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THE JOURNAL OF FLIGHT SAFETY FOUNDATION

JULY–AUGUST 2011

Myths and Training

This is not a column I like writing, and I know I am going to upset some people, but I have to comment on the recent release of more preliminary information regarding the crash of Air France 447, the Airbus A330 that fell into the Atlantic Ocean two years ago. The investigators have given us a clear idea of *what* likely happened and the sort of recommendations they will make when the final report is issued. The difficult part now is to understand *why* this tragedy happened and do something about it.

I spent two days with Airbus test pilots, accompanied by Foundation Executive VP Kevin Hiatt, trying to understand the nuances of envelope protection and failure modes. We spent some time going over the accident timeline and then flew the accident scenario in a simulator. I came away with a number of impressions.

First, I was amazed at how benign the initial failure really was. Some electronic centralized aircraft monitor (ECAM) messages, an autopilot disconnect and some bad speed indications. All of this happened in light turbulence, and lasted for less than a minute. The only response needed was to manually fly the same attitude the autopilot had been flying for hours. It should have ended with a logbook entry. Instead, there was an aggressive pitch up resulting in a 7,000-fpm climb, followed by a series of pitch-up commands that eventually resulted in a stall. These were not small or inadvertent commands. When airspeed numbers came back they were so low they looked erroneous. In fact, the airspeed dropped so low the stall warning was disabled. This had to be confusing. When stick backpressure was released, the aircraft accelerated a little bit and the warning came on again. This kept up all the way to the ocean.

So now we have to try to understand why all of this happened. We can never know what the accident pilots were thinking, so we are stuck making some guesses to help others avoid the same mistake.

Did they think they were at risk of a high-speed stall? Was this a real risk, or was it mythology? Test pilots will tell you it is very hard to get into a high-speed stall in a modern aircraft. Do crews understand this, or do they get their high-altitude aerodynamics lessons from dog-fighting shows on the Discovery Channel, or old textbooks written about the Boeing 707?

Perhaps the AF447 crew was trying to fly the stall scenarios they practiced at low altitudes. Stall training historically has focused on minimum altitude loss. Some pilots will even tell you they rely on the envelope protection to fly them out. Just go to TOGA (take off/go around power) and pull back. Let the airplane do the rest. The manufacturer will tell you that this is not the right procedure to use at altitude. Instead, pilots are encouraged to trade altitude for speed by reducing the angle of attack. Has this philosophy made it into simulator training, and more importantly, has it become the new norm on the line?

This tragedy compels us to ask some tough questions about training. Do we spend so much time driving simulators around at low altitudes with one engine out that the real risks are only discussed in the break room? This issue extends far beyond Air France and Airbus; it is about an industry that has let training get so far out of date that it is irrelevant, and people are left filling in the blanks with folklore.

William R. Voss
President and CEO
Flight Safety Foundation

AeroSafetyWORLD

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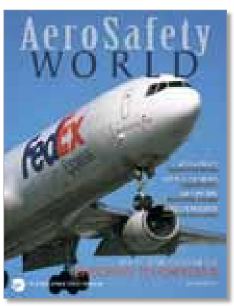

About the Cover
The MD-11's poor landing record shows a need for better training, NTSB says.
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IT'S NOT ALWAYS Politics

We live in a technical world in which few of us have a good understanding of all the technology we encounter. Since I'm talking to a sophisticated aviation crowd, that statement would seem to apply to you folks less than to the general population. But certainly, all of us have been humbled by a sufficient number of baffling run-ins with opaque and illogical technology to have a modest appreciation of how daunting this world can be to those not so skilled.

Consider, then, the point of view of an average legislator trying to fix a "problem" as perceived and defined by his or her constituents. If that legislator has some degree of understanding, either personally or through staff input, of the technology, including aviation, he or she will make an attempt to shape their efforts to placate the howls for change to conform to what that legislator believes will actually work, assuming an active degree of personal responsibility. Others less involved, knowledgeable or principled will be inclined only to take the advice of the aggrieved, and leave it at that. In the end, the legislator's goal is to make the problem go away, or at least to be perceived as having made a darn good effort.

And then there are the political acts driven by forces that really have nothing to do with the subject at hand, but end up having unintended consequences.

The flip side of that coin is legislator willingness to ignore technology problems that are not at all hard to see but are difficult to solve and lack any appreciable constituent push.

All this explains why airlines in Europe must pay passengers when flights are canceled for reasons far beyond anyone's control (volcanic ash, anyone?), why the crash of a regional aircraft largely due to fatigue and poor piloting is "corrected" by raising pilot experience requirements, why a regulator's funding (and tax-collecting ability) can be shut down due to disconnected budget squabbles and, finally, why the recent crashes of two modern freighters on fire provoke nearly zero interest outside of the industry.

Aside from mounting private and public educational efforts to try to deflect some of these ill-considered and, at times, harmful legislative "remedies," there's little we can do. But we can do something about burning freighters.

The question of what constitutes cargo too hazardous to fly has been answered in different ways depending on the type of operation being considered. It is, admittedly, a complex question, but the basic idea that some things that are too dangerous to be carried in the under-floor holds of passenger aircraft are just fine for freighters strains credulity.

Here's where technology creates a barrier for legislators that, in this case, is good. No one is pushing them for a solution, they know nothing about this issue, they don't want to know, and for that we can be thankful. However, we know there is a problem and that steps should be taken quickly to reduce the risks that freighter crews face. Lithium batteries are often suspected but rarely confirmed to be the source of aircraft fires. For starters, maybe we should leap to a course of action favoring safety and relegate them to trucks and ships and be done with it.

J.A. Donoghue

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

Serving Aviation Safety Interests for More Than 60 Years

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

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JULY 18–22 SMS Principles. MITRE Aviation Institute. McLean, Virginia, U.S. Mary Beth Wigger, <mbwigger@mitre.org>, <www.mitremai.org>, +1 703.983.5617.

JULY 18–27 SMS Theory and Application. MITRE Aviation Institute. McLean, Virginia, U.S. Mary Beth Wigger, <mbwigger@mitre.org>, <www.mitremai.org>, +1 703.983.5617.

JULY 19–21 Human Factors and Analysis Classification System Workshop. HFACS Inc. Washington, D.C. <info@hfacs.com>, <www.hfacs.com/store/hfacshfix-workshop-washington-dc>, 800.320.0833.

JULY 21–22 EASA Regulations for Flight Operations Inspectors. Baines Simmons. Zoe Martin, <zoe.martin@bainessimmons.com>, <www.bainessimmons.com/directory-course.php?product_id=133>, +44 (0)1276 855412.

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JULY 25–26 Quality Assurance for SMS. DTI Training. Yellowknife, Northwest Territories, Canada. <dtitraining@juno.com>, <staboada@dtiatlanta.com>, <www.dtiatlanta.com>, +1 866.870.5490, +1 770.434.5310.

JULY 27 Basic Auditing Principles. DTI Training. Yellowknife, Northwest Territories, Canada. <dtitraining@juno.com>, <staboada@dtiatlanta.com>, <www.dtiatlanta.com>, +1 866.870.5490, +1 770.434.5310.

JULY 29 SMS Overview/Safety Culture. The Aviation Safety Group. Myrtle Beach, South Carolina, U.S. Robert Baron, Ph.D., <www.tacgworldwide.com/07292011.htm>, 800.294.0872.

JULY 31–AUG. 2 Large Hub Winter Operations and Deicing Conference and Exhibition. American Association of Airport Executives. Seattle. Natalie Fleet, <natalie.fleet@aaae.org>, <events.aaae.org/sites/110705>, +1 703.824.0500, ext. 132.

AUG. 1–5 Investigation Management. Southern California Safety Institute. San Pedro, California, U.S. Denise Davalloo, <registrar@scsi-inc.com>, <www.scsi-inc.com/IM.php>, 800.545.3766; +1 310.517.8844, ext. 104.

AUG. 2–4 Partnering to Build the Next Generation Advanced Qualification Program (AQP). Delta Air Lines. Atlanta. Michelle Farkas, Michelle.Farkas@Delta.com, <aviationsafetyconference.com>, +1 404.715.1174.

AUG. 8–16 SMS Expanded Implementation Course. The Aviation Consulting Group. Fort Lauderdale/Miami area, Florida, U.S. Bob Baron, Ph.D., <tacg@sccoast.net>, <www.tacgworldwide.com>, 800.294.0872, +1 954.803.5807.

AUG. 9–11 Internal Evaluation Program — Theory and Application. Transportation Safety Institute, U.S. Department of Transportation. Oklahoma City. Troy Jackson, <tjackson@tsi.jccbi.gov>, <www.tsi.dot.gov>, +1 405.954.2602.

AUG. 15–16 Quality Assurance for SMS. DTI Training. Toronto. <dtitraining@juno.com>, <staboada@dtiatlanta.com>, <www.dtiatlanta.com>, +1 866.870.5490, +1 770.434.5310.

AUG. 15–19 Safety Management for Aviation Maintenance. University of Southern California Viterbi School of Engineering. Los Angeles. Thomas Anthony, <aviation@usc.edu>, <viterbi.usc.edu/aviation/courses/maint.htm>, +1 310.342.1349.

AUG. 17 Basic Auditing Principles. DTI Training. Toronto. <dtitraining@juno.com>, <staboada@dtiatlanta.com>, <www.dtiatlanta.com>, +1 866.870.5490, +1 770.434.5310.

AUG. 30–SEPT. 2 Fatigue Risk Management Systems (FRMS) Symposium and FRMS Forum. International Civil Aviation Organization. Montreal. <FRMS2011@icao.int>, <www2.icao.int/en/FRMS2011/Pages/Home.aspx>, +1.514.954.8219.

AUG. 31–SEPT. 1 EASA Regulations for Flight Operations Inspectors. Baines Simmons. Zoe Martin, <zoe.martin@bainessimmons.com>, <www.bainessimmons.com/directory-course.php?product_id=133>, +44 (0)1276 855412.

SEPT. 1–2 Aviation Safety Management Systems Overview Workshop. ATC Vantage. Tampa, Florida, U.S. Theresa McCormick, <info@atcvantage.com>, <www.atcvantage.com/sms-workshop.html>, +1 727.410.4759.

SEPT. 6–8 ATM Aircraft Data Communications Conference. Civil Air Navigation Services Organisation. Amsterdam, Netherlands. <events@canso.org>, <www.canso.org/nm-data-communications-conference>.

SEPT. 7–9 7th Annual FAA International Aviation Safety Forum. U.S. Federal Aviation Administration. Washington. Details to be announced.

SEPT. 7–9 Threat and Error Management Development. University of Southern California Viterbi School of Engineering. Los Angeles. Thomas Anthony, <aviation@usc.edu>, <viterbi.usc.edu/aviation/courses/tem.htm>, +1 310.342.1349.

SEPT. 8–9 Flight Safety Conference. Flightglobal and Flight International. London. Lizzie Law, <lizzie.law@rbi.co.uk>, <www.flightglobalevents.com/flightsafety2011?cp=EMC-FGCON_SAFE1_20110411>, +44 (0)20 8652 8818.

SEPT. 9–10 A Practical Approach to Safety Management Systems. Curt Lewis & Associates and Beyond Risk Management. Phoenix. Elaine Parker, <Elaine@beyondriskmgmt.com>; <www.regonline.ca/SMSPHXSep2011>; Brendan Kapuscinski, +1 403.804.9745.

SEPT. 12–13 Quality Assurance and Auditing: A Practical Approach. Curt Lewis & Associates and Beyond Risk Management. Phoenix. Brendan Kapuscinski, Brendan@beyondriskmgmt.com, www.regonline.ca/QAPHXSep2011, +1 403.804.9745.

SEPT. 12–15 ISASI 2011 Annual Seminar. International Society of Air Safety Investigators. Salt Lake City. <isasi@erols.com>, <www.isasi.org/isasi2011.html>, +1 703.430.9668.

SEPT. 12–15 Bird Strike North America Conference. Bird Strike Association of Canada and Bird Strike Committee USA. Niagara Falls, Ontario, Canada. <birdstrike@icsevents.com>, <www.birdstrikecanada.com/CanadaConference.html>, +1 604.681.2153.

SEPT. 12–16 Safety Management Systems Complete Southern California Safety Institute. San Pedro, California, U.S. Denise Davalloo, <registrar@scsi-inc.com>, <www.scsi-inc.com/safety-management-systems-complete.php>, 800.545.3766; +1 310.517.8844, ext. 104.

OCT. 31–NOV. 3 64th annual International Air Safety Seminar. Flight Safety Foundation. Singapore. Namratha Apparao, <apparao@flightsafety.org>, <flightsafety.org/aviation-safety-seminars/international-air-safety-seminar>, +1 703.739.6700, ext. 101.

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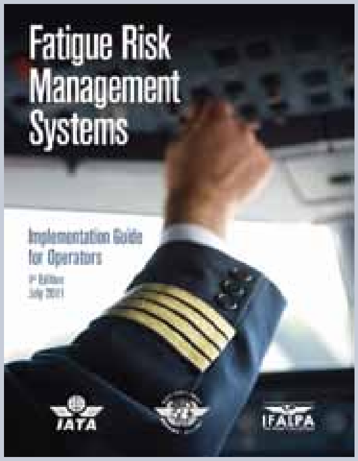
Be sure to include a phone number and/or an e-mail address for readers to contact you about the event.

Safety News

Guide to Managing Fatigue



Three international aviation organizations have released a fatigue risk management systems (FRMS) implementation guide designed to aid commercial aircraft operators.

The guide — developed by the International Civil Aviation Organization(ICAO), the International Air Transport Association (IATA) and the International Federation of Airline Pilots' Associations (IFALPA) — discusses the methodology and framework for implementing a fatigue risk management program and explains the scientific basis for FRMS.

"FRMS enhances safety scientifically and in consideration of today's operational realities and accumulated experience," said Guenther Matschnigg, IATA senior vice president for safety, operations and infrastructure. "This implementation guide now puts regulators, pilots and the industry on the same page when it comes to ensuring safe operations with optimum crew performance."

FRMS, an alternative to traditional prescriptive flight and duty time rules, calls for flight and duty schedules based on physiological and operational needs. It takes into account the effects on the human body of time of day and circadian rhythms.

"The value of this document is that pilots, regulators and operators have all agreed to a common approach to the complex issue of fatigue," said IFALPA President Don Wykoff.

ICAO adopted new international standards for FRMS earlier this year; the standards are due to take effect Dec. 15 (*ASW*, 5/11, p. 33).

Both the European Aviation Safety Agency (EASA) and the U.S. Federal Aviation Administration (FAA) have been reviewing their policies on fatigue. In late 2010, EASA published a notice of proposed amendment, to take effect in 2012, calling for limits on flight hours to be standardized among its member states.

The FAA published a notice of proposed rule making (NPRM) on the subject in 2010 and is scheduled to issue a final rule in August. The proposal calls for increasing to nine hours — up from the current eight-hour limit — the minimum rest time for pilots before they report for duty.

Fatigue Pact

In the aftermath of several reports of air traffic controllers sleeping on the job, the U.S. Federal Aviation Administration (FAA) and the National Air Traffic Controllers Association (NATCA) have negotiated an agreement on recommendations for reducing workplace fatigue.

Under the agreement, the FAA will continue to provide breaks, "based on staffing and workload," for controllers working on the midnight shift. FAA policy will continue to prohibit controllers from sleeping while on duty. Those working between 10 p.m. and 6 a.m. will be permitted to listen to the radio and read "appropriate printed material" while working, if their duties permit.

U.S. Federal Aviation Administration

Both sides said they agreed that controllers must "report for work well-rested and mentally alert" and that it is the controller's responsibility to notify a supervisor if he or she is too fatigued to perform assigned duties. The agreement also allows controllers to request leave if they are too fatigued to work.

The agreement calls for development by the FAA of a fatigue risk management system (FRMS) for air traffic operations. Planning must be complete by January 2012, according to the agreement. The FRMS will collect and analyze data involving work schedules to ensure that schedule design does not increase the possibility of fatigue.

Information-Sharing

A free exchange of safety information is vital to ongoing efforts to improve aviation safety worldwide, the Council of the International Civil Aviation Organization (ICAO) said in approving a new code of conduct for the collection, sharing and use of information.

"Transparency and sharing of safety information are fundamental to a safe air transportation system," said Council President Roberto Kobeh González. "The new code of conduct will help ensure that the information is used in a fair and consistent manner, with the sole objective of improving safety."

ICAO said that the code consists of "guiding principles to develop a consistent, fact-based and transparent response to safety concerns at the state and global levels." The code also is intended to encourage mutual trust among ICAO's member states "by providing reassurance as to how the information will be used," ICAO said.

Dagmar Witherspoon Chilman

Dagmar Witherspoon Chilman, a former vice president of Flight Safety Foundation, died June 6 in St. Augustine, Florida, U.S., after a long illness. She was 88.

A native of London, she served in British intelligence during World War II, parachuting behind enemy lines to exchange information with the French Underground. After her third drop into France, she was captured by German soldiers; she later was rescued by Canadian troops and returned to England.

After the war, she studied at London University and moved, first to Bermuda, and later to Washington, where she worked for Flight Safety Foundation until 1983.

She is survived by a daughter, Carol Anne Williamson of Wiarton, Ontario, Canada; two granddaughters; three great-grandchildren; and two brothers, Allan Leweson of Lancashire, England, and Desmond Leweson of Larnaca, Cyprus. She was preceded in death by a grandson.

Safety Task Force

A special task force has been designated by the Civil Aviation Safety Authority of Australia (CASA) to review the safety regulation of Australian general aviation.

The task force, which is scheduled to begin work in mid-August, is expected to focus on general aviation pilot licensing, air operator's certificates and other relevant safety requirements. Aerial agriculture will be the first area to be examined, and the Aerial Agricultural Association of Australia will cooperate in the effort, CASA said.

"CASA is committed to being a proactive safety regulator, and we are always looking to make sure our regulatory regime is effective," said John McCormick, CASA director of aviation safety.

The task force, which will be headed by CASA Eastern Region Operations Manager Peter John, is expected to operate for more than two years.

Wikimedia

Proposed Penalties

The U.S. Federal Aviation Administration (FAA) has proposed a $1.05 million civil penalty against The Boeing Co. for "allegedly failing to correct a known problem in production and installation of the central passenger oxygen system" in 777s.

The proposed penalty was based on inspections conducted between April and October 2010 of nine newly assembled 777s. The FAA said that inspectors found that spacers had been installed incorrectly in the distribution tubing of the airplanes' oxygen delivery systems. Improper installation can prevent the delivery of oxygen in case of depressurization.

In separate actions, the FAA proposed civil penalties ranging from $66,000 to $689,800 against 11 operators for a variety of alleged offenses.

The largest of the proposed penalties was against FedEx for allegedly violating U.S. Department of Transportation regulations for transporting hazardous materials.

© Andrew W. Sieber/Flickr

The FAA said that, between June 13 and Sept. 4, 2009, FedEx failed on 89 occasions to provide its pilots-in-command with complete information on the hazardous materials loaded onto their airplanes. The FAA also said that, between June 18 and Aug. 26, 2009, FedEx had accepted four hazardous goods shipments that "were not accurately described and certified in the accompanying shipper's documents."

The agency said that the alleged violations were found during an FAA inspection at FedEx facilities at Bradley International Airport near Hartford, Connecticut, U.S.

The FAA also proposed a $250,000 civil penalty against AirTran Airways for allegedly operating a Boeing 737 on four passenger flights while the airplane was not in compliance with FAA regulations. The airline failed to repair or test an angle-of-attack sensor after it was struck by lightning in March 2009, the FAA said.

In addition, a $194,249 civil penalty was proposed against ERA Helicopters for allegedly failing to conduct required pre-employment drug tests before the hiring of eight employees in 2010 and allegedly returning an employee to "safety-sensitive duties" before obtaining documentation that the person had completed the requirements that allowed the return to duty.

How Wide?

The Australian Civil Aviation Safety Authority (CASA) is reviewing the standards for runway widths in preparation for a move to align them more closely with international standards.

CASA says that, in the past 20 years, Australian standards have been changed to allow large aircraft to operate on runways that are narrower than the International Civil Aviation Organization (ICAO) standard.


Wikimedia

For example, Boeing 737s — required by Australian regulations to use runways that are at least 45 m (148 ft) wide — have been given special permission to land on runways that are 30 m (98 ft) wide. The narrower width is permitted under U.S. Federal Aviation Administration specifications.

In 2010, CASA said it planned to change its policies to base runway width standards on ICAO recommendations, and a policy review has begun.

"While this work is under way [CASA] has extended the current runway width approvals until February 2012," the agency said. "This means aircraft now operating into narrower runways can continue to do so. The extension provides time for CASA to assess options, finalize its proposals and consult on the changes with the aviation industry. Depending on the outcomes of the project, the changes being made to runway width standards may have an impact on a number of regional aerodromes with 30-m-wide runways."

Basil Victor Hewes

Basil Victor Hewes, who in 1978 received the Flight Safety Foundation Laura Taber Barbour Air Safety Award, died June 30. He was 89.

He served in the British Royal Air Force during World War II, and later flew as a captain for Delta Air Lines and was the director of flight operations for Air Atlanta. He was air safety chairman for the Air Line Pilots Association, International (ALPA) and founder of the ALPA Fire and Rescue Committee. His work led to the discovery of the lethal properties of burning cabin materials and later to the development of rules for fire-resistant cabin furnishings.

Electronic Flight Bags

The Civil Aviation Safety Authority of Australia (CASA), citing the increase in aviation software for iPads and other electronic tablets, is preparing new standards on the use of electronic flight bags. CASA's plans also call for development of new guidance material for pilots.

Work Stoppages

Work was interrupted on airport modernization projects around the United States after the U.S. Congress delayed passing a bill that would have given the Federal Aviation Administration (FAA) the authority to continue the work.


© Xavier Marchant/iStockphoto

"This is no way to run the best aviation system in the world," U.S. Transportation Secretary Ray LaHood said.

The previous FAA reauthorization expired at midnight July 22. Congress did not act before the midnight deadline, and as a result, the FAA issued stop-work orders at dozens of major projects, including runway safety initiatives and research and testing associated with development of the Next Generation Air Transportation System (NextGen).

Among the projects that were affected were $250 million in contracts for the design and installation of runway-status lights at one dozen major airports across the United States. The lights are designed to tell pilots when they can safely move their aircraft onto runways or taxiways. Work also was interrupted on construction of new air traffic control towers in Las Vegas; Oakland and Palm Springs, California; Wilkes-Barre, Pennsylvania; Kalamazoo, Michigan; and Gulfport, Mississippi.

Stalled Progress

More effort is needed within Canada's aviation industry to resolve key safety issues identified by the Transportation Safety Board of Canada (TSB), Wendy Tadros, chairwoman of the TSB, says.

Bill Fawcett/Wikimedia

"Right now, progress is stalling," Tadros said in evaluating efforts to address safety issues identified in the TSB's Watchlist — a list of nine key issues that the TSB considers the greatest risks to Canada's transportation system. The aviation issues on the list include the risk of collisions on runways, collisions with land and water, and landing accidents and runway overruns.

Tadros said the TSB has observed progress during the past year in addressing marine and rail safety issues, but she called the absence of similar progress in aviation "troubling."

"We need to do more," she said. "Without strong leadership, we won't reduce the risk of collisions or aircraft overruns at Canada's airports, nor can we ensure better data and voice recorders on aircraft — areas where Canada needs to meet new international standards."

In Other News …

The U.S. National Transportation Safety Board is conducting a study to evaluate the safety of **homebuilt aircraft**, which number about 33,000 in the United States. The study will examine transition training for pilots of homebuilts, flight test and certification requirements, and maintenance. … A committee of the Australian Senate has issued nearly two dozen recommendations on **pilot training** and aviation safety, including a proposal that would require the first officers of large jet airplanes to hold airline transport pilot licenses. … David Grizzle, the chief counsel for the U.S. Federal Aviation Administration (FAA) since 2009, has been named chief operating officer of the FAA **Air Traffic Organization**.

Compiled and edited by Linda Werfelman.

Citing more than a dozen hard landings and rollovers of Boeing McDonnell Douglas MD-11s in the past two decades, the U.S. National Transportation Safety Board (NTSB) is pressing for changes in training to help pilots better handle the airplane during landing.

In two safety recommendations issued in July 2011 to the U.S. Federal Aviation Administration (FAA), the NTSB called on the FAA to require Boeing to "revise its *MD-11 Flight Crew Operating Manual (FCOM)* to re-emphasize high sink rate awareness during landing, the importance of momentarily maintaining landing pitch attitude after touchdown and using proper pitch attitude and power to cushion excess sink rate in the flare, and to go around in the event of a bounced landing."

After Boeing completes the revision, the NTSB said, all operators of MD-11s should be required to incorporate the company's recommended procedures for bounce recognition and recovery into their own operating manuals and to teach the procedures during recurrent simulator training.

The recommendations were issued during the investigation — by the General Authority of Civil Aviation of Saudi Arabia, with the NTSB participating — of the July 27, 2010, crash of a Lufthansa Cargo MD-11F during landing at King Khalid International Airport in Riyadh. The airplane bounced twice, with a "strong pitch up after the second hard touchdown" and then strong nose-down pitch forces, the NTSB said in a letter to FAA Administrator Randy Babbitt that outlined the safety

'Shocking' Touchdowns

BY LINDA WERFELMAN

recommendations. The fuselage broke apart, and the two pilots — the only people in the airplane — were injured, one seriously. Investigation of the accident is continuing.

The captain later told accident investigators that he considered the airplane's behavior after touchdown "shocking" and "much beyond [his] experience," the NTSB said.

Information from the flight data recorder showed that the airplane first touched down at 2.1 g — 2.1 times standard gravitational acceleration. Then the airplane bounced about 4.7 ft (1.4 m) and touched down again at 3 g.

"After the second touchdown, the aircraft reached a pitch attitude of 13 degrees, and a third touchdown, on the main gear, exceeded 4 g," the NTSB said. "Flight data indicated that two large forward and aft control column inputs were made between the first touchdown and the third and final touchdown."

In later discussions with accident investigators, the captain said he had not expected the "strong movement of the nose" and that the airplane's pitch attitude was "higher than the maximum allowable and outside of his comfort zone."

The captain also said that, although he had been trained to maintain 7.5 degrees of pitch in recovering from a bounced landing, he had not completed Lufthansa Cargo's "bounced landing recovery procedure training," a one-time course that was developed because of the company's experience — and the experiences of other operators — with hard landings in MD-11s. The first officer had completed the

The NTSB says pilots need better training to avoid unexpected bounced landings in MD-11s.

© Chris Sorensen Photography

one-time course in 2010 while he was undergoing his initial training.

During the course, pilots are taken to a simulator, where an instructor demonstrates a hard landing. The pilot trainee then takes control and "maintains 7.5 degrees of pitch and applies go-around thrust to recover," the NTSB said.

Lufthansa Cargo's top pilots said after the accident that the simulator course had limitations.

"The company's MD-11 chief flight instructor stated that the simulator was limited in its ability to capture the true sensation of a bounced landing, and the head of flight operations said that, while bounced landing training was positive training, it may still be difficult for a pilot to recognize a bounce in a real aircraft," the NTSB said.

A similar accident — the March 23, 2009, crash of a FedEx MD-11 at Narita International Airport in Japan — also remains under investigation by the Japan Transport Safety Board (JTSB). Both pilots — the only people in the airplane — were killed, and the airplane was destroyed by the crash and the subsequent fire.

The NTSB, which is participating in the accident investigation, said that information from the flight data recorder and the airport's localizer surveillance camera showed that the airplane "bounced after touching down initially on the right main landing gear and subsequently bounced once more before the left wing … fractured and the airplane rolled over to the left and caught fire."

"The vertical acceleration at initial touchdown was 1.63 g, followed by acceleration as high as 3.06 g when the airplane touched down on the nose landing gear following the last bounce."

The investigation is continuing into the crash of this Lufthansa Cargo MD-11F in July 2010 in Riyadh, Saudi Arabia. The fuselage broke apart after a bounced landing.

© Associated Press

A JTSB interim report, released in April 2010, said that the examination of a number of operations and human performance issues — conducted in cooperation with the NTSB — included a review of MD-11 handling characteristics. The report noted that interviews had indicated that the MD-11 is faster on approach and "less forgiving than other large airplanes" and that pilots must "remain more alert on the MD-11 than on other airplanes."[1]

Seven Events in Two Years

In its safety recommendation letter, the NTSB acknowledged that it is "not uncommon for jet transport aircraft to experience a small skip or bounce during landing." Nevertheless, the NTSB added, MD-11s have been involved in 14 such events since the aircraft entered service in 1990 (Table 1, p. 15). Of the 14 events, seven occurred in the past two years.

"The number and severity of these events raise concerns that MD-11 flight crews are not effectively trained to recognize and arrest high sink rates during landing or to properly control pitch attitude following a hard landing," the NTSB said.

In a report on an earlier MD-11 landing accident, the NTSB noted the MD-11's "known tendency to pitch up" after deployment of ground spoilers and suggested that "a reduction or elimination of the pitch-up tendency would simplify MD-11 landing techniques and may help prevent future MD-11 landing incidents and accidents."[2]

In its July safety recommendation letter, the NTSB noted that the Boeing *MD-11 FCOM* recommends a sink rate of 2 to 4 fps during the landing flare, and that the airplanes are certified to land at maximum landing weight with a sink rate of 10 fps (600 fpm) and "an ultimate sink rate of 12.3 fps."

The NTSB added, "Boeing defines hard landings that exceed 12.3 fps or that involve rapid derotation [lowering the nosewheel to the runway after the main gear touches down] after the initial touchdown as severe."

Instructions in the *FCOM* say, "If the aircraft should bounce, hold or re-establish a normal landing attitude and add thrust as necessary to control the rate of descent. Avoid rapid pitch rates in establishing a normal landing attitude. *Caution: Tail strikes or nosewheel structural damage can occur if large forward or aft control column movements are made prior to touchdown.*"

MD-11 Severe Hard Landings

Date	Location	Operator	Event
Apr. 30, 1993	Los Angeles	Delta Air Lines	Bounced hard landing
Aug. 19, 1994	Chicago	Alitalia	Landing bounce and porpoise
July 31, 1997	Newark	FedEx	Wing spar break and rollover
Aug. 22, 1999	Hong Kong	China Airlines	Wing spar break and rollover
May 22, 2000	Taipei, Taiwan	Eva Air	Hard landing and go around
Nov. 20, 2001	Taipei, Taiwan	Eva Air	Bounce and nose landing gear (NLG) strike
June 7, 2005	Louisville, Kentucky, U.S.	UPS	Hard NLG strike
March 23, 2009	Tokyo	FedEx	Wing spar break and rollover
June 3, 2009	Urumqi, China	China Cargo	Hard landing and tail strike
June 9, 2009	Khartoum, Sudan	Saudi Arabian Airlines	Hard landing
Sept 13, 2009	Mexico City	Lufthansa Cargo	Hard landing and NLG strike
Oct. 20, 2009	Montevideo, Uruguay	Centurion	Hard landing and main landing gear collapse
July 27, 2010	Riyadh, Saudi Arabia	Lufthansa Cargo	Hard landing and fuselage failure
Sept. 22, 2010	Kabul, Afghanistan	World Airways	Hard NLG strike

Source: U.S. National Transportation Safety Board

Table 1

Timing the Flare

The NTSB said that some operators have provided specific instructions to their pilots aimed at helping them avoid high sink rates through "appropriate combinations of power and pitch" and appropriate timing of the landing flare.

As examples, the NTSB noted that:

- Lufthansa Cargo includes in its MD-11 training information a table that "guides pilots when to commence the flare based on gross weight, temperature and pressure altitude."
- UPS information suggests that the airspeed trend vector "may be a useful tool" in determining when to begin to flare.
- FedEx, which operates more MD-11s than any other airline, tells its pilots to pay particular attention to "aural altitude calls and [the] radar altimeter."

"Although the pilot monitoring also has a role in recognizing and responding to high sink rates — for example, calling out the sink rate and calling for a go-around — the ability to appropriately judge when to initiate the flare is a fundamental pilot skill that is learned in training and checked periodically," the NTSB said.

In reviewing the circumstances surrounding the events cited in Table 1, the NTSB noted that several were associated with high sink rates at touchdown. For example, the Aug. 22, 1999, accident involved a China Airlines MD-11 that developed a high sink rate before touchdown at Hong Kong International Airport. In an attempt to counteract the sink rate, the captain used "a large elevator input, resulting in destructive force on the structure at touchdown," the NTSB said.

Of the 315 people in the airplane, three were killed, 50 were seriously injured and 153 received minor injuries, the Civil Aviation Department of Hong Kong said in its final report on the accident. The report said that investigators identified the cause of the accident as "the commander's inability to arrest the high rate of descent existing at 50 ft radio altitude."[3]

The NTSB cited the June 9, 2009, severe hard landing of a Saudi Arabian MD-11 in Khartoum, Sudan, in which the "sink rate" alert from the airplane's enhanced ground proximity warning system sounded repeatedly, from the time the airplane descended through 100 ft

Boeing McDonnell Douglas MD-11

The McDonnell Douglas MD-11 — a derivative of the Douglas DC-10 — entered service in 1990. Boeing produced the 200th — and last — of the medium/long-range passenger/freight transports in 2001.

The MD-11 differs from the DC-10, in part, because of its two-pilot, all-digital flight deck; winglets; and redesigned tail. The MD-11 wing area is smaller — 346.33 m^2, including winglets, compared with the DC-10-30's 367.7 m^2 — and its standard maximum takeoff weight is greater — 602,555 lb (273,314 kg), compared with the DC-10's 571,983 lb (259,450 kg).

It is equipped with either three Pratt & Whitney PW4460 turbofan engines, each rated at 60,000 lb static thrust (267 kilonewtons); three Pratt & Whitney PW4462 turbofans, each rated at 62,000 lb static thrust (267 kilonewtons), or three General Electric CF6-80C2D1F turbofan engines, each rated at 61,500 lb static thrust (274 kilonewtons).

Standard fuel capacity is 40,183 gal (152,092 L) for the passenger version and 38,650 gal (146,290 L) for the freighter version and the mixed passenger/cargo version.

Maximum takeoff weight is 625,500 lb (283,727 kg) for all versions.

Maximum operating Mach number is 0.945. Maximum level speed at 31,000 ft is Mach 0.87, or 511 kt. Maximum design range with fuel reserves is 6,821 nm (12,633 km) for the passenger version, 3,867 nm (7,161 km) for the freighter and 6,717 nm (12,440 km) for the mixed version.

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

above ground level until touchdown, which was recorded at 3.06 g.

Rapid Derotation

Rapid derotation also has been a factor in a number of MD-11 hard landing accidents, the NTSB said, citing the July 31, 1997, FedEx accident in Newark, New Jersey, U.S., in which the captain "initiated a rapid nose-down elevator input within 0.5 second following initial touchdown, resulting in a second touchdown that exceeded the airplane's design structural limits."[4]

In the June 7, 2005, accident involving a UPS MD-11 in Louisville, Kentucky, U.S., the pilot "moved the control column forward sharply following the initial touchdown, reducing pitch angle from 5 degrees nose up to 1 degree nose down in 1.5 seconds," the NTSB said. The subsequent touchdown on the nosewheel was measured at 2.5 g.

As a result of its investigation of the Newark accident, the NTSB recommended in 2000 that the FAA establish a government–industry task force to develop a pilot training tool including a syllabus for simulator training in stabilized approaches, and techniques for recognizing and recovering from high sink rates, overcontrol in pitch and premature derotation.

The FAA subsequently issued an appendix to Advisory Circular 120-71, "Standard Operating Procedures for Flight Deck Crew Members," and Flight Standards Information Bulletins for Air Transport (FSATs) 00-08 and 00-12 to discuss stabilized approaches and reduction of approach and landing accidents.

"Despite the corrective action … MD-11 crews continue to have difficulty in judging the flare maneuver and in making appropriate pitch and power changes after hard landings," the NTSB said. "The frequency of MD-11 hard landing accidents suggests that generic guidance on these concepts is not sufficient or effective."

The NTSB said that "enhanced operational guidance and recurrent training will provide near-term improvements that reduce the risk of MD-11 landing accidents," while the board continues to identify and evaluate factors that contribute to the accidents.

Notes

1. JTSB. *The Interim Report of Aircraft Accident Investigation.* <www.mlit.go.jp/jtsb/eng-air_report/N526FE.pdf>. April 16, 2010.

2. NTSB. Aircraft Accident Report NTSB/AAR-00/02, *Crash During Landing; Federal Express Inc., McDonnell Douglas MD-11, N611FE; Newark International Airport, Newark, New Jersey; July 31, 1997.*

3. Civil Aviation Department of Hong Kong. Aircraft Accident Report 1/2004, *Report on the Accident to Boeing MD11, B-150, at Hong Kong International Airport on 22 August 1999.* December 2004.

4. NTSB. Accident Report no. DCA97MA055. July 31, 1997. The flight crew and three other FedEx employees received minor injuries in the crash or while exiting the airplane through a cockpit window to escape from a fire that destroyed the airplane. The NTSB said the probable cause of the accident was the captain's "overcontrol of the airplane during the landing and his failure to execute a go-around from a destabilized flare."

500 Meters to Spare

Dutch report on a high-speed rejected takeoff explores the 'RTO dilemma.'

BY MARK LACAGNINA

Problems began early in the takeoff when the first officer, the pilot flying, had difficulty keeping the Boeing 737-800 tracking the runway centerline at Eindhoven (Netherlands) Airport the morning of June 4, 2010. He also saw an unusual airspeed-trend indication on his primary flight display (PFD). Shortly after the captain called "V_1" and "rotate," the nose began to lift on its own and move left and right.

The first officer pulled back the thrust levers, automatically activating the autobrake and speed brakes. The captain took the controls, per standard operating procedure (SOP), and completed the rejected takeoff (RTO). The 737 came to a stop 500 m (1,640 ft) from the end of the 3,000-m (9,843-ft) runway. There were no injuries or damage to the aircraft.

The first officer told investigators for the Dutch Safety Board (DSB) that he rejected the takeoff after V_1 — the *maximum* airspeed at which the first action should be taken to initiate an RTO — because he believed that the aircraft was not safe to fly.

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In the final report on what it characterized as a serious incident, the DSB did not fault or condone the first officer's decision.[1] A perception that an aircraft is unsafe to fly is *the* universally accepted reason for conducting a high-speed RTO. The board merely said, "Rejecting a takeoff above V_1, especially when the nosewheel is off the ground, is in principle considered to be improper and unsafe."

In addition to presenting the facts gathered about the incident — an effort that was hindered by the board's lack of access to the 737's cockpit voice recorder — the report explores the V_1 concept, the nature of high-speed RTOs and the "dilemma" faced by pilots who must make a split-second decision armed with limited training and guidance.

Return Trip

The flight crew had flown the 737, operated by Ryanair, from Faro, Portugal, to Eindhoven, a joint civil/military airport, earlier that morning. The captain had 3,628 flight hours, including 2,061 in type. The first officer had 2,300 flight hours, including 1,170 in type.

The report did not specify how many passengers were aboard for the return flight to Faro, which was scheduled to depart at 1030 local time.

As the aircraft was taxied from the gate, the first officer performed a flight control check and observed no anomalies.

The airport traffic controller told the flight crew to depart on Runway 04 from an intersection, but the crew requested and received clearance to begin the takeoff from the approach end, thus using the full length of the runway.

The crew had derived the following takeoff speeds from the aircraft flight manual: 140 kt for V_1 and 141 kt for V_R, or rotation speed. V_1 is defined erroneously by the Ryanair flight crew operations manual — and by many other publications — as "takeoff decision speed" (see p. 23). European regulations define V_1 as follows:

> *V_1 means the maximum speed in the takeoff at which the pilot must take the first action (e.g., apply brakes, reduce thrust, deploy speed brakes) to stop the airplane within the accelerate-stop distance. V_1 also means the minimum speed in the takeoff, following a failure of the critical engine at V_{EF}, at which the pilot can continue the takeoff and achieve the required height above the takeoff surface within the takeoff distance.*

V_{EF} is the speed, set by the airplane manufacturer for performance certification, at which the critical engine is assumed to fail during takeoff.

V_1 and V_R are designated with symbols on the airspeed scales displayed on the captain's and first officer's PFDs. Also relevant to this incident is the display of a trend vector — a green arrow — on the airspeed scale. When the aircraft is accelerating or decelerating, the green arrow points upward or downward from the current airspeed shown on the vertical scale to the airspeed predicted to be reached within 10 seconds. The trends are computed by the air data inertial reference units (ADIRUs) from airspeed and longitudinal-acceleration data.

Troubling Trends

The winds were reported from 030 degrees at 5 kt, gusting to 10 kt, when the crew began the takeoff from Runway 04 at 1045.

The first officer selected the autothrottle takeoff mode, and the captain placed his hand near the thrust levers, per SOP. Typically, Ryanair places the responsibility for an RTO decision solely with the captain. In this case, however, the first officer made the decision, and the captain backed him.

The first officer initially had difficulty maintaining directional control but stabilized the aircraft on the runway centerline before airspeed reached 60 kt. Both pilots told investigators they believed that the heading deviations had been caused by asymmetric engine power.

A cross-check at 80 kt revealed no airspeed deviations, but when heading deviations recurred at 90 kt, the captain suspected an engine problem and again checked the engine indications. However, "the left and right engine parameters were found to be correct and symmetric," the report said.

As airspeed neared 140 kt, the first officer observed that the trend vector on his PFD predicted a large *decrease* in airspeed. At the same time, the airspeed scale on the captain's PFD showed a trend toward an inordinately large increase in airspeed. According to statements made during the investigation, neither pilot commented on the unusual trend indications.

"There is no reference in any manual or training program as to how the speed trend information should be used or monitored during takeoff," the report noted.

'Atmospheric Disturbance'

Shortly after the captain called "V_1" and "rotate," and removed his hand from the thrust levers, large lateral accelerations began, and the aircraft pitched 1.4 degrees nose-up, lifting the nosewheel off the runway for nearly two seconds.

Recorded flight data showed that airspeed was 152 kt, or 12 kt above V_1, when the first officer brought the thrust levers to idle. The 737 reached a maximum of 160 kt during the RTO; maximum deceleration was 0.56 g.

After the 737 was taxied back to the stand, smoke was observed coming from the overheated brakes. "Consequently, the crew decided to disembark the passengers and let the brakes cool off," the report said.

The recorded data showed that different airspeed and angle-of-attack (AOA) values had been computed by the captain's and the first officer's ADIRUs. Investigators concluded that the unusual airspeed trends displayed during the takeoff had been caused by an "atmospheric disturbance" that had affected the airspeed and AOA sensors located on either side of the fuselage. The uncommanded rotation and the large lateral accelerations also were ascribed to an "external, possibly atmospheric phenomenon."

However, "an explanation or cause for the atmospheric disturbance could not be determined," the report said. Investigators ruled out wake turbulence from a light aircraft that preceded the 737 on takeoff. They also found no evidence that mechanical turbulence from buildings and structures near the runway had caused the disturbance.

Only an engineered material arresting system kept this CRJ200 from plunging down a steep cliff during a high-speed RTO at Charleston, West Virginia, U.S., in January 2010.


© Fredric Parisot/Planespotters.net

RTO Dilemma

The report said that pilots face a dilemma when confronted with a situation that might necessitate a high-speed RTO — that is, an RTO initiated above V_1. The dilemma is caused, in part, by current guidance that leaves much to pilot interpretation and judgment.

For example, the quick reference handbook (QRH) for the Ryanair 737 contains both *prescriptive* and *general* rules for rejecting a takeoff. Among the prescriptive rules is that an RTO should be initiated if an engine fire warning occurs below 80 kt. "This 'if-then' rule is accommodating in the decision-making process and takes little processing time if such a circumstance is detected," the report said.

General rules are not so accommodating to decision making. For example, the 737 QRH echoes many other guidance documents in saying that a high-speed RTO should be conducted only if the aircraft is "unsafe or unable to fly."

"This general rule takes time to process, evaluate circumstances, apply and take appropriate actions," the report said. Moreover, the terms are not defined and leave room for interpretation.

At the DSB's request, Boeing provided the following definitions:

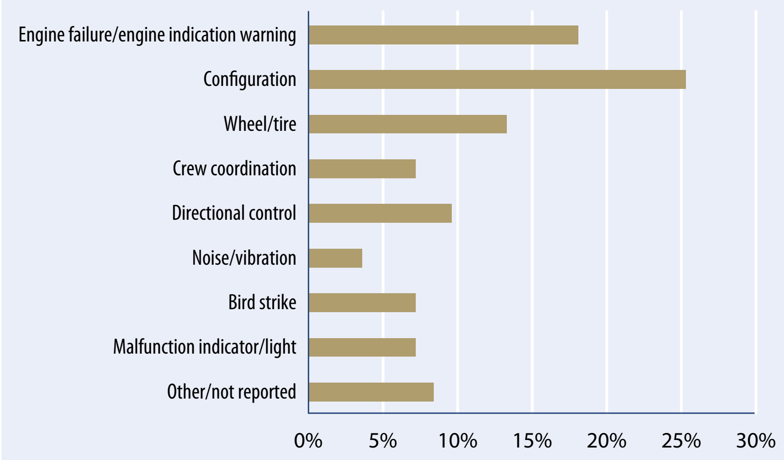
> *Unsafe to fly — the circumstance whereby rejecting the takeoff carries significantly less risk than flying the aircraft.*

Unable to fly — the circumstance where there is a reasonable probability of not being able to control the aircraft if the takeoff is continued and the aircraft becomes airborne.

The report said that these definitions also require interpretation and pilot judgment. "The reason given for not defining circumstances which fall under the 'unable' or 'unsafe' to fly [conditions] is that this may lead to misunderstanding among crews and ultimately to incorrect decision making."

The DSB recommended a re-evaluation of the RTO concept and procedures in light of current technology and human factors research. "During takeoff, the time to make a decision and take action is minimal; guidance and training are therefore essential," the report said. "With rules that require interpretation and judgment, pilots face a dilemma in a potentially critical time situation."

Causes of High-Speed RTOs, 1994–2008



RTO = rejected takeoff

Source: Gerard W.H. van Es

Figure 1

RTO Research

Citing research performed by several organizations, including the National Aerospace Laboratory (NLR)–Netherlands and Flight Safety Foundation (FSF), the DSB report noted that although the RTO concept and pilot training for RTOs focus on engine failures, less than one-quarter of all RTOs actually are conducted because of engine failures.

Gerard van Es, senior consultant on flight safety and operations to the NLR Air Transport Safety Institute, found in a study of 72 high-speed RTOs between 1994 and 2008 that 18 percent were prompted by engine failures or warnings.[2] The study focused on jet and turboprop airplanes with maximum weights above 5,500 kg (12,125 lb).

Configuration issues — including incorrect flap and flight control settings, and weight and balance problems — topped engine failures as prompting 26 percent of the high-speed RTOs during the period (Figure 1).

Among the other reasons for initiating a high-speed RTO were problems with wheels or tires (13 percent); directional control (9 percent); crew coordination, bird strikes and malfunction indications (7 percent each); and noises or vibrations (3 percent).

The study found that nearly half (44 percent) of the high-speed RTOs should not have been conducted. "This is clearly in hindsight, as most pilots really thought they were making the right decision at the time," van Es said, noting that RTOs often are conducted for more than one reason (as in the 737 incident at Eindhoven).

"Assessing such complex situations is difficult and often not well-trained," he said. "There are often no references as to what might make the aircraft 'unsafe to fly.' The data suggest that pilots have difficulty in taking a correct decision to continue the takeoff past V_1."

Detect, Decide, Act

Van Es found that high-speed RTOs led to 1.4 accidents and/or serious incidents per 10 million takeoffs in 1994–2008.

He also found that the rate of accidents and serious incidents involving high-speed RTOs is decreasing. The rate was 1.9 from 1980 to 1993, or 25 percent higher. Van Es noted that the decreasing rate might be due to more reliable engines and tires, improved maintenance and the publication in 1993 of the *Takeoff Safety Training Aid*.[3]

The 298-page training aid, which includes the 1990 report on the U.S. National Transportation Safety Board's special investigation of RTOs, was developed by the U.S. Federal Aviation Administration (FAA) and the aviation industry.

Van Es stressed that although the definition of a high-speed RTO is one in which the first *action* to reject the takeoff is made above V_1, the *decision* to reject often is made below that speed. This was the case in one in every 10 of the high-speed RTO accidents/incidents in the 1994–2008 data set.

Timely reaction to an event requiring an RTO is critical, he said. In many cases, the airplane continues to accelerate at 3 to 6 kt per second, and the available runway length decreases as the crew recognizes and/or calls out a problem, makes a decision to reject the takeoff and takes the first action to do so.

Current transport airplane certification standards build in a detection time of only one second. Then, "for pilots, it is difficult to make the right decision with limited time available," van Es said. Even if the correct decision is made, significant delays in taking action still occur.

Current training practices may be contributing to the delays. "Currently, pilot simulator training often presents RTOs as engine-related events, [although] the majority of RTO accidents are not related to engine problems," he said.

Pilots should be trained for RTO events other than engine failures or fires, van Es said. He also recommended that the *Takeoff Safety Training Aid* be revised and "brought back to the attention of the aviation community."

Common Risk Factor

In a study of takeoff excursion accidents, Flight Safety Foundation found that "the most common risk factor … was an RTO initiated at a speed greater than V_1."[4]

High-speed RTOs were involved in nearly half (45 percent) of the 113 excursion accidents — runway veer-offs and overruns — involving fixed-wing aircraft weighing 12,500 lb/5,700 kg or more from January 1995 through March 2008.

The FSF report on the study said that many high-speed RTOs "resulted from pilots' perceptions that their aircraft may have suffered a catastrophic failure that would not allow safe flight." The perceptions often were erroneous, indicating that "many pilots may be predisposed to respond by stopping, rather than by going," the report said.

"The repeated fear that the airplane might not safely fly, given some disconcerting event occurring at or after V_1, indicates a possible deficit in pilots' understanding of airplane performance and in their appreciation for the low probability of circumstances that would truly prevent safe flight."

The DSB, the NLR's van Es and the Foundation agree with a recommendation made 18 years ago by the *Takeoff Safety Training Aid* — that training is the key to prevent mishaps resulting from high-speed RTOs.

"In the final analysis, the pilots operating the flight are the ones who must make the go/no-go decision and, when necessary, carry out a successful RTO," the training aid said. "They need appropriate training to assure that they can and will do the best job in the very difficult task of performing a high-speed RTO."

Notes

1. DSB. "Rejected Takeoff After Takeoff Decision Speed 'V_1'; Boeing B737-800, at Eindhoven Airport, 4 June 2010." The English version of the report is available at <www.onderzoeksraad.nl/en/index.php/onderzoeken/afgebroken-start-2010040/>.
2. Van Es, G.W.H. "Rejecting a Takeoff After V_1 — Why Does It (Still) Happen?" Presented at the FSF European Aviation Safety Seminar in Lisbon, Portugal, on March 15–17, 2010. A report, NLR-TP-2010-177, based on this presentation is available at <www.nlr-atsi.nl/id~13386.html>.
3. The *Takeoff Safety Training Aid* is available on the Foundation's Web site at <flightsafety.org/files/RERR/TakeoffTrainingSafetyAid.pdf>.
4. FSF. *Reducing the Risk of Runway Excursions: Report of the Runway Safety Initiative*. The report is available at <flightsafety.org/current-safety-initiatives/runway-safety-initiative-rsi>.

The training session on regulations had numbed our senses, so the chief pilot posed a question to get us thinking. I don't remember the exact wording, but it was something like: "Is it ever legal to descend below decision height without the required visual references in sight?"

The answer is yes: If you decide to go around upon reaching decision height because you don't see what you need to see, the airplane most likely will descend below DH while you're cobbing the power, cleaning up and otherwise getting out of Dodge.

Perfectly legal. That's why it's called *decision* height.

Here's a question for you: What is takeoff decision speed?

If you responded that it's an old, discarded definition of V_1, you're right.

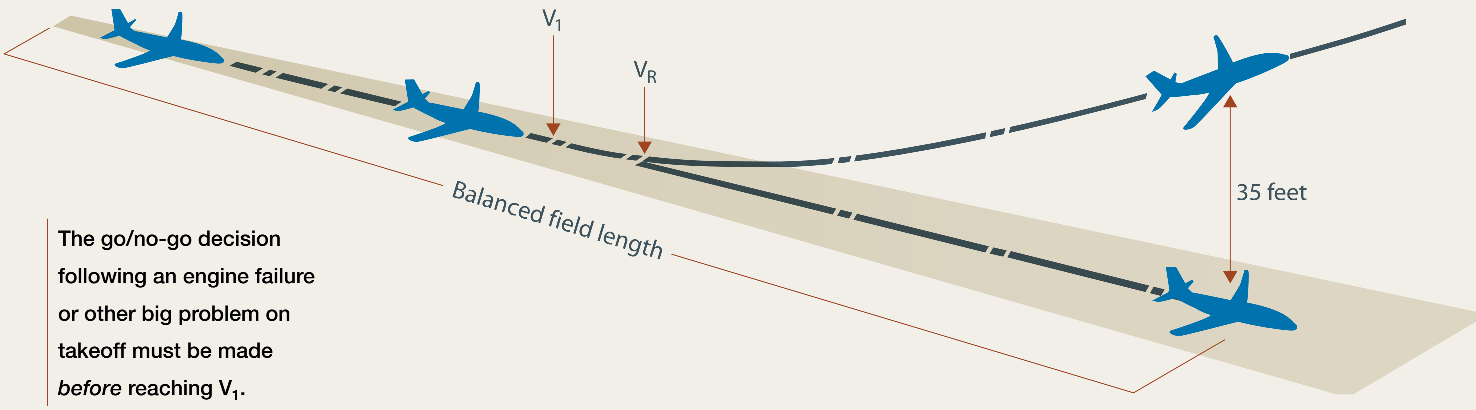
If, however, you said that it *is* V_1, put on the dunce cap and go to the corner with the U.S. Federal Aviation Administration (FAA), the U.S. National Transportation Safety Board, the Transportation Safety Board of Canada, the Australian Transport Safety Bureau, the New Zealand Transport Accident Investigation Commission, and probably many others (you know who you are). All have defined V_1 in recent publications as *takeoff decision speed*.

Even the Dutch Safety Board, which recently published a probing report on a high-speed rejected takeoff (RTO), used "takeoff decision speed" in the title (see p. 18, this issue). Inside the

High Time to Redefine V_1

The current 72-word definition is unwieldy and causes a dangerous default to 'takeoff decision speed.'

BY MARK LACAGNINA



The go/no-go decision following an engine failure or other big problem on takeoff must be made *before* reaching V_1.

report, where there was plenty of room, the board did publish the current definition:

> *V_1 means the maximum speed in the takeoff at which the pilot must take the first action (e.g., apply brakes, reduce thrust, deploy speed brakes) to stop the airplane within the accelerate-stop distance. V_1 also means the minimum speed in the takeoff, following a failure of the critical engine at V_{EF}, at which the pilot can continue the takeoff and achieve the required height above the takeoff surface within the takeoff distance.*

The old definition of V_1 was officially scrapped because it created 'a great deal of misunderstanding and disagreement.'

Whew. That is a great explanation of the V_1 concept, but as a V-speed definition, it is downright obese.

It replaced *takeoff decision speed* 13 years ago, when the FAA, followed closely by the Joint Aviation Authorities, precursor of the European Aviation Safety Agency, overhauled the transport category airplane takeoff performance certification standards (*Flight Safety Digest*, 10/98). Among the changes were requirements to account for worn brakes and wet runways in establishing accelerate-stop performance.

The old definition of V_1 was officially scrapped because it created "a great deal of misunderstanding and disagreement" by insinuating that it is the speed at which the go/no-go decision is made, according to the FAA.

Unlike *decision height* on approach, the go/no-go decision following an engine failure or other big problem on takeoff must be made *before* reaching V_1. This is critical to takeoff safety.

Regulations require transport category airplane pilots to ensure that the departure runway is long enough to allow the takeoff to be safely continued or rejected from a predetermined go/no-go point on the runway. That point is where the airplane reaches V_1 while accelerating for takeoff.

During certification, manufacturers designate V_1 speeds for various airplane configurations and takeoff weights, and for the temperatures and field elevations at which the airplane is expected to operate. Typical practice is to establish V_1 speeds that result in equal accelerate-stop and accelerate-go distances. This "balanced field length" ends at a point where the airplane, with one engine inoperative, will be either stopped on the runway or at a specific height — 35 ft over a dry runway or 15 ft over a wet runway.

The accelerate-stop distances or balanced field lengths published in airplane flight manuals are based on the assumption that the first *action* to reject the takeoff is made at V_1.

Although the current "definition" of V_1 nicely encapsulates the overall concept, it is an unwieldy, writer's-cramp-inducing monster that has spooked folks who should know better into conjuring *takeoff decision speed* from the ashes because it's … wieldy.

I have long suspected that the continued use of the discarded definition by authoritative sources might have something to do with the continuing prevalence of accidents and incidents involving high-speed RTOs.

This creeping malaise prompted me, on my own, to petition the FAA to take another shot at redefining V_1. The current definition, I said, "is too long to be conveniently used in publications and presentations, thus the persistent use of the confusing and inaccurate — and abandoned — definition: *takeoff decision speed*." I asked the agency to change the definition to *takeoff action speed* or a "similar term that reflects the V_1 concept and ends the confusing connotation that V_1 is the airspeed at which the decision must be made to reject or continue the takeoff."

The FAA duly stamped "FAA-2009-0562" on my petition and posted it on a Web site, <regulations.gov>, where it has languished for two years with nary a comment.

Recently, I came across this statement: "One common and misleading way to think of V_1 is to say, 'V_1 is the decision speed.' This is misleading because V_1 is not the point to begin making the operational go/no-go decision. The decision must have been made by the time the airplane reaches V_1."

That is from the *Takeoff Safety Training Aid*, an excellent product of a joint effort by the industry and the FAA that was published *18 years ago*. I'd say it is high time for action.

InSight is a forum for expressing personal opinions about issues of importance to aviation safety and for stimulating constructive discussion, pro and con, about the expressed opinions. Send your comments to J.A. Donoghue, director of publications, Flight Safety Foundation, 801 N. Fairfax St., Suite 400, Alexandria VA 22314-1774 USA or donoghue@flightsafety.org.

Joining the Team

BY RODOLFO QUEVEDO

As a newcomer to Flight Safety Foundation in July, I would like to introduce myself. Known in the industry as Rudy, I've joined the Foundation after 31 years in the airline industry. In my role as deputy director of technical programs, I will be working with Jim Burin, the director, to further develop FSF capabilities and provide more value to our members while, most importantly, enhancing safety.

After I earned my Federal Aviation Administration aircraft mechanic certificate with airframe and powerplant ratings, I began my aviation career as an aircraft maintenance technician with Eastern Airlines in 1980, working at the Miami maintenance base. In those days, most airlines had seasoned veterans who mentored new technicians. I credit all of the aviation veterans at Eastern for guiding me in those early years, a process that I believe is crucial for the proper development of expertise and professionalism.

After nine years at Eastern, I moved to US Airways — known as USAir in those days — working for the next 16 years as a line maintenance technician at the airline's stations in Newark and La Guardia airports. At US Airways, I first began working in safety positions as part of my involvement with the International Association of Machinists and Aerospace Workers' Flight Safety Committee. I acted as liaison, representing technicians on safety, quality and regulatory compliance issues. I also worked with the US Airways quality assurance team and the National Transportation Safety Board in the investigation of incidents and accidents.

This exposure to aircraft accidents developed my passion for enhancing air safety. I was then afforded an opportunity to work in JetBlue's safety department. In this capacity, I was responsible for system safety evaluations and analyses of the carrier's operational programs.

From JetBlue, I moved to North American Airlines as director of safety. North American provided me with an opportunity to leverage my experience to enhance operational safety programs and to develop the carrier's safety management system. In addition to my airline experience, I have utilized my fluent Spanish skills in Latin American aviation safety work.

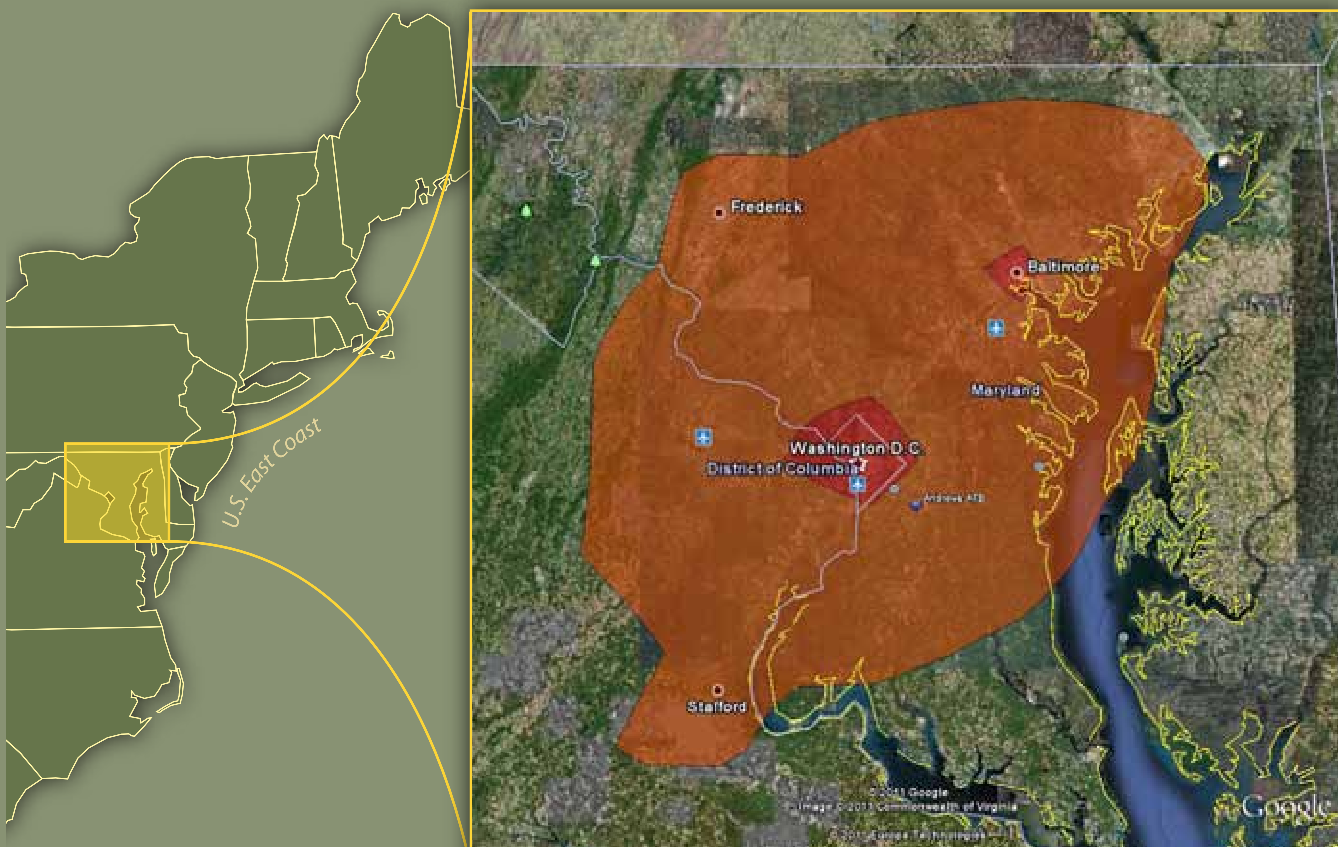
I believe my background will enhance the Foundation's ability to serve the needs of our members, especially in Latin America. In addition, I will be part of the Foundation's increased focus on maintenance and engineering issues, and the interfaces between the pilot and the "system outside the flight deck." One area where I hope to add a fresh perspective is the recent focus on professionalism, specifically the effects of ground-based workers' professionalism on safety of flight.

Throughout my career, I've been familiar with some of the Foundation's technical projects and always found them to be top-notch. I'm pleased to have the chance to work on safety issues that benefit the industry as a whole as part of the Foundation team. I am looking forward to serving you.

LightSquared Update

Wireless broadband network proposes to solve proven risks of harmful interference to aviation GPS receivers.

BY WAYNE ROSENKRANS



GPS = global positioning system

Altitude tested for signal interference — 500 ft above ground level

Contour of no GPS position output — transport category aircraft receiver

Contour of no GPS position output — transport category and general aviation aircraft receivers

U.S. National Telecommunications and Information Administration (prepared by National Space-Based Positioning, Navigation and Timing Systems Engineering Forum, based on LightSquared proposal as of January 2011)

International specialists have joined a chorus of voices urging the U.S. Federal Communications Commission (FCC) to indefinitely delay the launch of commercial service on LightSquared Subsidiary's 4G/LTE[1] wireless broadband network (*ASW,* 4/11, p. 31).

The opponents' position as of mid-2011 was informed by multiple independent research programs that demonstrated harmful interference to global positioning system (GPS) receivers, an unacceptable risk without adequate mitigations. In late January, the FCC had granted the company a waiver of rules, enabling network buildout to proceed on the condition that harmful interference to GPS receivers would be mitigated satisfactorily.

In June, the International Civil Aviation Organization told the FCC that "the potential disruption to aviation use of GPS caused by the LightSquared system would have a far-reaching impact on current and future aviation operations" and urged the commission to ensure that the U.S. commitment to provide vital GPS standard positioning service worldwide "is not unintentionally jeopardized by the introduction of the LightSquared system."

The International Air Transport Association expressed strong opposition and alarm that "interference to GPS signals will directly impact the U.S. Next Generation Air Transportation System (NextGen)" and urged the FCC "to take all necessary steps to ensure that GPS service provision is not compromised in any way by the LightSquared system."

In July, the FCC heard from more non-U.S. interest groups. The Directorate General for Enterprise and Industry, European Commission, said that a European Space Agency analysis found that when aircraft fly into the United States, LightSquared would pose a grave threat to operators equipped with European Geostationary Navigation Overlay Service receivers and, by 2014–2015, could degrade reception of signals from the Galileo satellite constellation. The European Positioning, Navigation and Timing Industry Council added that members also had deep concern about aircraft and vessels traveling to the United States while receiving signals from Russia's Global Navigation Satellite System and China's Beidou-2, or Compass, navigation system.

The FCC's primary data collection effort for the LightSquared proceeding, called the Technical Working Group (TWG), was led jointly by LightSquared and the U.S. GPS Industry Council. In parallel, the U.S. Federal Aviation Administration (FAA) appointed RTCA Special Committee 159 (SC-159), Global Positioning System, to study LightSquared network effects on GPS receivers, and the National Telecommunications and Information Administration (NTIA) directed the National Space-Based Positioning, Navigation and Timing Systems Engineering Forum to perform similar research.

The engineering forum's June 1 report to the NTIA recommended that "LightSquared should not commence commercial services per its planned deployment for terrestrial operations in the 1525–1559 MHz MSS band due to harmful interference to GPS operations."

Since *ASW's* previous story about LightSquared, the FCC opened a new public comment-rebuttal period, closing Aug. 15, to consider the TWG's findings and LightSquared's modified proposal. The FCC said in its announcement, "The [TWG effort] identified significant technical issues related to potential LightSquared operations [i.e., the 1545.2–1555.2 MHz channel] most proximate to the band used by GPS. … The tests demonstrated potentially significant interference between LightSquared operations in the upper portion of the band and various GPS receivers. The tests also identified some interference issues in the lower 10 MHz portion of the band. The overall conclusion of the testing is that transmissions in the upper 10 MHz channel — the channel nearest to the 1559–1610 MHz GPS band — will adversely affect the performance of a significant number of legacy GPS receivers.

"LightSquared indicates its willingness to operate at a lower power than permitted by its existing FCC authorization; agree to a 'standstill' in the terrestrial use of its upper 10 MHz frequencies immediately adjacent to the GPS band; and commence terrestrial commercial operations only on the lower 10 MHz portion of its spectrum [1526–1536 MHz], and to coordinate and share the cost of underwriting a workable solution for the small number of legacy precision measurement devices that may be at risk."

In the TWG's June 30 final report, its Aviation Sub-team said, "All three phases of the currently proposed LightSquared deployment plan are incompatible with aviation GPS operations absent significant mitigation, and would result in a complete loss of GPS operations below 2,000 ft above ground level over a large radius from the metro deployment center. For the originally defined LightSquared spectrum deployment scenarios, GPS-based operations are expected to be unavailable over entire regions of the country at any normal operational aircraft altitude."

RTCA SC-159 on June 16 issued its report to the FAA. In part, the committee said, "The study concludes that the current LightSquared terrestrial authorization would be incompatible with the current aviation use of GPS, however, modifications could be made to allow the LightSquared system to coexist with aviation use of GPS. … From an aviation perspective, LightSquared upper channel operation should not be allowed."

Jeffrey Carlisle, executive vice president, regulatory affairs and public policy, LightSquared, said in the TWG report's recommendations, "It is inescapable that it is [GPS device manufacturers'] disregard for [FCC] policies regarding immunity of receivers to transmissions in nearby frequency bands that is the source of the technical problem. … Transmissions in the [1526–1536 MHz channel] will not adversely affect the performance of over 99 percent of GPS receivers. … LightSquared is optimistic that further analysis … will support the consistency of LightSquared lower channel operation with FAA performance standards."

Note

1. The term *4G* refers to fourth-generation mobile broadband; LTE means long-term evolution, an advanced protocol.

Airlines welcome efficiency and safety benefits of ADS-B, but some can't make the business case to equip fleets now.

WAIT *and* SEE

BY WAYNE ROSENKRANS

Uncertainty about U.S. airlines' willingness to voluntarily install new avionics eight years before the upgrade becomes mandatory surfaced repeatedly in a public discussion in mid-2011, dividing stakeholders who, nevertheless, share high aspirations for the U.S. Next Generation Air Transportation System (NextGen). During this government-industry meeting, several presenters credited the Federal Aviation Administration (FAA) with success in building a substantial portion of the ground infrastructure for automatic dependent surveillance–broadcast (ADS-B). This satellite-based aircraft tracking system already has been authorized for air traffic control (ATC) to separate suitably equipped aircraft within current areas of ADS-B coverage, pending nationwide coverage in 2013 (Table 1).

The theme of the meeting — the RTCA 2011 Annual Symposium, held June 15–16 in Washington — was "Accelerating NextGen Through Public–Private Partnership."

Encouraged by the FAA and some industry colleagues to join early adopters, several presenters from airlines expressed support for NextGen — a massive migration of air traffic management from radar-based systems to satellite-based systems. But the same presenters were adamant that, for now, their capital investments will exclude ADS-B Out avionics, the *equipage* that provides the capability to continuously transmit aircraft position data to the ADS-B network in controlled airspace. The federal aviation regulation requiring the equipage will take effect on Jan. 1, 2020.

Other presentations explored efforts to accelerate airspace modernization, harmonize equipment and procedures,

and enhance safety. These efforts are being pursued in an international context demanding interoperability, synchronization of activity and readiness for implementation, specialists said.

Since September 2010, Dave Barger, chairman and chief executive officer of JetBlue Airways, has headed the FAA's NextGen Advisory Committee (NAC). He called NextGen implementation "truly tough" yet feasible for government and industry teams. The NAC, with RTCA support, has developed priorities and a roadmap for achieving four near-term and mid-term NextGen objectives: metroplex-level rollout, a phased concentration on 21 multi-city areas by 2016; creation of metrics for judging the effectiveness, cost-benefit and safety of implementation stages; development of incentives for aircraft equipage; and finalization of how satellite communication (sat comm) technology and procedures will replace voice with text display for routine messages between flight crews and ATC.

In early June, the NAC gave the FAA a list of NextGen mid-term operations that will depend on aircraft equipage. The committee also has advised the agency on integration of elements, preliminary system performance indicators, steps in NextGen rollout to metroplexes, and a plan for special activity airspace.

"NextGen is far more than science and technology … more than equipage or metroplex prioritization," Barger said. "It is implementation … how each of us operates. This is built on trust and on following through with commitments. … Nothing will overcome challenges like simply implementing NextGen [and] delivering promised incremental improvements using equipment on aircraft today. … The greatest [take-away lessons should be]: First, we don't have a choice. The status quo is not acceptable. Second, NextGen is an ongoing transformation; it won't happen as a 'big bang,' it will happen in steps."

No one has to look hard at U.S. airspace to realize that the airspace around New York "is imploding" in its limitations and disruptive spillover effects, or to grasp ADS-B as fundamental to the long-term solution, Barger added. "[ADS-B] technology is amazing, and has leveled the playing field," he said. "[At JetBlue we asked,] 'How do we start to drive the procedures and use [this] technology aboard aircraft?' NextGen already is driving our procedures and training.

FAA Progress in NextGen Airspace Access and Airport Surface Operations, 2010

Metroplex (Primary City)	Airspace Access Improvement	Airport Surface Operations Improvement
Anchorage, Alaska	OPD	
Atlanta, Georgia	OPD	DDU
Atlantic City, New Jersey	EVAL	
Boston, Massachusetts		N-CTL
Cape Canaveral, Florida	UAS	
Charlotte, North Carolina		DDU, RWY*
Chicago, Illinois		DDU
Dallas-Fort Worth, Texas		DDU
Denver, Colorado	3D-PAM	DDU
Detroit, Michigan		DDU
Kansas City, Missouri		DDU
Las Vegas, Nevada	OPD	
Los Angeles, California	OPD, ITA	DDU
Louisville, Kentucky	OPD	DDU
Memphis, Tennessee		SMDS-CDQM
Miami, Florida	OPD, ITA	
New York, New York	AS	DDU, RWY**, SMDS
Newark, New Jersey		DDU
North Texas	MS	
Oklahoma City, Oklahoma	CSPO	
Orlando, Florida		SMDS-CDQM
Philadelphia, Pennsylvania		DDU
Phoenix, Arizona		DDU
Portland, Oregon		RWY***
San Francisco, California	ITA	
Seattle, Washington	RTA	DDU
Washington, D.C.	MST	

ADS-B = automatic dependent surveillance-broadcast; AS = airspace redesign (John F. Kennedy International Airport); CSPO = closely spaced parallel operations (simulation); DDU = data distribution unit for ADS-B (installed); EVAL = research platform for NextGen integration and evaluation capability (initiated); ITA = initial tailored arrivals; MST = Metroplex study team (initiated); N-CTL = N-control, a gate-hold procedure to reduce fuel burn and emissions (demonstration); NextGen = Next Generation Air Transportation System; OPD = optimized profile descents; RTA = Required time of arrival (flight trial); RWY* = Runway 18R/36L (extended); RWY** = Runway 13R/31L and taxiway NY (reconstruction); RWY*** = Runway 10L/28R (extended); SMDS-CDQM = Surface management data sharing and collaborative departure queue management (demonstration); 3D-PAM = Three-dimensional path arrival (demonstrations); UAS = Unmanned aircraft system integration (demonstrations)

Source: U.S. Federal Aviation Administration (FAA), "FAA's NextGen Implementation Plan," March 2011

Table 1

U.S. Federal Aviation Administration

… NextGen will not only raise the safety bar but [also accomplish goals in] environmental improvement, energy policy, the economy and employment."

As a budget item, NextGen capital expenditures ought to be seen as a long-term investment for which airline executives do not require costs to be recouped within the first two or three years, some presenters suggested.

FAA Perspectives

FAA Administrator Randy Babbitt pointed to positive examples of government-industry partnership in ADS-B implementation. "RTCA's Task Force 5 recommendations two years ago [*ASW,* 4/10, p. 30] helped us to shape the way we implement NextGen," he said. "The NAC is part of our effort to change the FAA's oversight structure to be more in keeping with current demands." A pending internal change at the FAA, requiring approval by the U.S. Congress, is expected to separate responsibilities for NextGen from responsibilities for day-to-day system operations and regulatory oversight, he added.

"We can all agree that equipage is a critical building block," Babbitt added. "We cannot fail to equip universally with all the components needed. … These are tough economic times, and we need to balance our fiscal restraints with the need for equipage."

Increases in jet fuel prices have influenced some airlines to look again at their business case for ADS-B equipage and other NextGen technology, and in flight line demonstrations, the savings and other benefits have been proven, he said.

"Southwest Airlines started using global navigation system [GPS]-based required navigation performance [RNP] approaches at a dozen airports this year," Babbitt said. "They estimate they'll save $60 million a year in fuel once they can use these procedures systemwide.

"Alaska Airlines has been a leader in using RNP approach procedures at Juneau [Alaska] International Airport [also long a test site for ADS-B; *ASW,* 12/08, p. 42]. … The airline estimates it would have canceled 729 flights last year into Juneau alone due to bad weather if it were not for these approaches."

The United States currently has more than 250 RNP approach procedures available for use by about 2,000 airline and business aviation aircraft. "Alaska Airlines is joining the FAA, the Port of Seattle and Boeing Commercial Airplanes to further develop [fuel-saving] RNP procedures at Seattle-Tacoma International Airport," he said.

Delta Air Lines reported savings of 60 gallons (227 L) of fuel per flight by using continuous descent from cruise to the runway with engines idle. "We want to see this safety and efficiency systemwide," Babbitt said, noting that the FAA has worked accordingly to reduce by 40 percent the time required to design and issue area navigation (RNAV) and RNP procedures.

"With ADS-B, we have achieved new levels of safety and efficiency for air travel in the Gulf of Mexico, where there is no radar coverage," he added. "Helicopters in the Gulf are ferrying as many as 10,000 workers a day out to thousands of oil rigs. Equipped aircraft are saving five to 10 minutes and 100 lb [45 kg] of fuel each flight. JetBlue equipped some of its aircraft with ADS-B to allow its Airbus A320s to fly more direct routes … over water … taking advantage of new RNAV routes from Boston and New York down to Florida and into the Caribbean that bypass the congestion. This is a trial period during which JetBlue will share flight data with us to see how and where they are saving time,

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JetBlue expects its early adoption of NextGen technologies to 'raise the safety bar' as well as save time, distance and fuel.

distance and fuel. We hope it will lead JetBlue to equip the balance of their fleet — and, meanwhile, to provide concrete data that we believe will inspire other carriers to equip their fleets."

The collective insight of RTCA's Task Force 5 and the FAA's NAC to roll out NextGen metroplex by metroplex so far has worked as envisioned. "We've already completed assessments of the airspace around Dallas-Fort Worth and Washington, D.C., and made recommendations," he said. "We're finishing studies at Charlotte, North Carolina, and in Northern California. Next up will be Houston, Atlanta and Southern California."

Not every airline will reap the same benefit from ADS-B and other NextGen technologies, said Carl Esposito, vice president, Honeywell Aerospace. Airlines therefore should recognize the importance of the ADS-B technology being available now, he said. Honeywell has been studying ways to minimize operator costs and time for related software upgrades during NextGen implementation.

FAA Research and Development

This year, the FAA has been shifting some of its NextGen expenditures to better demonstrate to airlines how ADS-B can produce tangible short-term results. "We have invested in research and development to do risk reduction up front and to make a textbook case of how [ADS-B] works," said Paul Fontaine, manager of the FAA Technology and Prototyping Group. One focus has been integrated arrival and departure management, he said.

For operations from top of descent to the surface environment, airlines and controllers gradually will see more airlines using ADS-B capabilities that increase their flexibility, such as a high-capacity arrival management system that pre-positions streams of aircraft.

"We have proved the constant descent angle/optimum profile descent," Fontaine said. "That is where we will move in metroplex airspace." Significant research and development of related capabilities, such as initial tailored arrivals at coastal airports, also is being completed in 2011. "Three-dimensional-path arrival management already in use in Denver will bring benefits to controllers of [the time-based metering function of the FAA's traffic management adviser system and] RNP arrival routes," he said.

At the surface, the FAA has followed through on the Task Force 5 recommendation to use ADS-B to increase situational awareness for both ATC and company ramp controllers "so everyone is able to see the same thing" on digital airport map displays.

Pressure to accelerate NextGen also has influenced the FAA to take corrective actions in the design process for instrument approach procedures. These eliminate rework and error-prone manual methods, and increase the robustness and integrity of automation in aeronautical charting, said John Hickey, deputy associate administrator for aviation safety. "We will be developing a singular, automated system from beginning to end, and everybody in the agency will [interact with charting] data in the same way."

"It is pretty widely known inside the federal government [that cuts in operations funding] will be quite Draconian from fiscal years 2012, 2013 and the out years, and this will have a severe [impact] on our ability to carry out [NextGen]. At the fiscal year 2006 funding levels [proposed by some federal legislators], the FAA will have to make hard decisions [involving the attrition] of a lot of people. This could be a serious problem."

Airlines Wait to Equip

Some FAA specialists see unresolved issues — despite more than three years of discussions — in fundamental assumptions by airlines versus the federal government as both have analyzed expectations in timing and paying for ADS-B equipage.

"We have a big challenge: We all view the business case differently," said Kris Burnham, the FAA director, investment planning and analysis. "There is no one NextGen business case. … Even within the FAA, we are dealing with hundreds of business cases. … Our focus has been understanding [ADS-B's] potential value and, in that context, refining program plans, increasing stakeholder involvement and reducing risk."

In comparison, Ed Lohr, director of fleet strategy, Delta Air Lines, was among airline representatives who said that closing the business case for aircraft equipage in the near term is very difficult. "The investment needs to fit either our need for competitive advantage or our need to remedy a [competitive] disadvantage," Lohr said. "Until [NextGen technology] does that, we cannot invest."

Similarly, Bob Johnson, managing director of flight operations, American Airlines, said that the company supports NextGen as a force for moving the nation in the right direction, yet faces some near-term realities about equipage. "It is important to American that once [NextGen] generates efficiencies, and competitors have an advantage, we make sure that as NextGen evolves, we do as well," he said.

"We are involved in equipping [aircraft with ADS-B in the new coverage area] in South Florida," Johnson said. "We have a large investment already in

The FAA demonstrates ADS-B with a Garmin Apollo MX20 multifunction display at its technical center in Atlantic City, New Jersey.

fleets and in training pilots in [technologies] that can be applied now. … We are not interested in the future ADS-B [capabilities] until the FAA is further along on current technology. … We will not equip [with ADS-B now] and then go exploring for benefits of NextGen [if] the benefit is 10 years out. We wield a pretty sharp pencil, and we are looking for tangible benefits in any investment we make first in navigation capability, then in data comm capability."

Steve Fulton, chief technical officer, GE Aviation, noted that airlines' reluctance to equip airplanes with ADS-B could blunt other aviation advancements. "We invest to have the latest and best technology in engines [to achieve] a 15 percent improvement in specific fuel consumption," Fulton said. "[Airlines already] have flight management systems that can navigate in four dimensions. It is a real loss when engine efficiency [gains are] lost because of inefficiency in the ATC system."

Neil Planzer, vice president, air traffic management, Boeing, said that in light of expected federal budget cutting, "Using RNP, there are clear capacity improvements, and we do not have to have everything done [at once]. There are lots of [technological] capabilities that would provide significant benefit now. But what we have done is churn the same things, study and study them, and do seminars around the world." If this pace continues, he said half-jokingly, his grandchildren likely will find themselves on an RTCA NextGen implementation committee, and "the nation still will not be able to have one more airplane landing at La Guardia Airport."

Global ADS-B Perspective

Worldwide interoperability of ADS-B equipage and commonality among ATC procedures will be "absolutely critical to safety," said Rob Eagles, director, safety, operations and infrastructure at the International Air Transport Association (IATA).

Bo Redeborn, principal director air traffic management, Eurocontrol, told the symposium that the United States and European countries still have a "golden opportunity to harmonize" ADS-B applications within NextGen and Single European Sky Air Traffic Management Research (SESAR). So far, however, they "have not been successful in achieving harmonization in all areas" and they now "want to reduce the amount of resources [expended] to achieve this," he said.

Despite interaction between U.S. specialists and their counterparts in other world regions, some harmonization gaps remain in the use of ADS-B, especially with SESAR, JetBlue's Barger agreed, speaking for the NAC. "In the short term, SESAR is properly funded," Redeborn noted. "The [European] issue now is related to incentives [for operators to proceed with ADS-B equipage] … the need for them to allocate $4.2 billion in 2014–2044. We have had a few examples in military aviation and general aviation where [ADS-B] benefits have been obvious. But we also see that when money is so tight, that also jeopardizes the solidarity [of states]."

Marc Hamy, vice president, SESAR and NextGen programs, Airbus, said that the company is fully committed to these transformations on both sides of the North Atlantic as "the only way to deal with traffic growth." This commitment includes quickly exploiting every ADS-B capability.

"First, we need interoperability, and we are working very well with Boeing," Hamy said. "Second, we need to have coordination and to be ambitious. Airbus is looking for a real transformation of air traffic management — solutions that have a long-term vision. Operators will not accept the need to refit every year." The solution, however, is not to wait for perfect harmonization because doing nothing is unacceptable and significant benefits would derive from the acceleration of SESAR and NextGen, he added.

Lengthening the retesting interval may increase administrative efficiency, but it also raises safety concerns.

English Proficiency Level Bust

BY PHILIP SHAWCROSS

The European Aviation Safety Agency (EASA) has submitted a draft proposal to the European Commission, for consideration this November, to extend the current license validity for pilots with International Civil Aviation Organization (ICAO) operational Level 4 language proficiency from the three years recommended by ICAO to four years.

EASA reasons that this is a more convenient time frame for license renewal. Although the three-year interval between retesting is an ICAO recommendation and not a standard, it is a minimum that is universally applied, with some states in South America and the Baltic having even legislated for a two-year validity.

The arguments against such an extension merit serious consideration.

Such a decision would introduce two norms within Europe: a four-year cycle for pilots and a three-year cycle for air traffic controllers. And it hardly seems compliant with EASA's own Basic Regulation 216/2008 "to assist member states in fulfilling their obligations under the Chicago Convention, by providing a basis for a common interpretation and uniform implementation of its provisions" and "establishing appropriate cooperation with third countries and international organizations."

A safety-related decision should not be taken on grounds of administrative convenience. No evidence has been advanced that a longer retesting cycle would enhance safety. With the ICAO endorsement process not yet in place, the language testing environment is still immature, with tests of varying standards and levels, "test shopping" highlighted by the recent European Civil Aviation Conference report and many documented cases of malpractice.

While many pilots regularly flying international routes have prolonged and extensive opportunities to practice their English, a purely routine use of English through standard phraseology for standard procedures and with limited social contact only maintains a restricted core of the language that might be inadequate for managing unexpected and abnormal situations.

Research shows that language proficiency erosion, or language attrition, occurs rapidly over time; the lower the initial level, the faster the rate of erosion, unless systematic strategies and a high degree of motivation counter this trend.

Moreover, it is well documented that one's language and communicative proficiency, even in one's native language, deteriorates sharply under stress. If we combine gradual language proficiency erosion with sudden stress-related factors, our "Level 4"–endorsed speaker may actually be functioning effectively at a low Level 3 or high Level 2.

Finally, if the four-year retesting cycle were to be introduced, Europe, which has high standards in so many fields, would be setting an example of less than best practice for the world. This could threaten levels of safety in regions where language proficiency is less robust than in Europe and undermine the safety principles behind the ICAO Language Proficiency Requirements.

The aviation community owes it to itself and the traveling public to have an open and well-informed discussion before any such legislation is adopted.

Philip Shawcross is president of the International Civil Aviation English Association.

InSight is a forum for expressing personal opinions about issues of importance to aviation safety and for stimulating constructive discussion, pro and con, about the expressed opinions. Send your comments to J.A. Donoghue, director of publications, Flight Safety Foundation, 801 N. Fairfax St., Suite 400, Alexandria VA 22314-1774 USA or donoghue@flightsafety.org.

Much has been written about the high-stress nature of aviation, but the role of family life largely has been left in the background. Yet, irregular duty periods and missing out on activities at home can spur a significant and detrimental cycle of stress.

In a study of the relationship between their domestic situations and their perceived effectiveness on duty, a group of U.S. Coast Guard helicopter pilots ranked six family-related factors highest among 53 potential sources of stress.[1] The factors included backlogs of tasks, arguments, lack of money, child-related issues, use of time at home, and the overall degree to which home life matches expectations. Interestingly, only 14 of the 53 potential stressors involved family issues.

A similar survey of British commercial pilots found that work/family factors significantly influenced both job performance and the ability to cope with stress, and that the most important aid in coping with stress was stability in relationships and in home life.[2] The study noted that "the primary effect of home stress on work is in the mental or cognitive consequences: recurring thoughts during periods of low workload, decreased concentration and a tendency not to listen." In other words, demands at home can lead to preoccupied workers, a perilous condition in a safety-sensitive business.

The study of the Coast Guard pilots found that crewmembers perceive their

A stressful family life can affect performance in the cockpit.

ON THE Home Front

BY PATRICK CHILES

© Chris Sorensen Photography

flying performance as degraded during periods of high stress at home. When family problems carry over into the cockpit, they negatively affect several aspects of performance, including situational awareness, landing accuracy and smoothness, ability to divide attention, and the perceived degree of general airmanship.

Fatigue and mental preoccupation were found to be the most frequent manifestations of home-based stressors. Pilots reported feeling tired because of sleep disruption. Exhaustion is a common response to the stress of an argument or other especially tense event.

Social Isolation

Potential coping strategies, such as fostering stability at home, often are undermined by the nature of the profession. Stability is difficult to achieve when dealing with extended absences or irregular duty periods. Moreover, limiting relationships to workplace colleagues can lead to feelings of social isolation among the family.

Common in the aviation industry are around-the-clock jobs that must be staffed by licensed or otherwise specially trained individuals. Especially at smaller operations with limited staffing depth, this can lead to demanding schedules with very little flexibility — and social consequences that often are not appreciated by those who work 9-to-5.

Physiological and psychological effects of rotating shift work are fairly well known. It is common to end a duty cycle or shift period feeling too exhausted to participate in family functions.

Research psychologist and sleep specialist J. Lynn Caldwell said that this can cause spouses and children to feel neglected.[3] "This is especially true when the duty period occurs between 1500 and 2300 — that is, while the family is home," she said. "Dinner time cannot be shared, for example, and other evening social activities are missed."

Irregular duty periods preventing pilots from participating in family activities can cause spouses and children to feel neglected.

Reduced socialization is an insidious relationship hazard of the 24/7 work cycle. "Many people who work rotating shifts reduce their social activities because such schedules do not allow consistent involvement, which can lead to a feeling of social isolation," Caldwell said.

Sporting activities, family gatherings and recreational or religious activities usually occur in the evenings, on weekends or on holidays when a flight crewmember might be on duty. Friends or relatives with no exposure to the same lifestyle may not understand.

Difficult Readjustment

In addition to the known effects of irregular duty periods, the intense nature of many aviation jobs — the way they can consume attention while on duty and affect personalities while off duty — should not be underestimated.

Author Drew Whitelegg said that, because of the intense service aspect of their jobs, flight attendants often have difficulty readjusting to life back at home.[4] Many flight attendants reported that, after days of being confined to a cabin with hundreds of needy passengers, they avoid a simple touch or are unable to hold a conversation with family members. "The image here is one of workers so agitated by the demands of the job that they cannot switch off: not exactly the hallmark of a group not taking work home with them," he said.

Whitelegg noted that the "intermittent husband syndrome" is an example of situations common to professions in which a spouse is regularly away from home for extended periods. The much-anticipated reunion can create as much stress as joy. "In situations where male pilots are away and their female partners are left at home, research suggests that families suffer from more stress-related illness and marital difficulties than those where husbands do not travel," he said. "Family routines become disrupted, with negative effects on wives and children."

Vicious Cycle

Another study found that "high job demands in the form of workloads and time pressures, coupled with lack of control, are likely to lead to mental strain and cardiovascular disease, particularly when social support is low."[5]

This stress is compounded by work environments with strong performance expectations, including peer pressure to excel. The inability to meet family obligations because of the time and energy required for work compounds the stress felt on the job. A vicious cycle can develop.

Aviation professionals often experience high job demands, inflexibility and time pressure. They live with strict deadlines, often balancing conflicting demands, and stress is the body's natural response. Stress, combined with the competitive "Type A personality" so common in the industry, can take a toll on physical or psychological health, or on satisfaction with the job or with a marriage.[6]

Of the 33 recommended coping strategies resulting from the study of the Coast Guard pilots, the two highest rated were "stability with a spouse" and a "smooth and stable home life." These were, in fact, cited by *all* of the pilots surveyed. Having a spouse with some knowledge of flying also was perceived as contributing to better flying performance. This would seem to support the strong "squadron family" culture so prevalent in military aviation.

The third most highly rated coping strategy was "talking to an understanding spouse or partner." This is further supported by a similar investigation of emergency medical personnel in Europe.[7] The study suggested two fundamental strategies to manage work-family stress: "psychological detachment" from the job while at home and "verbal expression of emotions." The study warned, however, that venting one's frustrations to an understanding listener can have the negative effects of causing the frustrations to linger and increasing the stress.

Psychological detachment — physical separation from the workplace and mental disengagement through activities that put one's focus on something else — can be very effective. It was more strongly correlated with overall "life satisfaction" than was relief of psychological strain.

The study noted that "when work interferes with family responsibilities, disconnecting from job-related duties can be an important resource to diminish the effects of conflict on psychological strain." There is a limit, however; the study also noted that work intrusion on the family, leading to poor life satisfaction, and family intrusion on work, causing psychological strain, were factors that appeared less moderated by psychological detachment.

Familiar detachment strategies such as getting enough sleep, exercising and enjoying hobbies were cited by the Coast Guard study.

The nature of our industry makes some of the consequences on home life unavoidable, but the tools to manage them are generally well within our grasp and in an employer's interest to foster.

Patrick Chiles is a member of the Flight Safety Foundation Corporate Advisory Committee.

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© Lufthansa Flight Training

Airlines analyze incidents to continuously redefine 'training to proficiency' for flight attendants.

Advanced Qualification

BY WAYNE ROSENKRANS | FROM ORLANDO

Flight attendants appreciate proficiency-based, scenario-oriented training that mirrors concepts now applied to airline pilots — such as practicing and demonstrating skills without pass/fail jeopardy, cabin safety specialists say. When deficiencies in performance or procedures appear, such training also provides built-in corrective mechanisms, several presenters said during the World Aviation Training Conference and Tradeshow, April 19–21, in Orlando, Florida, U.S.

Southwest Airlines provided an example of how conventional flight attendant training prepared cabin crews to respond successfully to rapid decompressions aboard two Boeing 737s — Southwest Airlines Flight 2294 on July 13, 2009, and Flight 812 on April 1, 2011. Larry Parrigin, Southwest Airlines' manager, curriculum and program development, presented cabin safety lessons learned from Flight 2294, noting that the final report on Flight 812 had not yet been published by the U.S. National Transportation Safety Board.

Other airlines focused on lessons from the first five years of implementing an advanced qualification program (AQP) for flight attendants. The U.S. Federal Aviation Administration (FAA) describes AQP, under Subpart Y of Federal Aviation Regulations Part 121 which governs air carrier operations, as "an alternative method for developing training and testing materials for pilots, flight attendants and aircraft dispatchers based on instructional systems design, advanced simulation equipment and comprehensive data analysis to continuously validate curriculums." One current motivation for U.S. airlines to adopt AQP for flight attendants is their anticipation that the FAA in 2011 will issue its final rule on conventional training "requiring flight attendants to complete 'hands on' performance drills every 12

German authorities were persuaded that Lufthansa's experienced flight attendants can adequately familiarize themselves with details of the Airbus A380 via an interactive three-dimensional video that complements a cabin emergency evacuation trainer.

months using emergency equipment and procedures" and "requiring trained and qualified flight attendant ground instructors and evaluators."

Decompression Lessons

Flight 2294 was en route from Nashville, Tennessee, to Baltimore at Flight Level 350 (approximately 35,000 ft) with two pilots, three flight attendants and 126 passengers when a rapid decompression occurred about 25 minutes after takeoff. "After an emergency descent, the aircraft landed safely at Charleston, West Virginia, [with] no injuries to the crew or passengers," Parrigin said. Cabin pressure was lost because of fatigue cracking between rivets fastening the aluminum skin near the fuselage crown, creating an 18-in by 12-in (46-cm by 30-cm) opening just forward of the vertical stabilizer, he said.

The cabin crew told investigators that they had experienced a "textbook" decompression. "They followed the procedures on which they had been trained," he said. "There was rapid air movement and condensation fogging, and they even remarked about the scorched smell … from the oxygen-generating systems. All oxygen mask compartments opened as designed, and flight attendants reported no difficulty activating oxygen flow."

Every airline faces obstacles in providing a realistic environment for decompression training, however. "Scenario-based training takes a significant amount of time [and more staff than conventional Part 121 training, ideally a one-to-one ratio of instructors to trainees] as opposed to lecture-based training," Parrigin said. "It is also often impractical, and would be too costly, to depict things like wind blast, cabin temperature changes and condensation fogging."

Some flight attendants later said they felt unprepared for the extremes of passenger behavior that they encountered. "Flight attendants saw active panic with screaming and yelling," Parrigin said. "There were [passengers] who believed that the oxygen system wasn't working, that oxygen wasn't flowing [although oxygen was flowing]. Some were confused about how to activate the flow of oxygen and were afraid to break something if they pulled the lanyard. … A lot of folks became physically ill with airsickness symptoms. They also had negative panic with passengers taking no action whatsoever. A handful of folks actually had paid attention [to the preflight safety briefing] … and correctly donned the oxygen masks."

Other aspects of the emergency ran somewhat counter to the flight attendants' expectations. The airplane pitch angle during the emergency descent was not as severe as expected, for example. "Flight attendants were not aware that, in the presence of structural damage, the flight crew would slow the [rate of] emergency descent [to prevent further structural damage]. The pilots assumed the flight attendants would remain seated from the outset of the emergency until landing."

The shallow descent and passengers' needs for assistance distracted one flight attendant, who performed his decompression-related duties without first breathing from the nearest oxygen mask or taking a seat and securing his restraints. "[This] flight attendant stated that he was in the cabin providing beverage service when the event occurred," Parrigin said. "Instead of immediately stopping and taking oxygen where he was, he walked to the front part of the aircraft. He said he wasn't aware of any hypoxic symptoms. … At the onset of the emergency, the front flight attendant and the back flight attendant both used the drop-down masks by their jump seats. [Training] must drill the procedure until breathing oxygen is an automatic reflex anytime the masks deploy."

The Southwest Airlines flight attendant manual also had stated that in a decompression, the flight crew will establish communication with the cabin crew, not vice versa. "We need to close that gap [by] saying there needs to be positive communication established either way," he said.

AQP Pioneer

In June 2006, Delta Air Lines was the first U.S. air carrier to apply for, and later adopt, an AQP for flight attendants, said Michelle Farkas, the company's general manager, in-flight service advanced qualification program. "We have truly realized … better crew performance through

Farkas (top) and Reese

Photos: Wayne Rosenkrans

the scenario-based training," she said. "Our flight attendants look forward to it because they are able to conduct scenarios in a 'safe' environment." "Safe" in this context means that when flight attendants make mistakes, instructor-evaluators point out the mistakes solely to enhance proficiency, not to jeopardize the crewmember's certification or employment status.

"Under AQP, the most important thing is to ensure that we are conducting our training in an environment that is as close to the [line] operation as possible," Farkas said.

One AQP innovation at Delta has been follow-up training for new flight attendants, called continuing qualification, six to eight months after beginning to work in line operations. "Continuing qualification includes a high-level review of emergency equipment, preflight checks [and gaining] some more comfort around the doors because a lot of our flight attendants have the opportunity to fly all [nine] aircraft [types]." A multi-option requalification curriculum for flight attendants who have had prolonged time away from flight duty has been revamped similarly.

Proficiency data from the previous calendar year drives curriculum changes for the current year, she said. For example, "During the merger [with Northwest Airlines], with one aircraft in particular, we were noticing that our flight attendants were [unsuccessful] in some of the drills," Farkas said. Proficiency data — combined with one-on-one coaching results and feedback about any procedural uncertainty from the flight attendant comment tracking system — help flight attendant trainer-evaluators develop solutions during monthly meetings with Delta's health, safety and security team.

"We've also put together door operations videos, [video tours of aircraft and an] unanticipated-evacuation procedures video," Farkas said. "Being able to convert [information] into a format that can be used on an [Apple] iPad, an iPod Touch or an iPhone [has led to] very high usage."

Post-Merger AQP

Airline mergers generate many threats, but under an AQP, cabin safety professionals are well positioned to participate in risk assessment, said Vicki Jurgens, health, safety and security chair of the Master Executive Council, Association of Flight Attendants–Communication Workers of America, representing cabin crewmembers at United Airlines. United is in the process of merging with Continental Airlines.

Airline-level threat and error management (TEM) involves many factors outside the scope of influence of any individual aircraft crewmember. "The increased operational complexity requires [cabin] crewmember attention to maintain the safety margins," Jurgens said. "[Our] job is to identify threats" that may be overlooked easily.

AQP principles require that the people responsible for a merger carefully review all the differences in processes, safety cultures, demographics and language/terminology to resolve areas of concern before problems, reduced safety margins or miscommunication appear in line operations, she added.

"We expect error, but we also expect to be able to identify, capture and resolve error," Jurgens said, citing five aviation safety action programs (ASAPs) used for that purpose at United. "We have had a 360-degree view of every situation [for about six years]. ASAP is going to be crucial for us; it is a safety net."

Experiential Learning

The experiential learning aspect of AQP — also called hands-on training — now plays a critical role in cabin safety, said Jessica Reese, supervisor, in-flight development, SkyWest Airlines, one of many regional airlines working toward AQP approval. "It was no surprise that 65 percent of our surveyed cabin crewmembers said that they would prefer to learn in a hands-on environment, while lectures came in at 19 percent," Reese said. "The reason is that flight attendants cannot replicate what they do in everyday [line operations by listening to] a lecture, reading their manuals or taking computer-based training [despite] advancements in virtual reality technology."

The move toward AQP has led to tighter integration of crew resource management (CRM) and TEM as all participants in cabin trainer scenarios work together to solve problems, Reese said. "In the Bombardier CRJ-200, we had experienced quite a few instances of smoke in the cabin due to an air conditioning packs issue," Reese said, "We decided to bring that scenario into our recurrent training to see how flight attendants and pilots [perform].

"I also observed a class a few weeks ago where a flight attendant forgot to stow her jump seat during an evacuation, so the pilots could not get out of the flight deck. She was so scared and embarrassed, realizing that the pilots were going to have to go out via the flight crew escape hatch, that I don't think she will ever make that mistake out on the line."

Other key aspects of SkyWest's move toward AQP have been routine feedback to training staff from line check airmen and lead flight attendants who monitor line operations for safety-related weaknesses in individual performance, and safety data collection and analysis.

Learning Cultures

Integrating mature-but-different learning cultures when two airlines merge poses safety challenges even under AQP, said Stephen Howell, director, in-flight services training, US Airways. The company's 2005 merger with America West Airlines prompted a reassessment of corporate values and the treatment of safety professionals.

Howell defines *learning culture* as a set of beliefs and behaviors in which "learning individuals can reinterpret their world and their relationship to the world."

"A true learning culture continuously challenges its own methods and ways of doing business," he said. "That is continuous improvement."

US Airways had a rare opportunity to reset its post-merger philosophy, he said. "First, we had to decide as an airline if we wanted to have an *execution culture* … or if we wanted to take on more [characteristics] of a learning culture … focusing on improvements [rather than] deliverables," Howell said. Having chosen to operate as a learning culture, "we improve low performers rather than [fire] them … diagnose [causes] when errors occur … analyze and discover what's happened, and learn from customers," he said.

US Airways also conducted a thorough analysis and identified many "East-West" differences in operations, from airplane call signs to flight attendant manuals. In revising standard operating procedures (SOPs) with best practices from both airlines, the first attempt was thorough but overdone. "We have since revised and refined [SOPs and flight attendant manuals covering all] East airplanes and West airplanes in about 20 different versions and configurations," Howell said.

Flight attendant training also was revised under AQP so East and West flight attendants could focus on operational differences. "We spent time taking them through training that reset everyone at the same level of competence and confidence [using the new SOPs]. To blend the cultures and 'walk the talk' during six months of merger training, we brought East instructors to teach West flight attendants and brought West instructors to teach East flight attendants."

Virtual Aircraft Visits

After a major investment — without any guarantee of approval by the German civil aviation authority — Lufthansa recently succeeded in a plan to allow experienced flight attendants to receive their Airbus A380 familiarization training via virtual reality technology, said Frank Ciupka, head, emergency training, Lufthansa Flight Training.

A suitable three-dimensional (3-D) computer model of the Lufthansa-specified A380 aircraft already existed inside Airbus, but key questions were the method, cost and reliability of presentation. Discarding other options, and taking advantage of consumer-level, 3-D movie-watching technology, the company equipped trainee stations with a 55-in (1.4-m) diagonal display, a game controller pad, a headset and active-shutter eyewear — electronic liquid-crystal-display glasses that simulate 3-D vision by synchronized high-speed blocking of the video image reaching each eye.

'A flight attendant forgot to stow her jump seat during an evacuation … I don't think she will ever make that mistake out on the line.'

Lufthansa also decided that the virtual aircraft visit and use of training devices should be separate, complementary parts of A380 familiarization training. "We asked the authority for approval to substitute for the real aircraft a visit to [our A380 cabin emergency evacuation trainer] in combination with a visit to the virtual aircraft," he said. "We have 12 trainee stations and one instructor station for the teacher [in a classroom]."

Trainees first watch a 12-minute, 2-D introductory video showing an animated drawing of the aircraft. The animation reveals the layouts of the lower and upper passenger decks and the flight deck. Elements such as stairways, galleys, trolley lift (serving cart elevator), lavatories, crew rest facilities and seats "fly" into place on the drawing.

The nominally two-hour virtual aircraft visit requires each flight attendant to be responsible for navigating with the game controller through the entire cabin to discover all functions and equipment, including exactly where each item of emergency equipment is stowed.

From April 2010 to April 2011, Lufthansa trained more than 2,000 pilots and flight attendants using the virtual aircraft visit. "About 10 percent of the trainees have experienced problems with motion sickness," Ciupka said. "This problem can be resolved with additional breaks and/or using the monitors in conventional mode without the 3-D feature. Younger crewmembers mostly found the virtual aircraft visit easy, and enjoyed it as they would enjoy playing a video game. Older crewmembers mostly had difficulties handling [the game controller] and therefore needed the full two hours."

More than 50 percent of the first year's trainees surveyed told the airline, that, given a choice, they would prefer to visit a real A380. "A month ago, however, a senior cabin attendant criticized the virtual aircraft visit," Ciupka said. "The next day, he came back to the instructor. He said that the evening before, he had had a conversation with his wife about his opinion that the virtual aircraft visit had been insufficient. Then he explained to her everything he had seen and done during the virtual aircraft visit. After listening awhile, his wife said, 'This new method might not be so bad since you now can describe the entire airplane.'"

New CPR Guidelines

Regardless of how flight attendants were trained to perform cardiopulmonary resuscitation (CPR) in the last decade, airlines worldwide in 2011 are introducing significant changes as national resuscitation bodies adopt the latest guidelines from the International Liaison Committee on Resuscitation (ICLR). The committee updates the guidelines every five years based on clinical studies, but national resuscitation councils determine what changes they will accept, said Richard Gomez, vice president education services and quality at MedAire. MedAire has updated its own curriculum by adapting the guidelines to train flight attendants to perform CPR in the aircraft cabin environment.

The latest ICLR guidelines essentially contain these changes: the new sequence of performing CPR is circulation–airway–breathing; checking breathing is now a quick visual scan of the victim for either no breathing or no normal breathing (i.e., no "look, listen and feel" step); the new rate of chest compressions is *at least* 100 per minute; the new depth for each chest compression is *at least* 2 in (5 cm); untrained or out-of-practice rescuers, or people unwilling/unable to give rescue breaths (ventilation), are now instructed to perform chest compressions only (also called *hands-only CPR*); rescuers who maintain current CPR certification — such as U.S. flight attendants trained to a national standard in compliance with Federal Aviation Regulations — normally should perform CPR with ventilation; and automated external defibrillators now can be used to shock the heart of an infant, using adult-size electrode pads with a modified method if pediatric-size pads are unavailable.

Flight attendants will still perform professional-level cardiopulmonary resuscitation under the latest guidelines.

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Flight attendant training has to include alternatives if a passenger, flight attendant or pilot for some reason cannot be given CPR on a galley floor or aisle floor. "Those are some of the considerations that trainers need to talk about, and trainers need to do some scenario-based training on the specific CPR [techniques for in-flight medical emergencies]," Gomez said.

Steven Garber and Friend

Falconry

BY STEVEN D. GARBER

The *Wall Street Journal* (WSJ) recently ran a front-page article saying, "Falcons at New York's John F. Kennedy International Airport (JFK) are out of work.[1] From early May through September for 15 years, they've been swooping and stooping around the runways, scaring off gulls and geese that might otherwise get sucked into jet engines. This year the falcons won't be flying. JFK has canceled their contract."

Anyone who knows the history of bird control at airports in the United States would not be surprised. The U.S. Federal Aviation Administration (FAA), the U.S. Department of Agriculture (USDA) and the Port Authority of New York and New Jersey have a long history of doing what's good for USDA instead of what's good for the flying public.

WSJ further said that JFK was "the first and only commercial airport in the U.S. ever to try falconry. The idea was to teach the local birds nesting in the sanctuary that a flight over the airport fence might turn them into lunch for a bird of prey. … That was before the Port Authority of New York and New Jersey's latest budget crisis. Now JFK's operator has cut short by a year its $3 million, five-year contract" and instead is "negotiating (without bids) to award the job of banishing birds to USDA.

"The USDA doesn't employ falcons. Its main technique for getting rid of birds from airports isn't shooing but shooting — with shotguns."

"'Falconry is just expensive,'" says Martin Lowney, director of USDA's wildlife-control service for New York state. "Compared to falconry, shooting is more economical and more effective.'" He's wrong on both counts.

When I ran the falconry program at JFK, I did it for $55,000 a year, not the $600,000 per year the Port Authority implies with its five-year, $3 million quote, and I made sure the falconers did a great job so we got more for our money.

After testing and showing how effective birds of prey are at helping to manage bird-related problems at airports, the Port Authority has made the mistake of listening to USDA and its inaccurate information. How can USDA say falconry is not effective and not cost effective? It clearly is both.

Much has been learned about airport falconry over the past 20 years; I was there from the beginning.

When done properly, nothing is as effective as old-fashioned labor-intensive bird control and harassment. Well-motivated and well-managed naturalists are brilliant at radically reducing the bird strike problems at the busiest airports. To do this properly, the bird strike problem has to be fought all the time, and yes, it is possible to do so cost-effectively.

Advising the Port Authority on how to reduce its bird strike problem in 1988, researchers concluded, "It is important to maintain the pressure at all times. Otherwise, birds will return."[2] In 1991, other researchers recommended "increased" and "continual" harassment patrols at JFK to reduce the bird strike problem.[3]

In 1992, after helping the Port Authority manage — some say mismanage — its bird strike problem for many years, USDA concluded, "The increasing numbers of bird strikes at JFK are clear evidence that standard bird control procedures conducted by the Bird Control Unit on the airport have not been effective in controlling the bird strike hazard."

In 1994, when USDA wanted to take over the management of the U.S. bird strike problem, it publicly stated that falconry was "both technically unfeasible and ineffective."

Because USDA had mismanaged the bird control situation at JFK, a federal judge forced the Port Authority to hire me to fix its bird strike problems. I started at the end of 1994, and, after reassessing everything the USDA said, I realized it was dead wrong about falconry.

About airport falconry, the USDA said, "Harassing … gulls with falcons

Should Thrive

Birds of prey are effective in the campaign against gulls, geese and other birds near airports.

would involve putting the gulls to flight frequently, thus increasing the potential for strikes during the harassment period. The flying falcons could themselves pose a hazard to aircraft. … The presence of a large number of falcons in [JFK] airspace … could present increased hazards to safe aircraft operations. The presence of falcons in or above the Jamaica Bay laughing gull colony [adjacent to the airport] could induce the gulls to [climb], thereby increasing the already high laughing gull–aircraft strike hazard.”[4]

USDA concluded, “The unreliable nature of [airport falconry] and the potential to increase the bird strike hazard make this alternative both technically unfeasible and ineffective. It is therefore no longer considered and not advanced for … analysis.”

Contrary to what USDA said, I quickly found that airport falconry was legally, technically and economically feasible and effective.

Unfortunately, USDA never got with the program. And unfortunately, the FAA helped USDA create a near-monopoly on many important aspects of bird control at airports. At the Port Authority, USDA does not have to compete with outside bids, as the *WSJ* reported, and USDA does not practice falconry, so it couldn’t compete anyway. And yet, it has continued to undermine falconry with misleading and often inaccurate information.

Fifteen years ago, falconry was well on the way to being proven effective at reducing bird strikes. The falconry program, while I was in charge, was responsible for reducing bird strikes at JFK by more than 70 percent. This was in addition to the many bird strikes that were avoided by first eliminating many of the bird attractants in the area, including the landfills.

Data I presented at international conferences and in the International Civil Aviation Organization *Journal*[5] showed that “trained birds of prey can reduce significantly the number of problem birds that visit.” We concluded, “Falconry, when implemented properly, holds tremendous promise as a means of bird control.”

This is what we learned at JFK: First, garbage attracts birds. When we caused three garbage dumps next to the airport to be shut down, a major bird attractant was eliminated, reducing the number of birds flying around and landing on JFK’s grounds. As might be expected, the number of bird strikes declined precipitously.

Despite that success, the Port Authority has allowed a garbage facility to be installed next to La Guardia Airport, despite law, regulations and intelligent reasoning (*ASW*, 10/09, p. 28).

And now, the Port Authority of New York and New Jersey has allowed its falconry program to be scrapped. Meanwhile, the Port Authority and USDA, with the help of the FAA, continue to allow bird control at airports to be poorly run and we, the industry as well as the flying public, are paying the price.

Steven D. Garber, M.B.A., Ph.D., runs the environmental consulting and contracting firm Worldwide Ecology, based in White Plains, New York, which specializes in environmental, safety, health, financial and legal issues related to aviation, biology, conservation, environment, park design and management, and green energy.

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Runway Risk Reduction

ICAO introduces a campaign to reduce incursions, excursions and other runway accidents.

BY LINDA WERFELMAN

With about one-third of all aviation accidents associated with runway operations, the International Civil Aviation Organization (ICAO) has introduced safety initiatives aimed at reducing runway-related accidents.

The initiatives were endorsed in late May by ICAO partners within the aviation industry, including Flight Safety Foundation, during the first meeting of the ICAO Global Runway Safety Symposium, held in Montreal.[1]

"We have a clear understanding on the roles and responsibilities of each of the partners in reducing and working toward eliminating runway incursions and excursions," Nancy Graham, director of the ICAO Air Navigation Bureau, said. "The multidisciplinary approach is the only option for coming to grips with a complex set of operational and human factors issues."

The initiatives include runway safety seminars to be held around the world to help develop regional action plans and encourage the formation of runway safety teams that will involve airlines, airports and air navigation service providers.

Other efforts call for "the compilation and further development of best practices and the greater sharing of information among ICAO member states and industry." One of the first requirements will be the development of common definitions, metrics and methods of analysis to enable more complete information sharing, as well as the improved reporting of operational hazards.

In addition, ICAO and its partners in the effort will develop multidisciplinary guidance material and training workshops.

One early product of the collaborative effort to reduce runway accidents is the *Runway Excursion Risk Reduction Toolkit* — in which the Foundation played a key role — which includes training modules, videos, best practices and other information, presented in an interactive format.

Increasing Potential

ICAO data show that, over the past five years, one-third of all aviation accidents have been linked to runway operations. As air traffic increases, Graham noted, the potential for runway accidents also will increase, and "we have to act now to develop and implement proved technological and operational solutions that will make sure we improve upon our remarkable safety record."

Studies conducted more than a decade ago identified a connection between growth in air traffic and an increase in runway incursions, "with one study in particular demonstrating that a traffic increase of 20 percent could result in as much as a 140 percent jump in the risk of a runway incursion," Graham wrote in the current issue of the *ICAO Journal*.[2]

These projections spurred work on the tool kit, which was first issued in 2005, and on related efforts, including a global agreement on a new definition of runway incursions — events involving "the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for landing and takeoff of aircraft" — which enabled more meaningful analysis of runway incursion data.

In addition, in 2007, ICAO published the *Manual on the Prevention of Runway Incursions*, Document 9870.

"All of these efforts by ICAO and other organizations have helped to improve runway safety significantly," Graham wrote. "Thanks to improved outreach and coordination locally and globally, these successes are ongoing as new technologies and procedures come online. Implementation of airport surface detection equipment, Model X (ASDE–X) and similar systems will continue to provide the more immediate and accurate situational awareness that pilots and controllers require to reduce the risk of incidents and accidents resulting from runway incursions."

Runway excursions are 30 times more likely than incursions, Graham wrote, citing Flight Safety Foundation's *Global Plan for the Prevention and Mitigation of Runway Excursions*, completed in 2009 by the Runway Safety Initiative — an international effort.

"Excursions are absolutely public enemy number one," she said.

The Foundation's report presented comprehensive countermeasures for runway excursions — events in which aircraft veer off the side of a runway or overrun the departure end. Briefing notes included in the plan emphasize the importance of stabilized approaches and methods of reducing the risk of landing "long and fast, with a tail wind, on a contaminated runway."

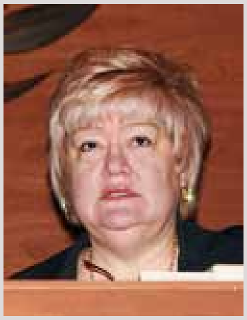
Graham said that ICAO has "continued to review and amend its requirements and guidance material" to incorporate worldwide best practices for dealing with incursions and excursions, as well as events attributed to runway confusion, which occurs when flight crewmembers unintentionally use the wrong runway or a taxiway for takeoff or landing.

All three areas are, "by their nature, multidisciplinary issues requiring high levels of coordination and cooperation between all stakeholders in the air transport community," she said. "Airport and aircraft operators, associations representing pilots and air traffic controllers, aircraft and avionics manufacturers, air navigation service providers and regulators all have important contributions to make and parts to play in the development of any effective runway safety solution."

U.S. Initiative

One challenge still facing ICAO is achieving better coordination of programs implemented by individual countries and facilities "so that the sharing of information and best practices … can benefit aviation stakeholders more quickly and on a globally harmonized basis," Graham said.

Nancy Graham



J.A. Donoghue

In the United States, the Federal Aviation Administration (FAA) recorded a reduction of more than 90 percent between fiscal year 2000 and fiscal year 2010 (which ended Sept. 30, 2010) in the most serious categories of runway incursions. However, the agency detected a reversal of the trend earlier in fiscal 2011.

Preliminary agency data showed that the 462 total runway incursions reported in the first half of fiscal 2011 — from October 2010 through March 2011 — exceeded the target of 441. Of the 462 incursions, 289 events (63 percent) were pilot deviations, 87 (19 percent) were operational errors/deviations, and 86 (19 percent) were vehicle/pedestrian deviations.[3]

The FAA recorded a reduction of more than 90 percent between fiscal year 2000 and fiscal year 2010 in the most serious categories of runway incursions.

As a result, in June, the FAA Flight Standards Service reiterated its recommendations for reducing runway-related occurrences — especially those that involve pilot error — by issuing Safety Alert for Operators (SAFO) 11004.

In the document, the FAA noted that in 2007, it had issued a "call to action" to reduce runway incursions by 10 percent in the five years ending in 2013.

The FAA said that after it issued the call to action, "runway incursions involving pilots steadily decreased. However, as time has passed, the trend has reversed."

Most of the recent incursions have been attributed to loss of situational awareness and failing to comply with instructions from air traffic control, the FAA said.

The agency cited recent data that show that air carrier and multi-pilot crew operations are involved in 20 percent of the reported runway incursion events.

"These operators, who carry the majority of U.S. passenger traffic, need to be mindful of this persistent problem and be proactive in prevention actions for air carrier operations," the FAA said, urging operators to implement a coordinated effort to mitigate runway incursion hazards.

"The problem of runway incursions touches many parts of an air carrier's organization; thus, it deserves attention at all levels of air carrier management and line operations. Through continued management emphasis and specific training for pilots and maintenance personnel, air carriers can instill permanent and effective understanding of the runway incursion problem and the means to eliminate it."

The SAFO recommended that pilots, maintenance personnel and ground personnel review airport signage, markings and lighting, as well as airport diagrams, notices to airmen and automatic terminal information service broadcasts to ensure that they are aware of any taxiway or runway closures, construction activities and other related risks.

Other recommendations called for increased attention to situational awareness, better use of crew resource management and proper radio communication, and compliance with appropriate taxi techniques.

The SAFO also urged operators; directors of safety, training and maintenance; and chief pilots to "distribute runway incursion prevention information and resources to pilots [and] maintenance personnel, as well as other personnel involved in taxiing aircraft or operating vehicles within the airport operation area"; to include runway incursion prevention in all training programs; and to "track runway incursion trends to determine need for review of causes and current practices."

Notes

1. ICAO's partnering organizations are listed as Airports Council International, Civil Air Navigation Services Organisation, European Aviation Safety Agency, Eurocontrol, U.S. Federal Aviation Administration, Flight Safety Foundation, International Air Transport Association, International Business Aviation Council, International Coordinating Council of Aerospace Industries Associations, International Council of Aircraft Owner and Pilot Associations, International Federation of Air Line Pilots' Associations, and International Federation of Air Traffic Controllers' Associations.

2. Graham, Nancy. "Focusing on Risk: A Global Approach to Runway Safety." *ICAO Journal.* 2011 (Issue 2): 3–4.

3. FAA. *FY 2011 2nd Quarter Performance Report.* March 2011.

BY RICK DARBY

Slippery Slope

Glideslope deviation was the most frequent factor in unstabilized approaches in the latest C-FOQA analysis.

The rate of flight operations events — exceedances of predetermined parameters — for participants in Austin Digital's corporate flight operational quality assurance (C-FOQA) program decreased in 2010, from 11.3 percent of the total flights in 2009 to 9.5 percent, a 15.9 percent drop (Figure 1). That rate was also lower than the five-year weighted average, 10.9, since the beginning of data collection in 2006. The program was created by Flight Safety Foundation (FSF) but is now administered by Austin Digital, with the data processed through the Austin Digital eFOQA event measurement system.

C-FOQA is designed to provide corporate flight departments with the advantages many airlines obtain from analogous programs. Flight data are recorded, downloaded from a quick access recorder and analyzed. The results are available to each operator for its own fleet, and publicly in an overall, de-identified form. Each operator also receives an annual report comparing its fleet to the aggregated fleet data.

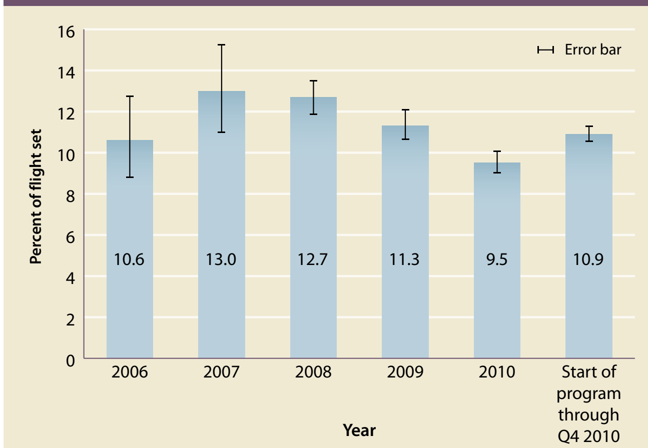
The rates appear in the latest report from Austin Digital, which aggregates and analyzes the metrics for the program.[1] The aggregated data were derived from flights of 46 aircraft of 12 types. The full data set has continued to grow, making the data more statistically significant, as shown by the decreasing size of the error bars.[2,3]

For 2010, the most frequent event in the unstabilized approach category was "above desired glide path on approach," with 65 GPWS (ground-proximity warning system) cautions (Figure 2). That factor had been second-most frequent in 2009, when "high rate of descent on final approach" was at the top of the list. "Fast approach" — which had been fifth-most frequent in 2009 — was next highest in the number of events, 62, of which 24 were GPWS warnings. The largest number of warnings, 30, were triggered by "late final flap extension."

Among all flight operations events, "GPWS: unknown warning type" led the field, with 200 events, of which 45 were warnings (Figure 3). For these events, the recorded data were sufficient to distinguish between GPWS cautions and warnings but not to determine the cause of the caution or warning.

Nevertheless, the analysts inferred the relative frequency of GPWS events by type using "an emulation of the possible GPWS mode envelopes … to estimate the most likely cause

C-FOQA Annual Flight Operations Event Rates, 2006–2010



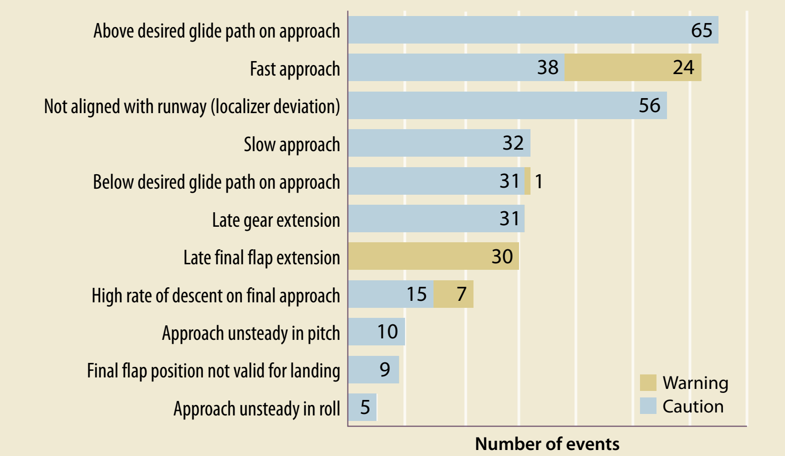
C-FOQA = corporate flight operational quality assurance

Note: Error bars are calculated with a 90 percent confidence interval.

Source: Austin Digital and Flight Safety Foundation

Figure 1

C-FOQA Unstable Approach Events by Type, 2010

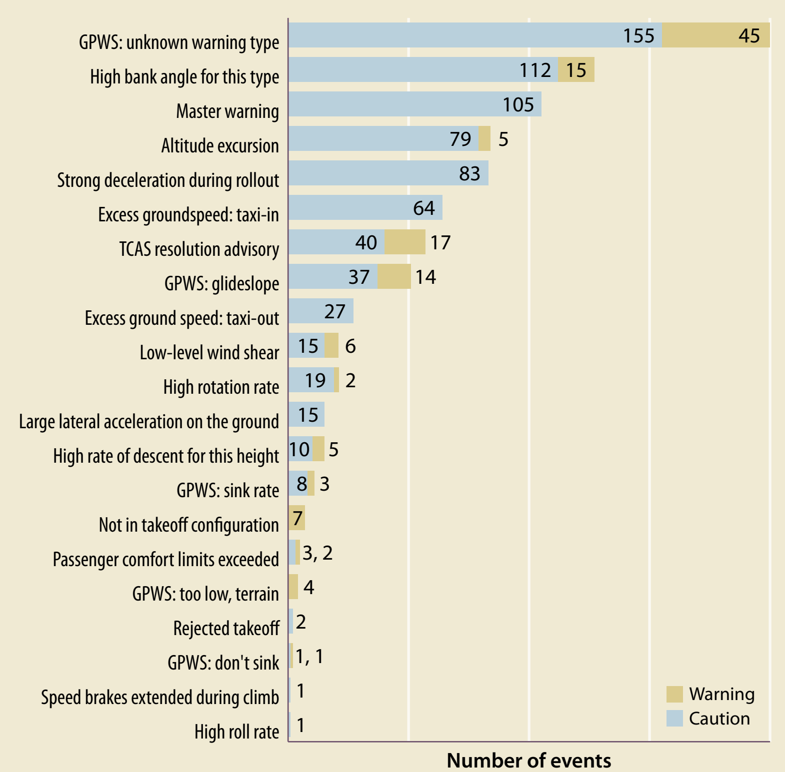


C-FOQA = corporate flight operational quality assurance

Source: Austin Digital and Flight Safety Foundation

Figure 2

C-FOQA Flight Operations Events by Type, 2010



C-FOQA = corporate flight operational quality assurance; GPWS = ground-proximity warning system; TCAS = traffic-alert and collision avoidance system

Source: Austin Digital and Flight Safety Foundation

Figure 3

for the alert." Glideslope deviations were found to be the most frequent by far, with 176 cautions and 53 warnings. Next most frequent were sink rate cautions and warnings, 24 in total.

Relative positions among the most common events shifted between 2009 and 2010. In 2009, "master warning" was in second place, "high bank angle for this height" in third place. The order was reversed in 2010. "Excess groundspeed: taxi-in" had been fourth most frequent in 2009, with "altitude excursion" occupying the same place in 2010.

Unstabilized approach events increased year-over-year. In 2010, the rate was 3.8 percent of total flights — the same rate as the five-year average — compared with 3.2 percent for 2009, a 19 percent increase (Figure 4, p. 52).

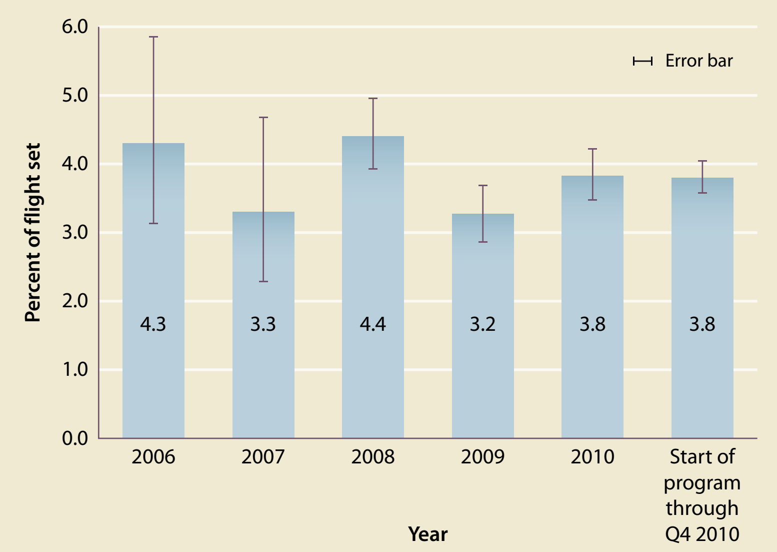
The analysts compared unstabilized approach event rates by the length of an operator's participation in the C-FOQA program. The highest rate, with 4.7 percent of approaches unstabilized, occurred in the first year. In succeeding years, the comparable percentages were 3.0, 3.4, 3.6 and, in the fifth year of participation, 2.6. For the entire data set, 3.6 percent of approaches resulted in unstabilized approach caution alerts, with 0.1 percent resulting in warning alerts.

In 2010, unstabilized approaches were identified most often as "above desired glide path" — the desired glide path being, for practical purposes, the instrument landing system glideslope — and "fast approach," each more than 0.7 percent of the data set (Figure 5, p. 52). "Below desired glide path," "slow approach," "late final flap extension" and "late gear extension" were about equally frequent, each at slightly under 0.4 percent of the data set.

The analysts found that more than 45 percent of flights were between 0.00 and 0.25 dots above the glideslope. About 0.75 percent of flights were between 1.50 and 1.75 dots above the glideslope; about 0.35 percent were between 1.75 and 2.00 dots above the glideslope.[4]

About 1.7 percent of flights were 0.80 to 1.05 dots below the glideslope, and 0.6 percent were 1.05 to 1.30 dots below the glideslope.

C-FOQA Unstable Approach Events Rates, 2006–2010



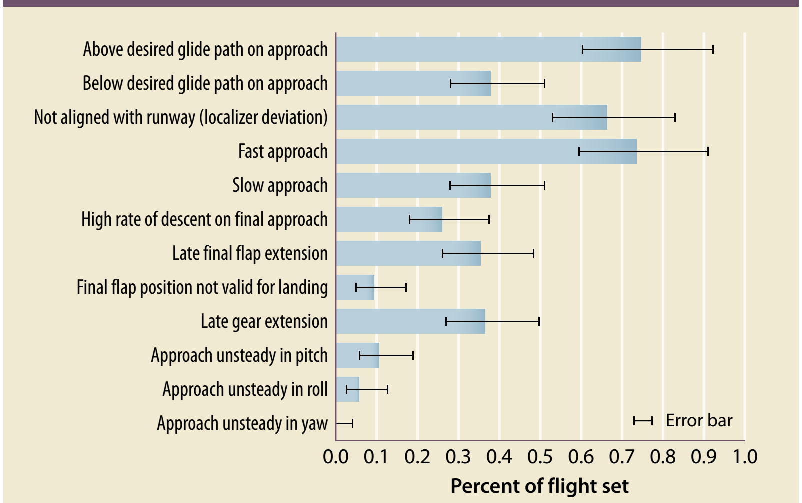
C-FOQA = corporate flight operational quality assurance

Note: Error bars are calculated with a 90 percent confidence interval.

Source: Austin Digital and Flight Safety Foundation

Figure 4

C-FOQA Unstable Approach Rates, by Type, 2010



C-FOQA = corporate flight operational quality assurance

Note: Error bars are calculated with a 90 percent confidence interval.

Source: Austin Digital and Flight Safety Foundation

Figure 5

The 2010 data showed that the recorded calibrated airspeed minus V_{app} at the landing threshold crossing — representing how closely the actual airspeed matched the calculated approach speed — was between 0 and minus 2 kt for about 24 percent of the flights. For another 21 percent or so, it was between 0 and plus 2 kt.

A scatter plot of groundspeed versus airspeed at touchdown in 2010 showed a majority of landings with a headwind, the next highest proportion of landings with less than 10 kt tailwind, and very few landings with the tailwind greater than 10 kt.

More than 25 percent of the 2010 flights had 75 to 80 percent of the runway remaining at touchdown. About 24 percent of flights had 70 to 75 percent of the runway ahead, and about 16 percent of the flights had the luxury of 80 to 85 percent of the runway remaining.

Stabilized landing criteria included a groundspeed of 80 kt with 2,000 ft (610 m) of runway remaining. Of the flights in which the groundspeed could be computed from C-FOQA data, the great majority met the criterion. Slightly fewer than 2 percent had between 1,500 ft (457 m) and 2,000 ft remaining; fewer than 1 percent were looking ahead to between 1,000 ft (305 m) and 1,500 ft of runway.

Notes

1. The report is available on the FSF Web site at <flightsafety.org/files/2010_C-FOQA_report.pdf>.
2. The error bars compensate for bias because of the sampling size. They indicate that there is a 90 percent probability that the rate for the C-FOQA operators would fall within the range shown if there were an infinite number of their flights available for analysis.
3. The report says, "Due to the evolving nature of the C-FOQA program, event definitions and triggering limits may have changed since [some operators enrolled in the program]. Because of this, it was deemed necessary to reprocess all of the data using the current (as of March 2011) configuration. The advantage of reprocessing all of the data … is that it assures that all the trend numbers are compared to the same standard, which in turn allows you to have a normalized trending comparison."
4. Percentages were based on all flights in which a valid instrument landing system glideslope signal was received.

In Plane English

A multi-media course comes to the aid of pilots and controllers who must meet new ICAO English language standards.

BY RICK DARBY

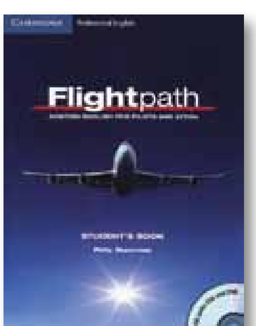
BOOKS

'Washing the Traffic'

Flightpath: Aviation English for Pilots and ATCOs

Shawcross, Philip. Cambridge, England: Cambridge University Press, 2011. 192 pp. Illustrations, student exercises. Includes three audio compact discs (CDs) and one DVD (digital video disc).

"*Flightpath* is intended to assist pilots and air traffic control officers [ATCOs] in reaching and maintaining a robust ICAO [International Civil Aviation Organization] Operational Level 4, keeping in mind that language proficiency is soon eroded over time and considerably reduced in stressful situations," Shawcross says.



The emphasis in English-language training for pilots has expanded beyond the ability to use standard phraseology in radiotelephony, although that remains a firm baseline. ICAO member state personnel are now required to meet at least Level 4, "operational," proficiency. Among the criteria for Level 4 are: "Responses are usually immediate, appropriate, and informative. [The speaker] initiates and maintains exchanges even when dealing with an unexpected turn of events. Deals adequately with apparent misunderstandings by checking, confirming or clarifying."

As the official international language of aviation, English sometimes poses formidable problems for non-native speakers. *Webster's Third New International Dictionary* contains 450,000 words, and the revised *Oxford English Dictionary* offers 615,000 to choose from. No wonder English needs guides to synonyms such as *Roget's Thesaurus*.

"The richness of the English vocabulary, and the wealth of available synonyms, means that English speakers can often draw shades of distinction unavailable to non-English speakers," says Bill Bryson in *The Mother Tongue*. "The French, for instance, cannot distinguish between house and home, between mind and brain, between 'I wrote' and 'I have written.'"

But speakers of other languages can make distinctions or have concepts difficult to express in English, another possible barrier.

"A second commonly cited factor in setting English apart from other languages is its flexibility," Bryson says. "This is particularly true of word ordering, where English speakers can roam with considerable freedom between passive and active tenses. Not only can we say, 'I kicked the dog,' but also, 'The dog was kicked by me' — a construction that would be impossible in many other languages."

English is further notorious for pronunciation that is not necessarily correlated with spelling. George Bernard Shaw pointed out that *fish* could just as well be spelled *ghoti*, with the gh from "enough," the o from "women" and the ti from "nation."

Non-native speakers can be excused if they feel at times that English kicks them, or that they are kicked by it.

Coming to their aid, Shawcross has taken advantage of audio, video and contemporary graphic design. The book is highly visual, featuring photographs, drawings, diagrams, maps and approach charts, with contrasting colors and shaded text boxes to aid comprehension.

It includes many exercises in which the student must answer questions, add appropriate words to incomplete sentences, describe what is shown in illustrations, practice conveying various kinds of information including equipment failures and emergencies, and check his or her progress. Some exercises involve listening to flight crew and controller transmissions recorded on the discs and answering questions based on them. Student partners may be asked to discuss scenarios or compare their responses.

Flightpath is logically organized: an introduction; Part A, "Hazards on the Ground"; Part B, "En Route"; and Part C, "Approach and Landing." The parts themselves are subdivided into "units" — for example, Unit 4 is "Runway Incursions."

The CDs and DVD are essential parts of the training methodology.

Each unit, in turn, consists of "operational topics," "communication functions" and "language content." Thus, operational topics for runway incursions include "runway confusion," "incident precursors" and "taxiing best practices." Communication functions include "call signs," "failure to seek confirmation" and "conditional clearances." Topics in language content include "safety vocabulary and synonyms," "taking notes" and "pronunciation, phrasing and fluency."

The CDs and DVD are essential parts of the training methodology and offer a rich source of scenarios for the student to work with. The recorded voices include a considerable variety of accents, conveying the flavor of differing pronunciations pilots will encounter on international flights and ATCOs will hear from pilots.

The following is an exercise in which an ATCO must respond to a pilot's misunderstanding, as indicated by his readback. Neither the controller nor the pilot speaks "the Queen's English" or its American equivalent; their pronunciation indicates that they are non-native-English speakers.

ATCO. "Delta three five seven, descend to altitude nine thousand feet, QNH [altimeter setting in hectopascals for height above sea level] one zero one seven." The controller pronounces "altitude" very much like "attitude."

Pilot. "Descend to altitude five thousand feet, Delta three five seven."

The student who is playing the ATCO role must correct the pilot's mistake. The text gives a suggested response:

ATCO. "Delta three five seven, negative: Descend to altitude niner thousand feet. I say again, altitude niner thousand feet."

Other recorded voices illustrate mispronunciations of English words. A controller says, "I am washing the traffic on my screen." A pilot informs the hearer that "we have a well that needs changing on our right main gear." "The purser has asked for more eyes," says a flight attendant.

Such errors may be amusing, but in the fast-changing, intense operational world they can lead to incomprehension or waste time as the mystery is cleared up. "There is a rich of hills … to the east of the field" will probably be understood in context as "a ridge of hills," but at the cost of a moment to figure it out. Sometimes that moment is needed to pay attention to other cues.

Many of the world's languages do not have the *th* sound often found in English words. In French — where the letter combination is rare and occurs mostly in names — and German, *th* is pronounced simply *t*.

In the relevant exercise, the student listens to the spoken sentences and is asked to "cross out the word you hear, and circle the word which is intended." For instance, "well" would be crossed out, "wheel" circled.

Runway excursions, which in a 14-year study period far outnumbered runway incursions and resulted in more fatalities, are covered in Unit 8, "Approach and Landing Incidents." More than three-fourths of runway excursions occurred during landing.

Students are given a list of 16 factors involving landing — for example, "failure to select the appropriate runway based on the wind"; "poor crew resource management"; "late runway changes"; and "incorrect or obscured runway markings." Students are asked to determine which factors relate to controllers, which to pilots and which to airports. Then, in a group, they discuss the question, "What do you think is the most immediate solution to these conditions?"

As in many of the exercises in all units, role playing helps learners practice correctly relaying information they have been given.

Ground crew to ATCO. "The surface of Runway zero niner left is contaminated."

ATCO to pilot. "Airport Maintenance says that the surface of Runway zero niner left is contaminated."

Pilot to ATCO. "Braking action is very poor on Runway two three right."

ATCO to pilot of aircraft on approach. "The last flight to land reported breaking action was very poor on Runway two three right."

The DVD consists of training and awareness videos sourced from Air New Zealand, Eurocontrol, Transport Canada and others. Although not specifically focused on aviation English, they feature re-creations of incidents in which spoken communication played a role, such as altitude deviations, call sign confusion and runway incursions.

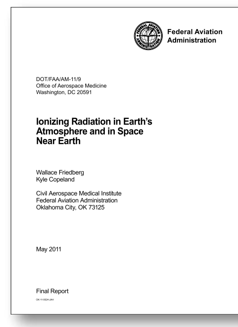
In one re-enactment, the flight crew of an Air New Zealand airliner is flying the approach to the destination — apparently on a Pacific island — and to all appearances, everything is correct. The autopilot has captured the instrument landing system glideslope and localizer.

All three pilots sense that something is wrong, however, and their concerns increase when lights of a nearby island come into view, closer than they should be. A check of the distance measuring equipment reveals that it is not reconciled with the altitude. The pilots unanimously opt for a go-around, climb the aircraft and eventually conduct a landing using an alternative navigation aid.

The narrator points out all the error defenses that had been breached for various technical and human factors reasons. One final defense still worked — the crew's situational awareness, along with their timely communication. Their readily understood interaction probably played a role in the successful outcome.

REPORTS

Catching Rays


Federal Aviation Administration

DOT/FAA/AM-11/9
Office of Aerospace Medicine
Washington, DC 20591

Ionizing Radiation in Earth's Atmosphere and in Space Near Earth

Wallace Friedberg
Kyle Copeland

Civil Aerospace Medical Institute
Federal Aviation Administration
Oklahoma City, OK 73125

May 2011

Final Report

OK-11-0024-JAH

Ionizing Radiation in Earth's Atmosphere and in Space Near Earth

Friedberg, Wallace; Copeland, Kyle. U.S. Federal Aviation Administration (FAA) Civil Aerospace Medical Institute. DOT/FAA/AM-11/09. May 2011. 28 pp. Tables, figures, references. Available via the Internet at <www.faa.gov/library/reports/medical/oamtechreports/2010s/2011>.

Ionizing radiation is a hazard to aviation and space travel. The report defines ionizing radiation as "a subatomic particle or photon sufficiently energetic to directly or indirectly eject an orbital electron from an atom."

It explains: "Living material consists of molecules composed of atoms held together by electron bonds. Ejection of orbital electrons can break the bonds that combine atoms as molecules. Particularly harmful to a biological system is the breakup of molecules of deoxyribonucleic acid (DNA).

"DNA carries information required for the function and reproduction of an organism. Improper repair of DNA damaged by ionizing radiation or by free radicals produced by ionizing radiation may lead to cancer. Free radicals are also believed to have a role in the etiology of atherosclerosis, rheumatoid arthritis, and other diseases. A free radical is an electrically neutral atom or molecule containing one or more unpaired electrons in the valence shell, and this makes it very reactive. Ionizing radiation particles produce free radicals when they react with the water in cells and with some cellular components."

Ionizing radiation can stem from outer-space sources such as exploding stars — called supernovae — and the sun. Air travel also is subject to ionizing radiation from radioactive cargo, radioactive substances released into the atmosphere by a nuclear reactor accident, lightning and other causes.

The report describes the state of research on the health effects of ionizing radiation. The effects are of two types, deterministic — also called non-stochastic effects or tissue reactions — and stochastic.

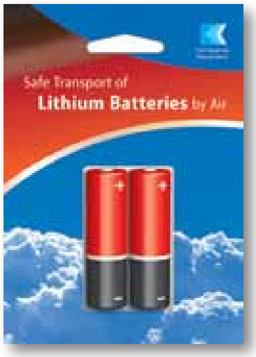
"Harm from ionizing radiation is called *deterministic* if the harm increases with radiation dose above a threshold dose," the report says. "The threshold dose is the dose below which no harm is observed, or the harm is not clinically significant. For most deterministic effects from low-LET [linear energy transfer, a measure of its power] radiation, the threshold dose is higher if the exposure time required to reach the dose is more than a few hours. Deterministic effects can occur soon (sometimes minutes) after radiation exposure if the dose is sufficiently high and delivered at a high rate."

A table in the report describes deterministic effects from various doses of ionizing radiation released in less than one day. At 0.15 Gray equivalent (Gy-Eq, the measurement unit for deterministic effects), the radiation can produce "temporary sterility in males"; by 2.4 Gy-Eq, "mild headache in about 50 percent. Almost constant nausea and vomiting in 70–90 percent"; at 4 Gy-Eq, "about 50 percent die within 60 days"; above 8, never mind, you're finished.

"Harm from ionizing radiation is called a *stochastic effect* … if the probability (risk), but not the severity of the effect, is a function of the effective dose," the report says. "It is believed that there is no threshold dose for stochastic effects. Stochastic effects include cancer, genetic disorders in succeeding generations and loss of life from such effects. The risk is cumulative and persists throughout the life of the exposed person. Thus, individuals exposed to ionizing radiation have an increased lifetime risk of cancer, and their progeny have an increased risk of inheriting genetic disorders."

The report includes recommended ionizing radiation dose limits from the FAA, the International Commission on Radiological Protection, the National Council on Radiation Protection and Measurements, and the European Union.

GUIDANCE MATERIAL



Carrying a Charge

Safe Transport of Lithium Batteries by Air

Hong Kong Civil Aviation Department. May 2011. 6 pp. Available via the Internet at <www.cad.gov.hk/english/pdf/Leaflet_lithium%20battery_May2011.pdf>.

Lithium batteries, both of the rechargeable lithium-ion type and the non-rechargeable lithium-metal type, are widely found in consumer electronics. Hardware with lithium batteries can be found in the cabins of passenger flights and in the cargo holds of passenger and cargo flights. They have been cited as causal factors in several on-board fires (*ASW*, 3/08, p. 42), and aviation industry regulators are working on rules to counter the risk (*ASW*, 3/10, p. 44).

As usual, the first line of defense is knowledge and care by front-line employees. This brochure, through text and full-color illustrations, explains the best practices for packing and shipping lithium batteries.

For example, a photo shows an example of correct packaging — the batteries separated by Styrofoam dividers, in individual blister packs and with an outer layer of insulation such as bubble wrap. Another photo shows the wrong way — loose and jumbled in a box along with metal objects such as tools.

The brochure discusses weight limitations, watt-hour ratings, lithium content limitations, labels on the outside of the box, documentation and other considerations.

Galley Leak Douses 747's Electronics

Many systems failed and several were degraded during an approach to Bangkok.

BY MARK LACAGNINA

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

JETS

Drain Line Blocked by Ice

Boeing 747-400. No damage. No injuries.

Inbound from London with 346 passengers and 19 crewmembers, the 747 was descending through 21,000 ft to land in Bangkok, Thailand, when the customer service manager told the flight crew that there was a substantial water leak in the forward galley. Cabin crewmembers had used five blankets to try to soak up the foul-smelling water from the galley floor.

Electrical system anomalies began as the aircraft was descending through 10,000 ft and turning onto an extended left downwind leg for Runway 01R. The autopilot and autothrottle disengaged, the first officer's instrument displays and the auxiliary engine indicating and crew alerting system (EICAS) display became blank, and the flight crew received indications of numerous electrical system anomalies.

"Many of the aircraft's communication, navigation, monitoring and flight guidance systems were affected," said the Australian Transport Safety Bureau (ATSB) in its final report, issued earlier this year, on the Jan. 7, 2008, incident.

Among the faults indicated by the primary EICAS, which remained operative, were the loss of power to three of the four alternating current (AC) system buses, discharging of the batteries in the main electrical system and the auxiliary power unit, and failures of some fuel pumps, the weather radar system, and the automatic cabin air conditioning and pressurization system. The customer service manager told the pilots that the cabin lighting also had failed.

A check of the circuit breakers on the flight deck showed that none of them had tripped. "The flight crew reported that they actioned several non-normal checklists in response to a number of [the] messages and annunciations," the report said. "However, after a period of time, the flight crew decided to discontinue actioning the non-normal checklists due to the constant action required in response to the continuous scrolling of the EICAS messages."

The captain's instrument displays continued operating in a "degraded mode," the report said. Among the items that also remained in operation were the standby flight instruments, one radio communications system and the right flap position indicator. Because only one AC bus remained on line, engine pressure ratio information, which is used to set power, was available only for the no. 4 engine.

Company standard operating procedure required an emergency to be declared following a critical system failure, but the crew did not declare an emergency. At the time, the 747 was on the downwind leg, being vectored by air traffic control (ATC) and was second in line for landing in day visual meteorological conditions.

The radio transmissions between the crew and ATC were weakening, likely because of decreasing battery power. "The captain reported that he considered that there might be a communication issue with ATC and took into account that the approach was being conducted in daylight and clear of cloud," the report said.

ATSB concluded that the crew should have declared an emergency because, if there had been a delay in landing, battery power might have been depleted, and the crew would have had only the standby flight instruments for reference and their mobile telephones for communication.

"It is understandable that the crew considered it desirable to land the aircraft as soon as possible; [however,] the crew could not have predicted whether further failures could have occurred," the report said. "As such, there was a possibility that the situation could worsen, resulting in further operational difficulties."

The electrical system anomalies had no major effect on the 747's engines, hydraulic systems and pneumatic systems. The pilots were able to configure the aircraft properly and landed it with the autobrakes, spoilers and thrust reversers operating normally. However, after shutting down the engines, they had to manually open the outflow valve to depressurize the cabin before the cabin doors could be opened.

Investigators traced the galley leak to an inoperable drain line heater that had allowed waste water to freeze in the line leading to the drain mast. This line is at the low point in the drainage system for the upper-deck galley and lavatory, and the main-deck forward galley and lavatory. The ice that formed in the lower line blocked the drainage system and caused the waste water to back up and overflow through the main-deck forward galley.

The radio transmissions between the crew and ATC were weakening, likely because of decreasing battery power.

"The water [then] flowed forward and through a decompression ['blow out'] panel into the aircraft's main equipment center before leaking onto three of the aircraft's four generator control units, causing them to malfunction and shut down," the report said.

Investigators found cracks around a number of fasteners in the plastic dripshield that was intended to prevent water from leaking through the galley floor and into the main equipment center.

The report noted that the 747 had accumulated 76,610 airframe hours since it was built in 1991. The operator told investigators that the procedure for a visual inspection of the main equipment center during each maintenance C-check "did not specifically target any aspect of the dripshield."

After the incident, Boeing and the aircraft operator implemented several measures to prevent a recurrence. "In addition, the U.S. Federal Aviation Administration issued a notice of proposed rulemaking to adopt a new airworthiness directive for certain 747-400 and 747-400D series aircraft to install improved water protection," the report said. "The ATSB has issued two safety recommendations and one safety advisory notice as a result of the investigation."

Stall During Air Show Practice

Boeing C-17A. Destroyed. Four fatalities.

The four-member crew of the Globemaster III, a four-engine troop and cargo transport, departed from Joint Base Elmendorf–Richardson, Alaska, U.S., the afternoon of July 28, 2010, to practice maneuvers for an upcoming air show. The first tasks on the flight plan were a maximum-performance takeoff at 133 kt to 1,500 ft above ground level (AGL) and a teardrop-like course reversal to position the aircraft for a high-speed pass 500 ft above the runway.

The pilot conducted the maximum-power takeoff at 107 kt and with a 40-degree nose-up attitude, leveled at about 850 ft AGL, rolled into an 80-degree left bank, leveled again for about seven seconds and then reversed into an "aggressive right turn" with an initial bank angle of 53 degrees, said the report by the U.S. Air Force Aircraft Accident Investigation Board.

Five seconds into the turn, the stall-warning system activated. "Instead of implementing stall-recovery procedures, the pilot continued the turn," and the bank angle reached 62 degrees, the report said. "The [pilot] utilized full right rudder and pulled the control stick aft, which stalled the aircraft. The aircraft ultimately reached a bank angle of 82 degrees and a descent rate of 9,000 fpm."

During this time, the copilot warned the pilot, "Not so tight, brother."

The safety observer three times said, "Watch your bank."

The report said that the pilot's "rapid and aggressive maneuvers" overpowered the aircraft's deep-stall-protection system, which is intended to prevent angle-of-attack from reaching a value at which the aircraft can enter a deep stall.

The pilot, copilot, safety observer and loadmaster were killed when the Globemaster struck wooded terrain and a railway. "The aircraft exploded [and] burned for approximately 36 hours," the report said.

The investigation board found "clear and convincing evidence that the cause of the mishap was pilot error," the report said. "The mishap pilot violated regulatory provisions and multiple flight manual procedures, placing the aircraft outside established flight parameters at an attitude and altitude where recovery was not possible."

The board also found that the copilot and safety observer did not take appropriate action to prevent "the developing dangerous situation." Among other contributing factors were "channelized attention, overconfidence, expectancy [and] misplaced motivation."

Engine Ingests Window Debris

Gulfstream III. Substantial damage. No injuries.

The Gulfstream was climbing through 35,000 ft, en route on a charter flight with two passengers from Farmingdale, New York, U.S., to Florida the afternoon of March 10, 2010, when the flight crew heard a sound similar to a compressor stall, followed by a loss of power from the right engine.

The pilot-in-command "immediately declared an emergency with ATC and initiated the checklist items for engine shutdown in flight," said the report by the U.S. National Transportation Safety Board (NTSB). "Shortly thereafter, the cabin service representative informed him that the no. 4 outer window pane on the right side of the airplane had separated."

The flight crew turned back to Farmingdale's Republic Airport and landed the airplane without further incident.

A borescope examination of the right engine showed that it had experienced a compressor stall and flameout after ingesting debris from the window pane.

The flight crew heard a sound similar to a compressor stall, followed by a loss of power from the right engine.

Examination of remnants of the outer window pane revealed fractures emanating from an area that had experienced progressive cracking. "The initial cause of the cracking could not be determined," the report said. "Review of the airplane logbooks revealed that all required inspections had been conducted on the window and [that] no anomalies were noted."

The last inspection of the window had been performed about a year before the incident. At the time, the window had accumulated 15,065 hours and 8,526 pressurization cycles since new.

Close Call With a Ground Vehicle

Boeing 737-800. No damage. No injuries.

Traffic at Cork (Ireland) Airport was relatively light the morning of July 22, 2009, when the air movements controller gave the surface movements controller permission to take a relief break. Traffic increased during the next 15 minutes, as the air movements controller coordinated traffic using both the tower and ground radio frequencies.

"The workload was still manageable but contributed to a level of distraction to the air movements controller," said the report by the Irish Air Accident Investigation Unit.

The 737 and another commercial aircraft were preparing for departure on Runway 17, a light aircraft was conducting touch-and-go landings on Runway 07, and another light aircraft was holding short of Runway 07. The operator of an airport vehicle designated as "Police 1" had received clearance to enter Runway 17, to perform a runway inspection, but had been told to hold short at the intersection with Runway 07-25.

The controller instructed the pilot of the airborne light aircraft to switch to Runway 25, to accommodate the departure of the 737 on Runway 17. He then scanned Runway 17 but did not see the airport vehicle on the runway. The controller later told investigators that the vehicle would have been difficult to see because of its size and light coloring, and because of rain drops on the tower windows.

The report also noted that earlier, a "RUNWAY OCCUPIED" strip had been placed in the controller's flight progress board when another airport vehicle, "Electrician 1," was on the runway. However, the strip had erroneously been removed when Electrician 1 exited the runway while Police 1 was still on the runway. The removal of the strip "may have reinforced [the controller's] belief that the runway was clear" when he cleared the 737 for takeoff, the report said.

The operator of Police 1, who was communicating with the controller on the ground frequency — the only frequency available on the vehicle's radio — did not hear the controller clear the 737 for takeoff on the tower frequency. Nevertheless, the vehicle operator exited Runway 17 when he heard the 737's engines accelerate and realized that the aircraft was rolling for takeoff.

"During the takeoff roll, as the aircraft approached 90 kt, the commander noticed the vehicle vacating onto the intersecting runway," the report said. "With the vehicle clear, the takeoff was continued. It was estimated that the aircraft and the vehicle were approximately 700 m [2,297 ft] apart prior to the resolution of the conflict."

The 737 had 164 passengers and six crewmembers aboard.

Among the actions taken by Cork Airport after the incident were the installation in all airport vehicles of radios capable of tuning both the tower and ground frequencies, and a requirement for vehicle operators to use the tower frequency when entering or operating on runways.

Overrun on a Wet Runway

Cessna Citation CJ2. Substantial damage. No injuries.

Inbound on a business flight with five passengers the morning of June 21, 2010, the pilot canceled his instrument flight plan and conducted a visual approach to the 5,000-ft (1,524-m) runway at Storm Lake (Iowa, U.S.) Municipal Airport. Thunderstorms in the area had contaminated the runway with standing water.

"The pilot thought that he needed less than 5,000 ft of runway to stop the airplane; [he] was not familiar with the required contaminated runway landing distance," the NTSB report said, noting that the airplane flight manual specified a landing distance of 5,900 to 6,250 ft (1,798 to 1,905 m) on a runway contaminated with standing water.

The pilot told investigators that he applied full braking after the CJ2 touched down "just beyond the runway numbers," the report said. "He reported that during the landing roll-out, the wind shifted from a quartering head wind to a tail wind, and that he was unable to stop the airplane on the runway due to the wet runway condition and the wind."

The nose landing gear and the left main landing gear collapsed when the airplane overran the runway, but none of the occupants was injured.

TURBOPROPS

Aardvark on the Runway

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

Shortly after the Dash 8 touched down on the runway at Kimberly (South Africa) Aerodrome the night of July 16, 2010, the pilot caught a brief glimpse of an aardvark illuminated by the landing light. The nose landing gear was still in the air when it struck and killed the animal.

"Immediately thereafter, the landing gear horn sounded, and the pilot attempted to hold the nosewheel off the runway for as long as possible," said the report by the South African Civil Aviation Authority.

The nose landing gear collapsed when it contacted the runway. The aircraft began to veer right, but the pilot was able to bring it to a stop on the runway centerline. The 40 passengers and four crewmembers were not hurt, and they exited the Dash 8 through the main cabin door.

The report said that Kimberly Aerodrome, which is bordered on one side by a nature preserve, provides an "ideal habitat for certain birds and wild animals." Hundreds of termite mounds on the airport property are especially attractive to aardvarks, which burrow under the perimeter fence to seek their staple diet. A solar panel that had provided power to electrify the perimeter fence had been stolen a month before the accident.

The airport's wildlife-control program consisted mainly of regular runway inspections and physically chasing away or firing shotguns at the aardvarks, according to the report.

Trim Cited in Control Loss

Beech King Air B200. Substantial damage. No injuries.

The pilot was making the first flight in the airplane the afternoon of Sept. 16, 2009, after routine maintenance was performed at Hayward (California, U.S.) Executive Airport. Shortly after lift-off, the King Air began to yaw and drift left, and the pilot applied right aileron and right rudder to correct the drift.

"The pilot reported that despite having both hands on the control yoke [and applying full right aileron], he could not maintain directional control," the NTSB report said.

The left main landing gear tire struck the top of an industrial building, the bottom of the left engine struck the top of another building, and the right main landing gear struck a railway car. The airplane pivoted, struck railroad tracks and slid backward before coming to a stop against a fence.

The report said that the pilot had not adequately conducted the preflight checklists and had not configured the airplane properly for takeoff. The rudder trim knob was found in the full-left position, and the elevator trim wheel was in the 9-degree nose-up position, or about 6 degrees higher than normal for takeoff. Investigators also found the right propeller lever set only slightly forward of the "FEATHER" detent.

Weak Window Blows Out

Fairchild Metro II. Minor damage. No injuries.

The pilot was conducting a charter flight with 10 passengers from Perth to Fortnam Mine, both in Western Australia, the morning of Aug. 16, 2010. The Metro was about 120 km (65 nm) north-northeast of Perth and climbing through 20,500 ft, when the right side window in the cockpit blew out and the cabin rapidly depressurized.

The pilot donned his oxygen mask, activated the passenger oxygen system, began an emergency descent and declared an emergency. "The pilot said that he used the aircraft's public address system to instruct the passengers to put on their oxygen masks," the ATSB report said. "In addition, because of the wind noise from the failed window, he also gestured to the front row of passengers by pointing to his own oxygen mask, which ensured that they understood the requirement to use oxygen."

The right side window in the cockpit blew out and the cabin rapidly depressurized.

After descending to 9,000 ft, the pilot told the passengers that supplemental oxygen no longer was required. "He established that the aircraft was controllable and decided to return to Perth, requesting that the airport emergency services be placed on 'local standby' for their arrival," the report said. The Metro apparently was landed without further incident.

The Metro received only minor damage related to the window failure. Investigators determined that debris from the failed window and items that exited the cockpit during the rapid depressurization — including the quick reference handbook, technical logs, navigation charts and a personal distress beacon — had not struck the airframe, right propeller or right engine.

Examination of the failed window revealed that cracks had formed in the upper edge of the pane and had propagated between the retainer holes.

Although dual-pane windows were available as an option for the Metro II, single-pane side windows, consisting of only the outer pane of the dual-pane configuration, had been installed in the Metro when it was manufactured.

The aircraft's logbooks showed, however, that when the right side window was replaced by the previous owner in 2006 because of crazing, an inner pane, rather than an outer pane, was installed.

The report said that the inner pane "was of reduced material thickness and was not designed to safely withstand cabin pressurization loads" by itself. After the window was installed, the Metro accumulated 1,700 pressurization cycles.

PISTON AIRPLANES

Pressed Ahead to a Ditching

Britten-Norman Islander. Destroyed. One fatality, four minor injuries.

The Islander was on a scheduled flight with nine passengers from Curaçao to Bonaire, both in the Netherlands Antilles, the morning of Oct. 22, 2009. The pilot was setting cruise power after leveling at 3,500 ft over the Caribbean Sea when the right engine lost power.

"The pilot feathered the right propeller and undertook a few restart attempts but without result," said the Dutch Safety Board report.

The pilot decided to continue the flight toward Bonaire, rather than return to the departure airport, which was much closer. This was a "nonacceptable risk," the report said.

The Islander could not maintain level flight with only one engine operating, partly because it had been overloaded by about 10 percent more than the maximum takeoff weight due to the operator's use of a nonstandard average weight of 160 lb (73 kg) for each occupant and his or her hand baggage. Recorded ATC radar data indicated that the average descent rate was 140 fpm after the engine failed.

The pilot did not brief the passengers about his intentions or prepare them for a possible ditching. However, the passengers, on their own initiative, began donning their life vests and agreed on an evacuation plan in the event of a ditching. Some of the passengers were unable to locate their life vests.

The pilot established radio communication with the Flamingo (Bonaire) Airport traffic controller. He did not declare an emergency but reported that he was having difficulty maintaining altitude. His last radio transmission was made when the Islander was 6 nm (11 km) from the field and descending through 300 ft. He ditched the aircraft shortly thereafter.

The pilot "managed to land the aircraft at sea in such a way that all the passengers survived this accident without serious injury," the report said, noting that four passengers sustained minor injuries.

According to passenger accounts, the pilot either had lost consciousness or was killed when his head struck the windshield frame and/or the instrument panel on impact. Some passengers tried unsuccessfully to free the pilot from his seat as the cabin filled with water.

"All nine passengers were able to leave the aircraft without assistance, using the left front door and the emergency exits," the report said. After the aircraft sank, they formed a circle in the water. "The passengers who were not wearing life jackets kept afloat by holding on to the other passengers."

All nine passengers were rescued by the occupants of two recreational-diving boats that arrived five minutes after the ditching. They were met ashore by emergency services personnel who transported six passengers to a hospital, where they were examined and released.

The aircraft was retrieved two months after the ditching. Extensive corrosion had occurred due to the long exposure with the seawater. As a result, investigators were not able to determine the cause of the engine failure.

Bad Fuel Causes Power Loss

Aero Commander 500S. Substantial damage. No injuries.

The new owner of the aircraft had hired two experienced pilots to ferry it from Portland, Oregon, U.S., to Bern, Switzerland. After several positioning legs, the pilots landed to refuel at Rankin Inlet, Nunavut, Canada, the afternoon of July 18, 2010. The Shrike was refueled with a wobble pump from two 45-gal (170-L) drums of 100-octane aviation gasoline (avgas) that the pilots had ordered five days earlier.

No anomalies were noted during the preflight run-up, but the engines did not produce full power on takeoff. The pilots rejected the takeoff and taxied back to the ramp. "A second run-up was completed, and once again all indications seemed normal," said the report by the Transportation Safety Board of Canada.

Shortly after rotation on the second takeoff attempt, cylinder head temperatures increased and both engines began to lose power. "The pilots attempted to return to the airport but were unable to maintain altitude," the report said. "The landing gear was extended, and a forced landing was made on a flat section of land approximately 1,500 ft [457 m]" from the airport.

Damage to the Shrike included a collapsed right main landing gear. The pilots and their passenger were not hurt.

Investigators found that both drums used to refuel the airplane had labels indicating that they contained 100-octane avgas. The pilots had checked the fuel in one drum and determined that it contained avgas. "Vision, touch and smell were not used to determine the type of fuel in the second drum," the report said. The pilots assumed that the second drum also contained avgas.

Laboratory analysis of remaining fluid in both drums revealed that one drum had contained only avgas but that the second drum contained both avgas and a heavier fuel, most likely diesel or jet fuel. Analysis of fluid retrieved from the Shrike's center tank, which directly feeds the engines, revealed that it was a 60/40 mixture of avgas and a heavier fuel.

Investigators found that the second drum actually was a "slop drum" that had been placed near the avgas drums at the fuel depot and inadvertently mislabeled by the fuel supplier.

Paperwork on Approach

Piper Aerostar 601P. Substantial damage. One serious injury.

The pilot was repositioning the Aerostar on Aug. 18, 2010, following maintenance that had included replacement of the cylinder head temperature gauges. On approach to Baraboo, Wisconsin, U.S., he noticed different readings on the two gauges.

"He moved his seat back to be able to better view the gauges [and] was recording the gauge indications on paper [when] the airspeed decreased, the sink rate increased, and the airplane descended and impacted trees and a corn field" about 0.5 mi (0.8 km) from the runway, the NTSB report said.

HELICOPTERS

Passenger-Pilot Pulls Mixture

Bell 47G-4A. Substantial damage. No injuries.

Shortly after takeoff from Shaw Island, Washington, U.S., on June 8, 2010, the helicopter was clearing treetops near the shoreline when the passenger, who held a rotorcraft certificate, told the pilot that the carburetor temperature indicator was in the yellow arc and asked if he wanted her to apply carburetor heat.

"The pilot said yes and watched as she reached for the lever," the NTSB report said. "The pilot did not see her move the lever because her hand was blocking his view."

The float-equipped helicopter was over a bay about a minute later, when the engine lost power. The pilot performed an autorotative landing on the water, and the helicopter flipped over, receiving substantial damage to the cabin and tail boom.

The passenger had retarded the mixture control, rather than the carburetor-heat control, the report said, noting that the controls are next to each other on the 47's pedestal.

Tie-Down Strap Overlooked

Bell 222U. Substantial damage. No injuries.

After removing the main rotor tie-down strap while preparing for an emergency medical services flight the night of April 9, 2010, the pilot saw a flight nurse on the other side of the helicopter and assumed incorrectly that she had removed the tail rotor tie-down strap.

Unknown to the pilot, the strap broke when the engines were started at Santa Maria, California, U.S., and a tail rotor blade and all the pitch-change links were damaged. After landing at a local hospital and boarding the patient, the flight nurse noticed strap material wrapped around the tail rotor driveshaft. The pilot shut down the engines, removed the material and then completed the mission to a hospital in Madera, California.

There, the pilot performed a closer inspection and noticed the damage. The operator grounded the helicopter for repairs.

The report said that fatigue likely was a factor in the accident. The pilot had awakened at 0800 the day before and had slept only two hours just before receiving the duty call at 0110.

Preliminary Reports, May–June 2011

Date	Location	Aircraft Type	Loss Type	Injuries
May 3	Mizoram, India	Cessna 208 Caravan	total	9 minor/none
The Caravan overran the runway and rolled down a steep embankment while landing during a scheduled passenger flight.				
May 5	Loreto Bay, Mexico	BAE Systems Hawker 125	major	3 minor/none
The flight crew reported a problem shortly after takeoff and then ditched the Hawker in the Gulf of California.				
May 7	Kaimana, Indonesia	CAIC MA-60	total	25 fatal
Visibility was reduced by heavy rain and fog when the twin-turboprop airplane struck the sea about 1,600 ft (488 m) short of the runway while landing.				
May 16	Atqasuk, Alaska, U.S.	Beech King Air 200	total	3 minor/none
The pilot reported encountering icing conditions shortly before the King Air crashed during a night approach for an emergency medical services flight.				
May 17	Denver, Colorado, U.S.	Beech 1900	major	11 minor/none
The airplane encountered wind shear on short final approach, touched down hard and veered off the runway.				
May 18	Los Menucos, Argentina	Saab 340	total	22 fatal
Shortly after reporting icing conditions at 19,000 ft and requesting descent, the crew declared an emergency. The Saab was in a steep dive when it struck the ground.				
May 18	Bournemouth, England	Beech King Air 90	total	2 minor/none
The crew reported a double engine failure shortly after taking off for a training flight and subsequently landed the King Air on a golf course.				
May 20	Istanbul, Turkey	Eurocopter Alouette	total	4 fatal, 1 minor/none
The four passengers were unable to exit the helicopter after it was ditched in the Bosporus shortly after takeoff.				
May 24	Kaduna, Nigeria	Beech King Air 90	total	2 fatal
The King Air struck terrain short of the runway on an approach during a postmaintenance test flight.				
May 25	Sedona, Arizona, U.S.	Embraer Phenom 100	total	2 serious, 3 minor/none
The airplane overran the 5,132-ft (1,564-m) runway on landing and came to a stop on a steep, rocky slope.				
June 6	Libreville, Gabon	Antonov 26	total	4 minor/none
The crew ditched the cargo airplane about 3 km (2 nm) from the runway after reporting an unspecified problem during a visual approach.				
June 7	Valle de Losa, Spain	Bell 407	total	2 fatal
The helicopter struck high ground in dense fog during a power line patrol flight.				
June 9	Postville, Newfoundland, Canada	Cessna 208	major	1 minor/none
The float-equipped Caravan veered off the runway after its right brake failed while landing on a cargo flight.				
June 11	La Salina, Colombia	Bell UH-1	total	8 fatal, 4 serious
The police helicopter struck power lines and crashed shortly after takeoff.				
June 11	El Gran Roque, Venezuela	Rockwell Turbo Commander	minor	2 minor/none
The airplane overran a 3,280-ft (1,000-m) runway during a rejected takeoff after losing power.				
June 15	Canillo, Andorra	Eurocopter AS 350	total	5 fatal, 1 serious
Low visibility prevailed when the helicopter crashed in mountainous terrain after its external load became entangled in trees.				
June 15	Gray, Tennessee, U.S.	Beech King Air 100	major	2 minor/none
The ferry crew lost control of the airplane during an encounter with moderate turbulence and icing conditions at 20,000 ft. Control was regained at 8,000 ft.				
June 20	Petrozavodsk, Russia	Tupolev 134	total	45 fatal, 7 serious
Adverse weather conditions prevailed when the Tu-134 struck trees and crashed during a nondirectional beacon approach.				
June 23	Simikot, Nepal	Dornier 228	major	3 minor/none
The Dornier veered off the runway while landing during a cargo flight.				
June 25	Iraklion, Crete, Greece	Boeing 737NG	major	187 minor/none
The 737's lower rear fuselage was substantially damaged during a tail strike on landing.				
June 30	Kuala Lumpur, Malaysia	Agusta Westland 139	major	1 minor, 2 none
The tail boom separated from the fuselage when the helicopter was landed hard after the crew reported a control problem during a training flight.				

This information is subject to change as the investigations of the accidents and incidents are completed.

Source: Ascend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