"The airplane continued to veer to the left, completely departed the paved surface and struck an earthen mound in the grass," the NTSB report said. "The nose landing gear fractured, and the airplane came to rest approximately 2,500 ft [762 m] beyond the start of the takeoff roll." None of the four people aboard the 441 was injured.

Examination of the airplane revealed that the left propeller start lock had not been disengaged before takeoff. Start locks engage automatically when the engines are shut down and the propeller levers are moved to the reverse setting. They prevent the propeller blades from feathering during shut-down and hold the blades in low pitch to minimize propeller drag and resultant high engine turbine temperatures during subsequent hot starts.

The pilot had 2,485 flight hours, including 1,473 hours in the 441. His inadvertent attempt to take off with the left propeller start lock engaged resulted in an asymmetric thrust condition. "Although there were no discrete annunciators to advise of start lock status, the airplane information manual provided means to recognize and correct when the start locks were not disengaged" before taxi and takeoff, the report said.

Gear Doors Snare Ground Crewman

Bombardier Q400. No damage. One minor injury.

As the aircraft was pushed back from the stand at Isle of Man Airport the morning of Sept. 3, 2009, the commander did not start the engines right away because air traffic control (ATC) had informed him that the departure would be delayed. Then, at the same time the ground crew told the commander to engage the parking brake, ATC told him that there would be no delay.

"He confirmed that the brakes were set, cleared the ground crew to remove the tow bar and received clearance from the ground crew supervisor to start the right engine," the AAIB report said. "He instructed the copilot to start that engine, which caused the forward nosewheel undercarriage (landing gear) doors to close, trapping the ground crewman who was attempting to remove the tow bar. … The commander immediately shut down the right engine, pulled the landing gear door release handle and exercised the elevator to dissipate the hydraulic pressure. The ground crewman was able to release himself with the assistance of his colleague and was taken to hospital with minor injuries [to his right arm and chest]."

The forward nose landing gear doors had been opened — and left open, per normal procedure before the first flight of the day — by company engineers who performed the preflight inspection. The doors remain open until the no. 2 hydraulic system is pressurized during engine start, which normally is performed during pushback, according to the report.

After the incident, the company issued a bulletin instructing pilots to ensure that no one is near the nosewheel bay during engine start; the bulletin also instructed ground crewmembers to ensure that the forward nose gear doors are fully closed before disconnecting the tow bar.

Attendant Suffers Anxiety Attack

Saab 340B. No damage. No injuries.

The airplane was at 20,000 ft, en route with 30 passengers and three crewmembers from Detroit to Marquette, Michigan, the night of July 30, 2009, when the flight crew heard several knocks on the flight deck door. The captain responded with an interphone call that was answered by a passenger who said that the flight attendant had become incoherent and was performing "numerous unusual activities," the NTSB report said.

"The captain advised the passenger to assist the flight attendant to a seat and to stow the service cart that was blocking the aisle," the report said. He then told ATC that he was diverting the flight to Traverse City because of a medical emergency.

"Prior to landing, the captain coordinated with a passenger to ensure that all passengers were seated and using their seat belts," the report said. "The flight made an uneventful landing and was met by paramedics and local law enforcement [personnel]."

Records of the flight attendant's post-incident examination and treatment noted a diagnosis of "acute anxiety/delirium of uncertain etiology [cause], resolved while in the emergency room." The treatment records, as well as a pre-employment medical-history questionnaire, indicated no pre-existing medical or psychiatric conditions.

"According to federal regulations, a single flight attendant was required for the incident flight," the report said. "In addition, there are no medical standards for flight attendants currently stipulated by federal regulations."

The flight attendant had become incoherent and was performing 'numerous unusual activities.'

Nose Gear Jams in Wheel Well

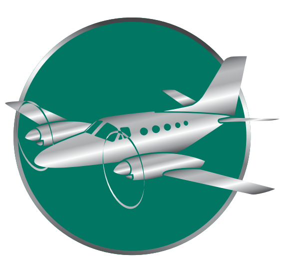
De Havilland Dash 8-300. Substantial damage. No injuries.

When the flight crew extended the landing gear on approach to Philadelphia International Airport the morning of Nov. 16, 2008, they saw indications that the nose landing gear was not properly configured for landing. They conducted a go-around and flew the Dash 8 to an area where they could troubleshoot the problem.

"The first officer transferred airplane control to the captain and performed the alternate landing gear extension checklist," the report said. "However, the anomalous indications remained, and the nose landing gear remained retracted." The crew flew the airplane past the airport control tower, and controllers confirmed that the nose gear doors were open but that the gear itself was not in sight. After several more attempts to lower the gear in consultation with airline maintenance personnel, the crew landed the airplane.

"During the landing, and after the airplane's main landing gear touched down, the captain held the nose of the airplane off the runway until the slowest speed possible," the report said. "After the nose contacted the runway, the airplane slid on it for about 525 ft [160 m] before coming to a stop. There was no fire. The [35] passengers deplaned via the main cabin door and were taken to the terminal by a bus."

Examination of the Dash 8 revealed that the nosewheel steering links had been overloaded and had fractured, allowing the nosewheels to rotate and to become wedged in the wheel well during the approach to Philadelphia. "Hardness testing satisfied the manufacturer's minimum requirements, and no determination could be made as to when the overload occurred," the report said.



PISTON AIRPLANES

Pinched Wire Causes Trim Runaway

Piper Seneca II. Substantial damage. No injuries.

The pilot said that the Seneca pitched down rapidly when he used the electric pitch-trim switch on his control yoke to establish a climb attitude shortly after taking off from Fort Worth, Texas, U.S., the morning of Nov. 17, 2009. "Despite his application of full-up elevator to arrest the descent, the airplane continued to descend," the NTSB report said. "The pilot was forced to make a landing in an open field."

Examination of the airplane showed that the pitch trim was in the full nose-down position and that the original trim switch had recently been replaced during an overhaul of the autopilot. "The switch wiring was not the original wiring and did not correspond to the original color codes on the wires," the report said. "One of the wires was pinched and pressing on the switch wafer stack; according to a representative of the manufacturer, [this] could have resulted in an [electrical short and a] runaway trim condition."

Overrun on a Short, Wet Gravel Strip

Cessna 207A. Substantial damage. Two minor injuries.

The pilot did not calculate the single-engine airplane's weight and balance before attempting to depart from Kongiganak, Alaska, U.S., for a scheduled commuter flight to Bethel the afternoon of Aug. 22, 2008. He told investigators that the tail struck the ground as he was loading the five passengers and "numerous" bags for the flight, but that the tail stayed off the ground after he and his "very large" front-seat passenger boarded.

"The pilot noted that [the airplane] was at or near gross weight but didn't have an exact weight of the airplane at the time he attempted to take off," the report said. He said that the Cessna accelerated slowly and decelerated each time it encountered one of the numerous puddles on the wet, 1,885-ft (575-m) gravel runway.

"About 3/4 down the runway, the airplane lifted off but would not climb," the report said. "The airplane flew over the end of the runway in ground effect … and began to sink. The pilot stated that he added another 10 degrees of flap to the 20 degrees he already had and pulled back on the control wheel to cushion the collision with the tundra." Two passengers sustained minor injuries in the crash.

VMC Roll Downs Air Tanker

Lockheed P2V-7. Destroyed. Three fatalities.

The Neptune had 2,070 gal (7,835 L) of retardant aboard when it took off from Reno, Nevada, U.S., the afternoon of Sept. 1, 2008, to fight a wildfire. Witnesses on the ground saw a fireball emerge from the left auxiliary jet engine shortly after the landing gear was retracted about 200 ft above the ground. The captain told the copilot, the pilot flying, "We got a fire over here." The copilot replied that he was holding full right aileron.

"At no point did either pilot call for the jettisoning of the retardant load, as required by company standard operating procedures, or verbally enunciate the jet engine fire emergency checklist," the NTSB report said. "Recorded data showed that the airplane's airspeed then decayed below the minimum air control speed [V_{MC}]." The airplane rolled steeply left and descended to the ground, killing the pilots and the flight mechanic.

Examination of the air tanker revealed that a fatigue-induced fracture of the 11th-stage compressor disk in the left jet engine had caused the compressor section to fail catastrophically.

HELICOPTERS

Tail Rotor Pitch Link Fails

Eurocopter AS 350-BA. Substantial damage. No injuries.

The pilot was returning to Rosehill, New South Wales, after transporting six passengers to Fitzroy Falls the afternoon of Sept. 19, 2008, when he felt a minor vibration in the anti-torque pedals. "Approximately five minutes after the onset of the vibration, it became violent," said the report by the Australian Transport Safety Bureau. "The pilot entered autorotation, declared a mayday and conducted a run-on landing on the Casula High School oval [athletic field]."

Examination of the helicopter revealed that a tail rotor pitch change link, which had accumulated 2,130 hours of service, had failed, resulting in lateral movement of the tail rotor and damage to the tail boom. "The pitch link had fractured from fatigue cracking that was the result of stresses induced in the link by excessive play in the heavily worn spherical bearing," the report said. "It was probable that bearing wear outside of maintenance manual limits existed but was not detected during the most recent after-last-flight inspection."

Wasp Nests Block Fuel Flow

Bell 47G-2A. Substantial damage. No injuries.

The pilot topped off the fuel tanks before departing from Rensselaer, Indiana, U.S., for a personal flight to Greenville, Michigan, the afternoon of Aug. 11, 2009. The engine lost power about two hours into the flight, and the pilot performed an autorotative landing in a field near Covert, Michigan. The tail boom was damaged when the tail rotor struck a wooden post during the landing.

The power loss had been caused by fuel starvation, the NTSB report said. "Inspection of the helicopter revealed that the left fuel tank was empty and the right fuel tank was full. The right tank fuel vent was completely blocked by mud dauber debris, along with the remains of two mud daubers. The left fuel tank vent was partially blocked by mud dauber debris. Both tanks feed to a central line which provides fuel to the engine."

Boulder Struck During Clearing Turn

Aerospatiale AS 350-B2. Substantial damage. No injuries.

After dropping off six passengers at a helipad near the Colorado River and escorting them to a trail head the morning of Aug. 27, 2009, the pilot restarted the engine to pick up another load of passengers waiting at the top of Grand Canyon, Arizona, U.S. "Boulders had been situated around the perimeter of the helipad by the operator to assist in marking its location," the NTSB report said. "The pilot stated that seconds after becoming airborne, and as he was maneuvering during a left clearing turn to depart the area, the helicopter's tail rotor impacted a perimeter boulder."

The helicopter pitched nose-down and yawed left and right, shuddering violently. "The pilot immediately descended from a hover and landed with the helicopter remaining upright," the report said.

Preliminary Reports, July 2010

Date	Location	Aircraft Type	Aircraft Damage	Injuries
July 3	Hong Kong, China	Agusta–Bell A139	destroyed	13 NA
The helicopter was ditched in Victoria Harbour after a tail rotor problem occurred on takeoff. No fatalities were reported.				
July 4	Alpine, Texas, U.S.	Cessna 421B	destroyed	5 fatal
Dark night visual meteorological conditions (VMC) prevailed when the emergency medical services (EMS) airplane crashed in an open field shortly after takeoff.				
July 6	Orange, New South Wales, Australia	Gippsland GA-8 Airvan	destroyed	1 minor
The cargo airplane crashed after clipping the top of a hangar on landing.				
July 7	Piedras Negras, Mexico	Piper Cheyenne II	destroyed	7 fatal
The Cheyenne stalled and crashed during a flood-inspection flight.				
July 10	Tulsa, Oklahoma, U.S.	Cessna 421A	destroyed	3 fatal
The airplane struck terrain on approach after its fuel supply was exhausted during a business flight.				
July 13	St. Ignace, Michigan, U.S.	Beech 58 Baron	destroyed	4 fatal, 1 serious
The airplane crashed on a highway during a departure that followed two rejected takeoffs.				
July 15	Brac Island, Croatia	Cessna Citation 550	substantial	5 none
The Citation overran the 1,440-m (4,725-ft) runway on landing and struck a ditch.				
July 16	Chute-des-Passes, Quebec, Canada	de Havilland Beaver	destroyed	4 fatal, 1 serious, 1 none
The floatplane struck a mountain in fog shortly after departing on a charter flight.				
July 17	Cairo, Egypt	Boeing 747-300M	substantial	22 none
The flight crew rejected the takeoff after an uncontained failure of the no. 4 engine.				
July 18	Rankin Inlet, Nunavut, Canada	Aero Commander 500S	substantial	3 none
The airplane crashed in a swamp after both engines lost power on takeoff.				
July 20	Kansas City, Missouri, U.S.	Boeing 777-200	none	1 serious, 21 minor, 244 none
The flight from Washington to Los Angeles was diverted to Denver after an encounter with severe turbulence at 34,000 ft.				
July 22	Kingfisher, Oklahoma, U.S.	Eurocopter AS 350-B2	destroyed	2 fatal, 1 serious
VMC prevailed when the helicopter struck terrain during an EMS positioning flight.				
July 22	Cleburne, Texas, U.S.	Piper Aerostar 601P	substantial	1 minor
The pilot landed the Aerostar in a plowed field after both engines lost power on takeoff.				
July 23	Gahbühel, Austria	Bell 204B	destroyed	1 fatal
The helicopter crashed while transporting an external load of concrete to a construction site.				
July 23	Elk Lake, Ontario, Canada	Bell 206B	destroyed	2 fatal
The helicopter crashed after striking a communications tower.				
July 23	Ward Cove, Alaska, U.S.	de Havilland Beaver	substantial	1 fatal
Instrument meteorological conditions prevailed when the cargo airplane struck terrain while holding for a special visual flight rules clearance into Ketchikan's Class E airspace.				
July 24	La Grande, Quebec, Canada	de Havilland Beaver	destroyed	2 fatal, 3 serious
The Beaver stalled and crashed after an engine problem occurred on takeoff.				
July 25	Chichibu, Japan	Eurocopter AS 365-N3	destroyed	5 fatal, 2 none
The EMS helicopter crashed after two crewmembers were lowered to the ground to assist mountain climbers.				
July 27	Riyadh, Saudi Arabia	Boeing MD-11F	destroyed	2 serious
The MD-11 touched down hard and veered off the runway. Preliminary reports varied on whether the crew reported a cargo fire on approach or the fire broke out after the hard landing.				
July 27	Oshkosh, Wisconsin, U.S.	Raytheon Premier I	destroyed	2 serious
The airplane struck terrain after it apparently stalled while being maneuvered to land.				
July 28	Conakry, Guinea	Boeing 737-700	substantial	10 serious, 87 none
The 737 overran the runway while landing in heavy rain.				
July 28	Islamabad, Pakistan	Airbus A321-200	destroyed	152 fatal
The A321 crashed while being positioned for a second approach in monsoon rains.				
July 28	Tucson, Arizona, U.S.	Aerospatiale AS 350-B3	destroyed	3 fatal
The helicopter descended rapidly and crashed on a street during an EMS positioning flight.				
July 31	Lytton, British Columbia, Canada	Convair 580	destroyed	2 fatal
The air tanker crashed during a forest fire-fighting mission.				

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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