AeroSafety WORLD

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SMS Reconsidered

I don't write about safety management systems (SMSs) much because everybody else seems to be getting "burned out" on the subject. Back when the international standards for SMS were signed out at ICAO, we all knew we were going to launch a new industry full of consultants. We also knew that all these consultants couldn't possibly know much about the subject and would be forced to regurgitate the ICAO guidance material that was being put out. It was obvious that the process people dealing with ISO and QMS would embrace the concept of SMS and treat it as another process exercise. It was also clear that regulators were going to have a very hard time evaluating an SMS and would be forced to reduce the concept to a series of checklists.

All of those predictions have come true, so it is time to take an honest look at where we are and where we go from here. The ICAO guidance was built around the "four pillars," so now everybody has an SMS with four pillars. And of course, now every regulator has a checklist that counts the pillars. We all have policies, posters, forms, processes and meetings. This is all really very comforting to people who have never grasped the concept of risk management. They are reassured by the fact that all they really have to do is fill out the right form and show up at the weekly meeting. Many well-meaning operators have worked themselves into a position where they are spending lots of time and money, but are not necessarily getting the intended results. Many managers have figured this out, and thankfully a few of them have come to us. We are learning a lot from these operators and, as a result, the Foundation is now trying to drive SMS back to its core principles

Before SMS was made complex by the consultants and process people, it was meant to do one simple thing — allocate resources against risk. I would suggest that we measure that instead of counting our meetings and posters. Please put away the checklist and try this approach instead. Go back to last year's budget, and see if you can find one single instance where information from your SMS caused you to spend money differently than you had planned. If you cannot find an example of that in your operation, you either have an extraordinarily brilliant budgeting process, or an SMS that is not delivering. I would bet on the latter.

If you want to go deeper, let me give you four simple audit questions that are really easy to answer if you have an effective SMS, and impossible to answer if you don't:

1. What is most likely to be the cause of your next accident or serious incident?
2. How do you know that?
3. What are you doing about it?
4. Is it working?

The easiest way to make people do silly things is to measure them against mindless objectives. I think SMS was always a serious and practical idea. It is supposed to change the way you manage risk. Find a way to measure those changes, and you will find a way to drive an effective implementation.

William R. Voss
President and CEO
Flight Safety Foundation

AeroSafetyWORLD

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

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'Roger, I've Got It'

"You've got it." When Jay Donoghue closed his final editorial with that phrase last month, I got a little nervous.

I have been a fan of *AeroSafety World* since its inception. Jay, who up until a few weeks ago was the editor-in-chief of the magazine and director of publications for Flight Safety Foundation, sent me an early copy and I was hooked. I thought then, as I do now, that the magazine was well-written, accurate and thought-provoking, characteristics that too often are missing from today's media landscape.

Now I find myself at the controls of *ASW*, and as everyone "kindly" keeps reminding me, I have big shoes to fill. Luckily for me, Jay, though retired happily, keeps answering my emails when I have a question.

I'm new to the Foundation, but I'm not new to aviation or journalism. I spent nearly 25 years at *Aviation Week* working in newsletters and magazines and on the web, and helping out with conferences when needed. Before that, I worked at newspapers in Virginia and Florida. I've reported on, and written about, a wide range of topics, and I've probably written or edited tens of thousands of stories, from two- or three-line newsletter blurbs, to lengthy, multi-part magazine pieces. I even did a little television early in my career, but ultimately I decided to heed the advice of one of my journalism professors, who said: "Jackman, you've got the face for radio and the voice for newspapers."

So, why did I jump at the opportunity to succeed Jay at *ASW*? The reasons are varied. I've already mentioned how I feel about the magazine, and that has only been reinforced since I came on board in early April. The staff here is top-notch. In addition, I have a lot of admiration for Jay, who I've known since my earliest days in Washington. I take it as a compliment that he approached me about applying for the position.

Just as important is my respect for the Foundation and its leadership, Bill Voss and Kevin Hiatt, particularly. Both are pros, and there are very few people in the industry who can match Bill's safety expertise. The Foundation's mission statement reads, in part, "Be the leading voice of safety for the global aviation community." After more than two decades of covering an industry that I have grown to love, I wanted the opportunity to contribute in some way. This is that opportunity.

Magazine publishing, like safety management, is a cooperative venture. The writers, editors and production people have defined roles, and you, our members and readers, have an important part to play as well. You are our window into what is going in the industry. If you have an idea for a story, or think a particular subject needs to be covered, please don't hesitate to send me an email.

Thanks in advance for your support, and I'm looking forward to working with you to continue the tradition of excellence at *AeroSafety World*.

"Roger, I've got it."

Frank Jackman
Editor-in-Chief
AeroSafety World

Serving Aviation Safety Interests for More Than 60 Years

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

Member**Guide**

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CHANGE Management

Everyone has their own idea of what change management is. At the Foundation staff meetings, I continue to inform our staff of pertinent information that affects us. I consider you, our readers and members, part of the Foundation audience. Change management processes may include creative marketing to enable communication between change audiences, but also deep social understanding about leadership's styles and group dynamics.

As a visible track on transformation projects, organizational change management aligns groups' expectations, communicates, integrates teams and manages people's training. It uses performance metrics, such as financial results, operational efficiency, leadership commitment, communication effectiveness and the perceived need for change, to design appropriate strategies for avoiding change failures or solving troubled change projects. (Credit goes to Wikipedia for the last three sentences.)

In keeping with my common theme through the past articles I have written for *AeroSafety World*, I want to inform you of another change you may have noticed with this issue. Jay Donoghue, our editor-in-chief and publisher of *ASW*, has left the halls of the Foundation for retirement and soaring in the blue skies. Jay came to the Foundation more than five years ago, and changed how we handled our publications. There were many individual bulletins and publications, but no real magazine. He took a vision that he had, along with a very talented staff of editors and graphic production specialists, and created one of the most respected safety publications in aviation. *ASW* has become a treasure trove of reference material for aviation and safety professionals. The Foundation will be ever thankful to Jay for establishing that benchmark.

But as I said in the opening paragraph, change is taking place and you need to be aware of it. Beginning with this issue our new director of publications and editor-in-chief is Frank Jackman, taking over the control yoke from Jay. Frank came to us from *Aviation Week,* where he most recently was the managing editor of civil aviation for the Aviation Week Intelligence Network. He brings 29 years of experience in a wide range of media, including newspapers, magazines and web-based news. Besides his excellent credentials, he will bring a complementary perspective to *ASW* and put some of the next-generation touches on it.

I have given him clearance to make those changes he and the staff would like to do, in order to keep the magazine fresh and relevant. One of the areas of change you will notice in future issues will be more emphasis on our different membership groups such as airports and maintenance. One other attribute that Frank brings to the Foundation is his desire to help make a difference in the Foundation and aviation safety as a whole. With his passion and background, I am sure we will see *ASW* continue to fly even higher.

As the Foundation moves through its 65th year, we are enjoying some of our past achievements, and looking forward to the new ones. Stand by for more changes so we can continue to serve you and our industry well!

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

Confusing Airmanship With Automation?

I read the article about the A340 tail strike and overrun (*ASW*, 2/12, p. 12). Had my teeth not been fixed in firmly, they would have fallen out.

Retired from airline flying for 20 years, I am now "out of the loop," in my dotage and in any case have always tried very hard not to be critical of others on the premise that "there but for the grace of God go I." And I have never flown a "glass" cockpit.

Having said that, and on the basis of your abridged version of the full Emirates A340 accident report, I wonder if many airline crews are now getting completely mesmerized by all the electronic goodies available to them, and forgetting the big picture, basic airmanship elements of the operation?

I flew the 747 classic for 12 years, in command on short-, medium- and ultralong-haul flights. Takeoff weights ranged from 220 to 377 tons. Many flights were really critical, performance-wise.

Melbourne to Dubai, the A340 must have been quite heavy. Are crews no longer thinking about their next flight until one hour prior to departure? Thinking about the criticality — or otherwise — of takeoff run distance required against available runway? The required body angle after rotation to achieve three-engine V_2 should one engine fail, etc.?

A before-preflight mindset on the 747 for an 11-hour flight might run as follows. It soon becomes second nature and can be modified for most aircraft types (including type variants). Believe me, it works and makes for a safer flight, modified for last-minute alterations.

Empty weight = 170 tons
Galley/miscellaneous equipment = 10 tons
350 pax @ 100 kg (including baggage) = 35 tons
Fuel @ 12 tons hourly burn plus reserve = 144 tons
Anticipated approx. gross takeoff weight = 359 tons

Someone really needs to take a long, hard look at selection and training requirements for the huge expansion in numbers of airline pilots in highly automated jet transport operations forecast for the next two decades. Don't let's confuse the two As — airmanship and automation.

While on my soapbox: if the preflight check-in is still one hour prior to departure, that is often woefully inadequate and often leads to rushed preflight activity. It really does need to be changed.

Nigel S. Travers-Griffin
Beleares, Spain

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

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

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MAY 21–24 ➤ Asia-Pacific Regional Runway Safety Seminar. International Civil Aviation Organization, Flight Safety Foundation, and Association of Asia Pacific Airlines. Bali, Indonesia. <www.icao.int/Meetings/BaliRRSS/Pages/default.aspx>.

MAY 21–25 ➤ Maintenance Accident Investigation Course. (L/D)max Aviation Safety Group. Portland, Oregon, U.S. <info@ldmaxaviation.com>, <bit.ly/iYEGyl>, 877.455.3629, +1 805.285.3629.

MAY 22–24 ➤ ATCA Technical Symposium. Air Traffic Control Association, U.S. Federal Aviation Administration and U.S. National Aeronautics and Space Administration. Kenneth Carlisle, <ken.carlisle@atca.org>, <www.atca.org/techsymposium>, +1 703.299.2430, ext. 310.

JUNE 6–7 ➤ Safety Management Systems Seminar. ProActive Safety Systems. Denver. Nick Campbell, <nickcampbell@proactivesafetyinc.com>, <bit.ly/InmGUy>, +1 303.881.7329.

JUNE 11–12 ➤ Flight Operations Manual Workshop: Employing IS-BAO. National Business Aviation Association. Chicago. Sarah Wolf, <swolf@nbaa.org>, <bit.ly/ye4ei9>, +1 202.783.9251.

JUNE 12–13 ➤ Evaluation of Safety Management Systems Course. CAA International. Manchester Airport area. <Training@caainternational.com>, <www.caainternational.com>, +44 (0)1293 768821.

JUNE 14–15 ➤ Overview of Aviation Safety Management Systems Training. ATC Vantage. Tampa, Florida, U.S. Theresa McCormick, <tmccormick@atcvantage.com>, <atcvantage.com/sms-workshop.html>, +1 727.410.4759.

JUNE 18 ➤ EASA Part M — Continuing Airworthiness Training. Avisa Safety System. Manchester, England. <bit.ly/yagAio>.

JUNE 18 ➤ Implementing a Just Culture. Baines Simmons. Surrey, England. <info@bainessimmons.com>, <bit.ly/whV9l4>, +44 (0)1276 855412.

JUNE 19–21 ➤ Airport Wildlife Mitigation Seminar. Embry-Riddle Aeronautical University. Dallas. <bit.ly/8XJejE>.

JUNE 19–22 ➤ Aircraft Fire and Explosion Course. Blazetech. Woburn, Massachusetts, U.S. Albert Moussa, <amoussa@blazetech.com>, <www.blazetech.com>, +1 781.759.0700.

JUNE 20 ➤ Part 145 Maintenance Organization Approvals Training. Avisa Safety System. Manchester, England. <bit.ly/xraCC9>.

JUNE 20–21 ➤ HFACS/HFIX Workshop. HFACS Inc. Los Angeles. <dnlmccn@yahoo.com>, <bit.ly/ycPTwh>, 800.320.0833.

JUNE 21 ➤ Basic IR-OPS Difference Course. GCS Safety Solutions. Lucerne, Switzerland. Carl Norgren, <Carl.Norgren@gcs-safety.com>, <www.gcs-safety.com>, +41 41 460 46 60.

JUNE 22 ➤ Basic Part FCL Difference Course. GCS Safety Solutions. Lucerne, Switzerland. Carl Norgren, <Carl.Norgren@gcs-safety.com>, <www.gcs-safety.com>, +41 41 460 46 60. (Also 9/20, 11/15)

JUNE 25–29 ➤ IBSC Conference. International Bird Strike Committee. Stavanger, Norway. <IBSCStavanger@gyro.no>, <www.int-birdstrike.org>, +47 6128 7320.

JULY 4–5 ➤ EASA Part 21 Cabin Safety Certification Course. Aerodac. London Gatwick. Terry Gibson, <terry.gibson@aerodac.com>, <bit.ly/FPGQ8b>, +44 (0)1342 719899.

JULY 9–13 ➤ Cabin Safety Investigation Course. (L/D)max Aviation Safety Group. Portland, Oregon, U.S. <info@ldmaxaviation.com>, <bit.ly/dY1qMp>, 877.455.3629, +1 805.285.3629.

JULY 9–15 ➤ Farnborough International Airshow. Farnborough, England. <www.farnborough.com/airshow-2012>.

JULY 16-20 ➤ SMS Principles and SMS Theory and Application. MITRE Aviation Institute. McLean, Virginia, U.S. <maimail@mitre.org>, 703-983-5617. (Also 9/17–21, 12/3–7).

AUG. 6–9 ➤ Unmanned Systems North America Show. Association for Unmanned Vehicle Systems International. Las Vegas. <info@auvsi.org>, <www.auvsishow.org/auvsi12/public/enter.aspx>, +1 703 845 9671.

AUG. 6–17 ➤ Aircraft Accident Investigation Course. (L/D)max Aviation Safety Group. Portland, Oregon, U.S. <info@ldmaxaviation.com>, <bit.ly/w9LKXD>, 877.455.3629, +1 805.285.3629.

AUG. 13–16 ➤ Bird Strike Committee USA Meeting. Bird Strike Committee USA and American Association of Airport Executives. Memphis, Tennessee, U.S. Natalie Fleet, <natalie.fleet@aaae.org>, <events.aaae.org/sites/120701/index.cfm>, +1 703.824.0500, ext. 132.

AUG. 27–31 ➤ ISASI Annual Seminar. International Society of Air Safety Investigators. Baltimore, Maryland, U.S. Ann Schull, <isasi@erols.com>, <www.isasi.org/isasi2012.html#>, +1 703.430.9668.

SEPT. 13–14 ➤ Aviation Human Factors and SMS Wings Seminar. Signal Charlie. Pensacola, Florida, U.S. Kent Lewis, <Lewis.Kent@gmail.com>, <www.signalcharlie.net/Seminar+2012>, +1 850.449.4841.

SEPT. 17–18 ➤ Flight Safety Conference. Flightglobal. London. <bit.ly/K4OT3A>.

OCT. 10–11 ➤ EASA Annual Safety Conference. European Aviation Safety Agency. Cologne, Germany. Gian Andrea Bandieri, <asc@easa.europa.eu>, <bit.ly/y2HfJp>, +49 221 89990 6044.

OCT. 16–19 ➤ SMS II and SMS Audit. MITRE Aviation Institute. McLean, Virginia, U.S. <maimail@mitre.org>, 703-983-5617.

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

OCT. 23–25 ➤ 65th annual International Air Safety Seminar. Flight Safety Foundation. Santiago, Chile. Namratha Apparao, <apparao@flightsafety.org>, <flightsafety.org/iass>, +1 703.739.6700, ext. 101.

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

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

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

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

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

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

Safety News

757 Windshield Fires

Operators of hundreds of Boeing 757s would be required to conduct repetitive inspections of electrical heat terminals on windshields and to repair or replace windshields, if necessary, under an airworthiness directive (AD) proposed by the U.S. Federal Aviation Administration (FAA).

The proposed AD, published in late April in the *Federal Register* and open for public comment until May 8, was developed in an effort to prevent smoke and fire on the flight decks of the affected airplanes.

The FAA said it has received reports from eight operators about nine events involving electrical arcing at the lower terminal blocks of flight deck windshields on 757s; four other reports discussed failures of upper terminal blocks. "More than one" incident involved open flames caused by arcing, the FAA said.

The agency said that in one reported event, the crew of a 757-200 experienced smoke in the cockpit, "followed by fracture of the inner pane of the first officer's windshield. This windshield fracture resulted in total loss of the first officer's outside visibility and small shards of glass striking the first officer." An examination of the windshield revealed electrical arcing at two electrical heat terminal connections.

The FAA said that, without corrective action, similar problems are "likely to exist or develop in other products of the same type design."

The proposed AD would require a detailed inspection of wiring and electrical terminal blocks at "the left and right flight deck window 1 windshield" within 500 flight hours after the AD takes effect. If necessary, corrective actions — including applying the correct torque to loose electrical connections, repairing damaged wiring and replacing unserviceable windshields — would be performed. In some cases, repetitive inspections would be required.

U.S. National Transportation Safety Board

The proposed AD applies to 664 U.S.-registered airplanes. In addition, regulatory authorities in other countries are likely to issue similar directives to apply to 757s under their jurisdiction.

The FAA issued a similar AD (2010-15-01) in July 2010 to require repetitive inspections of certain windshield electrical terminals on 757s, 767s and 777s, followed by corrective actions, if necessary. Implementation of the actions that would be required under the proposed AD would terminate the requirements of the previous AD, as they apply to 757s, the FAA said.

'Inconclusive Evidence'

Citing an absence of conclusive scientific evidence, the Australian Civil Aviation Safety Authority (CASA) has rejected a series of recommendations from a panel that examined issues involving cabin air quality, including allegations of contamination of cabin air by engine bleed air.

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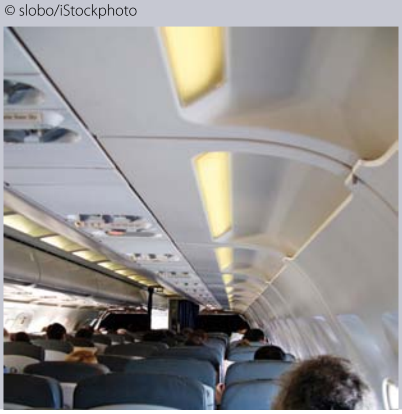

The panel's report, submitted to CASA in January 2011, found reports of cabin air contamination by bleed air are "quite rare," although reports are filed at a greater rate for military aircraft than civilian aircraft, and that there was "insufficient evidence to determine the existence of an aerotoxic syndrome," CASA said.

CASA said that, although it believes reporting requirements are adequate, it will remind operators of "their fumes-reporting responsibilities" and also will work with the Australian Transport Safety Bureau to analyze data from reported fumes events.

CASA also said that it would monitor further research in the area and review cabin air quality standards developed in the United States.

The agency rejected a number of the panel's recommendations "due to safety issues, the unsuitability of developing unique Australian requirements or a lack of regulatory authority."

It added, "The panel's inability to reach definitive conclusions highlights the fact that this is an area of research where reasonable people's views can differ. … It would not be prudent for CASA to make major policy and regulatory decisions on the basis of inconclusive evidence."

Laser Test

Pilots are being offered a self-assessment tool to evaluate the possibility that a laser strike on their aircraft has also damaged their eyes (*ASW*, 11/11, p. 29).

The U.K. Civil Aviation Authority (CAA) says its Aviation Laser Exposure Self-Assessment (ALESA) tool is intended to help pilots decide whether they have a significant eye injury and whether they should consult an optometrist or ophthalmologist.

ALESA, which was developed for the CAA by Stephanie Waggel of George Washington University and is available on the CAA website at <caa.co.uk/docs/49/Alesa card web.pdf>, asks pilots to look at a 10-cm by 10-cm (4-in by 4-in) grid and answer three questions about its appearance, as well as a series of questions about their laser exposure experience.

"Pilots obviously need very good eyesight to do their job and are naturally concerned that their livelihoods could be threatened if they are dazzled by a laser," said Ewan Hutchison of the CAA Medical Department. "We hope this new self-assessment tool will, in most cases, allay fears but also enable pilots to determine whether they should seek medical attention."

U.S. Federal Bureau of Investigation

Lasting eye damage is a rare result of a laser strike; temporary visual problems, including flash blindness, blurred vision, dazzle (intense glare) and corneal abrasions are more common, as are headaches.

The number of reported laser strikes on aircraft has increased dramatically in recent years, primarily because of the increased availability on the Internet of inexpensive, powerful lasers, authorities say. In the United Kingdom alone, about 1,600 laser strikes were reported in the first eight months of 2011, according to data compiled by Eurocontrol; by comparison, 30 strikes were reported in all of 2007.

Cooperative Effort

Latin American governments and the region's aviation industry must work together to improve safety and reduce the regional accident rate, which last year was 3.5 times the global rate, International Air Transport Association (IATA) Director General and CEO Tony Tyler says.

Although Latin American airlines "achieved a 32 percent improvement in the Western-built jet hull loss rate [in 2011], compared to 2010," those accidents accounted for 27 percent of jet hull losses worldwide, Tyler said. Air traffic in the region accounts for 6 percent of the world's total.

"If this does not improve, then the current rate of traffic growth means that in six years, carriers here will experience a major accident every eight weeks," he said in a speech to an IATA conference in Santiago, Chile, in late March.

"If Latin American aviation is to continue to deliver on its immense promise, safety must be addressed as a community working in partnership with government, and global standards must be at the heart of our joint efforts."

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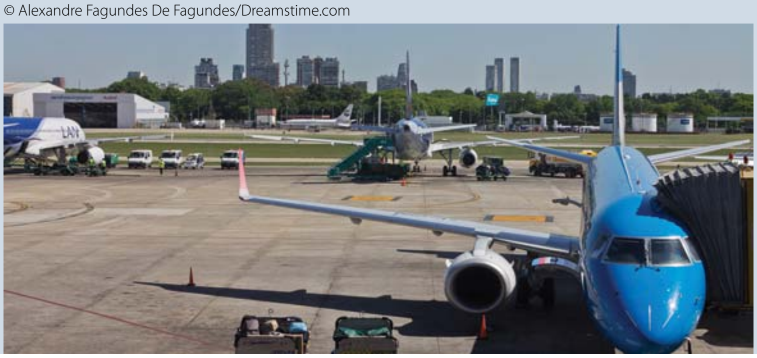

Maintenance Transition

Australian maintenance organizations are being urged to begin as soon as possible to transition to a new regulatory framework.

The deadline for compliance with the new regulations is June 26, 2013. By that date, organizations that maintain regular public transport aircraft and aeronautical products must have approval from the Civil Aviation Safety Authority (CASA) under Civil Aviation Safety Regulations Part 145, "Continuing Airworthiness — Approved Maintenance Organizations." Regular public transport air operators will be required to receive approval under Part 42, "Continuing Airworthiness Requirements for Airplanes and Aeronautical Products."

CASA said it would issue no extensions beyond the deadline.

More than 200 maintenance organizations and 30 regular public transport operators will be required to make the regulatory transition.

CASA said it is providing guidance for those making the transition, "with step-by-step information available on the CASA website" at <casa.gov.au>.

NextGen Critique

The U.S. Federal Aviation Administration (FAA) has failed to finalize program requirements for the six "transformational programs" that will serve as the foundation for the Next Generation Air Transportation System (NextGen), according to the U.S. Transportation Department's Office of Inspector General (OIG).

"Having a reliable and comprehensive program baseline through its end-state is key to providing effective oversight of a program and avoiding the cost overruns, schedule delays and unmet expectations that FAA has experienced with past modernization efforts," the OIG said in a report issued in late April.

The report said that the FAA instead has approved "shorter, discrete segments" of the six programs "to minimize risk in the near term," and added that the agency's approach "limits visibility into what the transformational programs will require for successful implementation, how much they will cost and what they will ultimately deliver."

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The six programs include automatic dependent surveillance–broadcast (ADS–B), the satellite-based surveillance system that provides information on aircraft location, as well as other programs that will provide data and voice communication, weather information and air traffic management technologies.

The FAA said it agreed with most elements of the OIG report's recommendations, including the establishment of an "integrated master schedule framework, policy and standard operating procedures" for the six transformational programs and a broader NextGen implementation package.

Quality Assurance

Transport Canada (TC) lacks a quality assurance program designed for continuous improvement of its aviation safety surveillance program, according to a report by the Canadian Office of Auditor General.

The report, issued in early April, said that TC has made progress in moving away from a "traditional surveillance approach" in favor of a systems-based approach that will allow for "more consistent and rigorous surveillance of aviation companies' compliance with safety regulations."

However, the report also found weaknesses, noting that "a minimum acceptable level of surveillance has not been clearly established to indicate how long aviation companies can operate without being inspected, and only two-thirds of planned inspections have been carried out."

In addition, the report said, most inspections are "not fully conducted according to established methodology and are subject to little management oversight."

In Other News …

The Independent Pilots Association, the labor union representing pilots for cargo carrier UPS, has filed a court challenge of the U.S. Federal Aviation Administration's (FAA's) exclusion of cargo pilots from new pilot duty and rest rules intended to guard against **fatigue**. The union asked a U.S. federal appeals court to order the FAA to reconsider. … Brazil and the United States have agreed to a public-private aviation **partnership** designed to enhance bilateral cooperation on aviation safety and other areas, including airport expansion, airspace management and aviation security.

Libyan Airlines Barred From EU

The European Commission has updated its list of air carriers banned from operating in the European Union (EU) to include all carriers certified in 21 specific countries, as well as five individual carriers.

Eleven other carriers are permitted to fly into the EU under operational restrictions.

© Gordon Zammi/Wikimedia

In addition, the European Commission said that, because of its "serious concerns regarding the safety oversight of air carriers licensed in Libya," Libyan civil aviation authorities adopted restrictions that bar all of its licensed carriers from EU operations at least until November.

Because of the restrictions, the EC Air Safety Committee said, "Inclusion of Libyan air carriers in the EU air safety list was not necessary. Nevertheless, implementation of the measures decided by the Libyan authorities remains subject to close monitoring."

Compiled and edited by Linda Werfelman.

Forecasting THUNDERSTORMS

An understanding of convection provides clues to these atmospheric monsters.

BY ED BROTAK

Convection remains a serious problem for the aviation community. Severe turbulence above the ground and strong winds with wind shear near the surface are among the hazards caused by convective activity, which plays a role in many aircraft accidents each year. Moreover, the massive hailstorm at Dallas–Fort Worth (Texas, U.S.) International Airport in April demonstrated how convection can seriously disrupt flight operations. Hundreds of flight delays and cancellations occurred, and damage to aircraft on the ground was extensive.

Meteorologists must know how convection operates in order to forecast it. They must make a model of the atmosphere, and even of the potential thunderstorm itself, to predict the weather that may be generated. The aviation industry would benefit from a better understanding of the workings of convection.

A simple key to understanding convection is to know that warm air rises and cold air sinks. More precisely, warm air is less dense and therefore buoyant (think of a hot air balloon). Cold air is denser and sinks (e.g., cold air drainage into a valley at night). The terms *warm* and *cold* are relative. A balloon with an inside air temperature of 32 degrees F (0 degrees C) still will rise if the outside air temperature is minus 40 degrees F (minus 40 degrees C). Similarly, convection can occur with temperatures below freezing.

Lapse Rate

So, to determine if air is going to rise, sink or remain where it is, we need to know the temperature of the "inside air" (inside the balloon or inside a cloud) and the temperature of the air outside. We also need to know the *lapse rate* — that is, the change in temperature with height. Outside air temperatures are measured at least twice a day — typically at 0000 and 1200 Greenwich Mean Time (GMT) — from dozens of sites across the United States and hundreds of other stations around the world. Balloon-borne instrument packs, called *radiosondes*, are launched to obtain data on temperature, moisture, pressure and winds up to 100,000 ft. Forecasters then have to determine the inside air temperature so that comparisons can be made.

Starting with the simple case of *dry convection* (no condensation or cloud), we know that air expands as it rises, and the expansion results in cooling. Using the basic laws of physics, we can derive the rate at which dry air should cool when lifted. This is called the *dry adiabatic lapse rate* ("adiabatic" refers to the expansion effect in this case), and the value is 5.5 degrees F per 1,000 ft (10 degrees C per 1,000 m). If the actual measured lapse rate is greater than this, then the parcel of air would be warmer than the environment and would continue to rise on its own. This is an unstable situation. We find lapse rates like this fairly close to the ground, usually on days with abundant sunshine. Columns of rising air, the *thermals* that glider pilots use, are common in this situation. But lapse rates of this magnitude are unusual at higher altitudes, and this type of convection is not "deep" (i.e., not extensive).

Dynamic and Dangerous

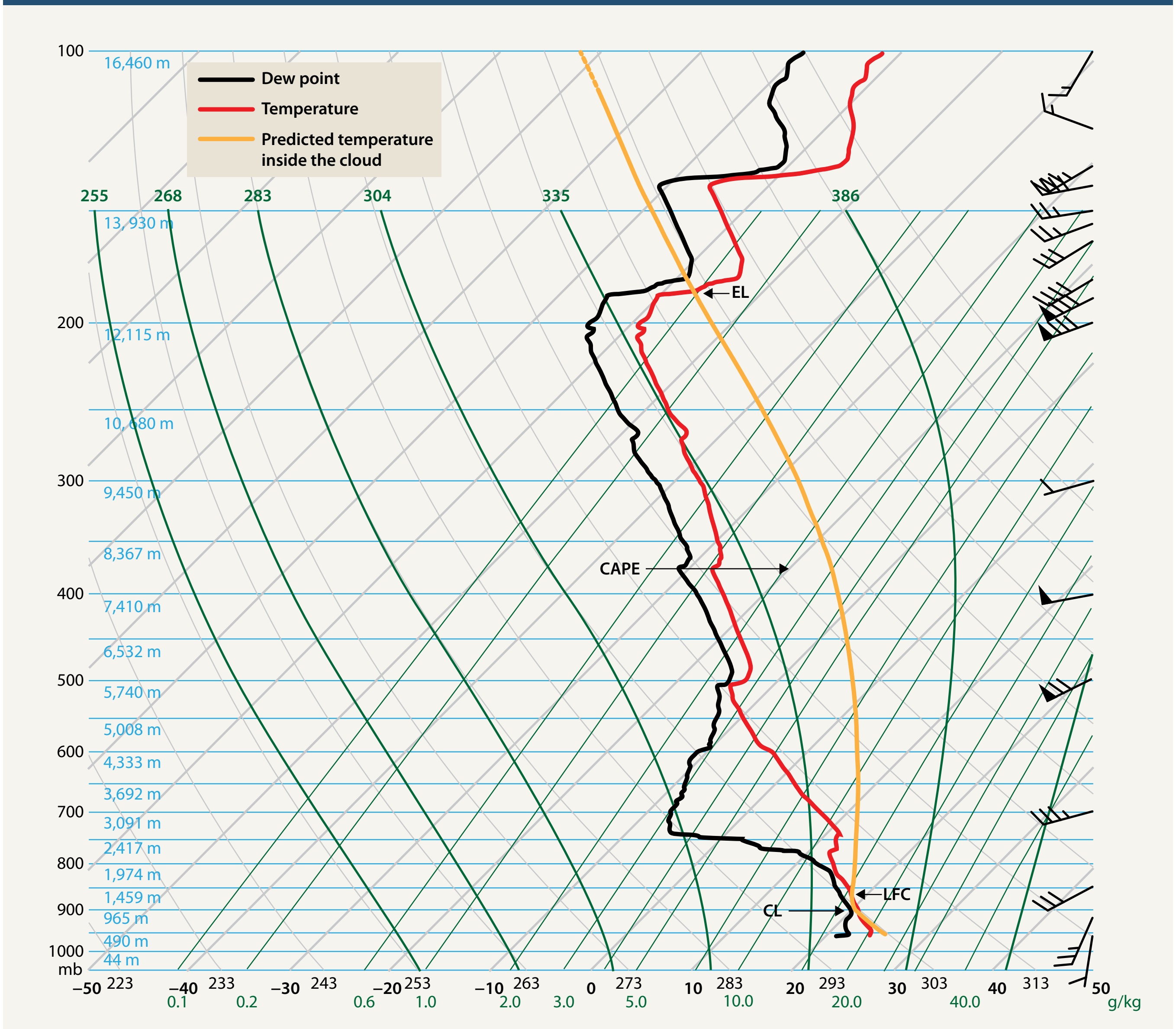
When water is added to the mix, the situation becomes more dynamic and potentially dangerous. Convective clouds, the cumulus cloud family, always provide some turbulence, which can range from a few bumps in "fair weather cumulus" to the potent updrafts and downdrafts in cumulonimbus thunderheads that can rip an airplane apart. On the plus side, the condensed water makes the air currents visible as clouds. Imagine if a pilot could not see currents of air rising and sinking at speeds that can exceed 100 mph (161 kph).

Besides making convective clouds and the various forms of precipitation associated with them, water plays a critical role in convective development. When water vapor condenses, heat is released. Technically, when water molecules go from the energetic gas form (vapor) to the more confined liquid form (water) or solid form (ice), energy is released. This *latent heat release* raises the temperature of the air within the cloud. If the parcel of air continues to rise, it will cool at a slower rate — the *moist adiabatic lapse rate*: 3 degrees F per 1,000 ft

(5 degrees C per 1,000 m). With the parcel cooling at a slower rate, it is still likely to be warmer than the surrounding air. Therefore, moist air is potentially more unstable. This process does not require a lot of moisture. Convective lifting is so strong, a moist layer near the surface, perhaps only a few thousand feet thick, is all that is needed to support convection. Interestingly, dry air aloft helps promote strong convection, whereas a deep moist layer aloft often produces heavy rain but less wind and turbulence.

So, the two primary factors that meteorologists look at to forecast convection are the lapse rate and low-level moisture. To quantify the forecasts, meteorologists have developed a number of indices that incorporate these two factors. The *Lifted Index*, the *Showalter Index*, the *Total-Totals Index* and the *K Index* can be calculated for each situation, and the numerical

Sounding at Springfield, Missouri, U.S., May 23, 2011



CL = condensation level LFC = level of free convection EL = equilibrium level CAPE = convective available potential energy

Source: Ed Brotak, from the Plymouth State Weather Center

Figure 1

values determined from the calculations can be compared to standard values for the occurrence of convection or severe convection. All of these indices were developed prior to the advent of computer technology. Although they are still used today, computer-generated products are much better.

Sounding the Atmosphere

The main tool meteorologists use to forecast convection is the *sounding*, a vertical profile of the atmosphere. A standard plotted sounding consists of two lines showing temperature and dew point, with wind data usually given on the side of the plot. Forecasters can use actual morning soundings and allow for expected changes by afternoon or, with today's sophisticated numerical models, use computer-generated forecast soundings for later in the day.

For an example, Figure 1 is the 0000 GMT 23 May 2011 sounding for Springfield (Missouri, U.S.) Municipal Airport. This sounding represents the atmospheric conditions that produced the thunderstorm that spawned the tornado that devastated nearby Joplin, Missouri. The red line is the actual temperature trace, and the black line is the dew point from the surface to 16,460 m (54,000 ft). From the surface temperature and dew point, we can calculate the *condensation level* (CL). For this calculation, we simulate the lifting of this surface air by using the dry adiabatic lapse rate to determine the height at which the air would be cooled sufficiently that its temperature equals the dew point. In this case, the condensation level is 840 m (2,750 ft). The condensation level typically marks the base of the cloud. Below this level, where the parcel of air is cooler, energy or lift must be provided for condensation to occur. The energy required is called *convective inhibition* (CINH). If this value is large (e.g., 200 or more) or there is nothing to help the parcel rise, there will be no convection. In this example, the CINH is a minimal value of 3.

The yellow line is the predicted temperature of the air inside the cloud. The red and yellow lines intersect initially at 1,300 m (4,200 ft). This is called the *level of free convection* (LFC). Above this level, the air inside the cloud is warmer than the air outside and will rise on its own. This becomes the updraft, the core of the storm. The lines cross again up at 13,000 m (42,000 ft), at what is known as the *equilibrium level* (EL). Above this level, the air in the cloud is colder than the environment. This often corresponds with the cirrus anvil of the thunderstorm cloud.

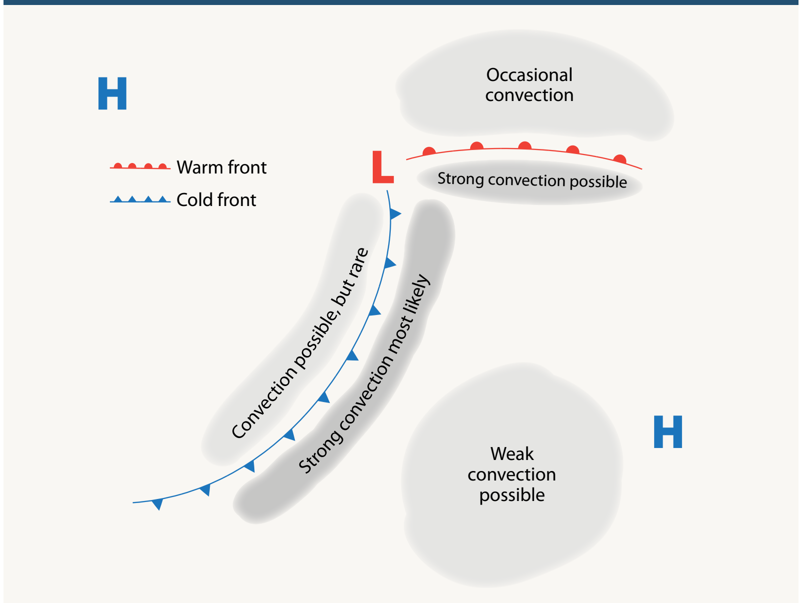
The updraft does not stop at the equilibrium level because the air in the updraft has accumulated upward momentum, or energy. This energy is proportional to the area on the sounding between the actual temperature trace and the parcel temperature trace — that is, where the parcel is warmer than the environment between the level of free convection and the equilibrium level. Meteorologists call this the *convective available potential energy* (CAPE). The CAPE indicates the potential strength of the updraft. A CAPE of 500 usually would support only weak convection, but the CAPE value here, 3,692, is indicative of severe thunderstorms. This excess energy propels the actual top of the cloud well above the anvil in what is referred to as an *overshooting top*. Viewed from above, the top of a thunderstorm looks like a boiling cauldron. The air in the updraft surges upward and then sinks back down in bursts. The actual height is a function of the CAPE. In this case, the predicted cloud top was an impressive 17,000 m (57,000 ft). With the tropopause height of 13,930 m (46,000 ft), this storm extended well into the stratosphere.

So far, we have discussed only the updraft of a thunderstorm. In terms of development, it is the updraft that produces the storm. But turbulence also consists of downdrafts, which can produce strong winds and wind shear at the ground. Initially, downdrafts are started as rain begins to fall from the cloud, pulling some air down with it. Evaporative cooling lowers the temperature of this descending air, accelerating the downdraft even more. Dry air aloft, which would intensify the cooling effect, is one thing meteorologists look for in predicting strong downdrafts. Large thunderstorms and thunderstorm complexes often develop complex circulations. Outside air can be pulled into this circulation and produce a mid-level (10,000 ft or 3,000 m) inflow. This colder, drier air can become a powerful downdraft. Also, this air brings with it momentum gained from the winds aloft. These strong winds can be brought down to the surface by the downdraft.

Convective Triggers

Even if the environment is potentially unstable, something is needed to start or trigger the convection. Typically, parcels of air need a boost to reach the condensation level — something to lift the unsaturated air upward, causing it eventually to cool to the dew point. From there, the latent heat that is released can help the parcels utilize the inherent instability. As mentioned above, strong heating of the surface by the sun in the late spring or summer is a typical convective trigger. If the temperature of the air near the surface warms sufficiently, the *convective*

Convection Catalysts



H = high pressure area L= low pressure area

Source: Ed Brotak

Figure 2

temperature can be reached, and parcels of air will start to rise on their own.

Orographic lifting is another common cause of convection. Winds blowing upslope can lift parcels of air to their condensation level. This is why convection is more prevalent over mountainous terrain. *Convergence* at low levels also can cause convection. When air converges near the ground, it is forced upward. This can happen ahead of a true front, along a gust front or the outflow boundary from previous convection, or beneath various upper-level systems.

The surface weather features shown in Figure 2 can cause typical "air mass" showers and thunderstorms to develop in the warm, humid, southerly flow on the west side of a high pressure area, away from any fronts or lows. Air mass thunderstorms are the result of daytime heating. This convection is not organized and usually is fairly weak. When convection occurs closer to the low and fronts, but still in the warm air, it tends to be more organized and stronger. The convection is aided by divergence aloft with upper-level troughs and the jet stream. This is what meteorologists call *synoptic forcing*.

When synoptic forcing is very strong, convection often organizes along lines parallel to the mean wind. These are the familiar squall lines. Often, the convection itself is strong to severe. Beside extreme turbulence aloft, strong winds at the surface are common, and hail is possible. Interestingly, moderate amounts of synoptic forcing and significant instability can combine to produce the strongest thunderstorms: the supercells. This was the case with the Joplin storm.

Rotating Updrafts

Another factor that forecasters examine at low levels is wind shear. When winds veer (turn clockwise) from the surface to several thousand feet, the updraft in a thunderstorm can convert this vertical wind shear into horizontal rotation. Rotating updrafts are associated with the strongest storms and produce the most severe weather, including strong straight-line winds, large hail and even tornadoes. To quantify this, meteorologists calculate the *helicity*, the difference between the winds at different levels. High helicity values (over 300) indicate greater potential for severe storms.

On many days, the convection is shallow, resulting in only fair weather cumulus clouds with little vertical development. The air may be too dry, and the clouds literally evaporate; or the atmosphere may be too stable to allow much development. In this situation, meteorologists often say the atmosphere is "capped." Stable lapse rates occur at levels above the effects of surface heating. When the atmosphere is uncapped and unstable, updrafts can soar tens of thousands of feet, producing *cumulus congestus*, or towering cumulus. When the updraft air finally reaches its thermal equilibrium level, it spreads out to form the anvil characteristic of a cumulonimbus cloud, the "thunderstorm cloud." Regardless of whether an anvil top has developed, cumulus clouds of this magnitude pose the greatest risks to pilots.

Edward Brotak, Ph.D., retired in 2007 after 25 years as a professor and program director in the Department of Atmospheric Sciences at the University of North Carolina, Asheville.

Standard Equipment

A proliferation of built-in and portable tablet computers, and an expanding array of aviation-specific software applications, have made electronic flight bags (EFBs) — cutting edge technological marvels only a few years ago — common fixtures in airplane cockpits.

As new hardware and software have emerged, studies of their roles have followed, along with the development of new guidance

With EFBs in more cockpits, regulatory authorities are developing new guidelines for their use.

BY LINDA WERFELMAN

Hardware and Software

Electronic flight bags (EFBs) are defined by the U.S. Federal Aviation Administration (FAA) as electronic display systems "intended primarily for flight deck use that [include] the hardware and software needed to support an intended function. EFB devices can display a variety of aviation data or perform basic calculations (e.g., performance data, fuel calculations, etc.). In the past, some of these functions were traditionally accomplished using paper references."[1]

There are three classes of EFB hardware:

- Class 1 EFBs are defined by the FAA as "portable, commercial off-the-shelf-based computers, considered to be [portable electronic devices] with no FAA design, production or installation approval for the device and its internal components." They are not permanently attached or mounted in the aircraft and must be secured during critical phases of flight.
- Class 2 EFBs typically also are portable, commercial off-the-shelf-based computers and may be used without FAA approval for their design, production or installation. Unlike Class 1 EFBs, they are attached or secured to a permanent mount during use.
- Class 3 EFBs are installed in the aircraft "in accordance with applicable airworthiness regulations," the FAA says.

There also are three types of EFB software applications: Type A applications, such as flight operations manuals, include no required aeronautical information and are intended for use on the ground or in non-critical phases of flight. Type B applications, such as weight and balance calculations, provide required aeronautical information; and Type C applications are approved by the FAA.

— LW

Note

1. FAA. Draft Advisory Circular 120-76B, *Guidelines for the Certification, Airworthiness and Operational Use of Electronic Flight Bags (EFB).*

from civil aviation authorities on the installation and use of three classes of EFBs (see "Hardware and Software").

Regulatory Revisions

Regulatory authorities in Europe and the United States have been working to revise their guidance on the use of EFBs.

At press time, the U.S. Federal Aviation Administration (FAA) was preparing to issue a revision of its 2003 advisory circular (AC) 120-76A, *Guidelines for the Certification, Airworthiness and Operational Use of Electronic Flight Bags (EFBs)*. A draft of AC 120-76B incorporated new information about portable EFBs, including Apple iPads and other tablet computers.

The European Aviation Safety Agency (EASA) is accepting comments until June 18 on a notice of proposed amendment (NPA) that would modify the definitions of the classes and types of EFBs, as well as the definitions of the responsibilities of EASA and national regulatory authorities. The proposed changes are "largely harmonized" with current FAA guidelines, EASA said.

EASA characterized the NPA as an "urgent step," noting that an absence of previous guidance from EASA has meant that most nations in the European Union have relied on a "somewhat obsolete" technical guidance leaflet (TGL 36) issued in 2004 by the European Joint Aviation Authorities.

"While technology has progressed, this TGL is … unable to offer guidance in view of the new safety challenges posed by the new EFB applications," EASA said. "Continuous progress of information technology on the commercial market outside aviation, leading to increasing use and requests for EFB applications, requires rulemaking initiative from the agency in the earliest possible time."

Safety Enhancements

EFBs have been in use since the early 1990s, when FedEx brought laptop computers onto the flight deck for pilots to conduct aircraft performance calculations. Since their inception, EFBs have been praised for enhancing safety — for example, by reducing errors in weight and balance calculations and takeoff performance computations, and through airport surface moving map displays that bolster situational awareness.

One relatively early example involved a FedEx pilot who used the performance software on his McDonnell Douglas MD-11's EFB to identify an alternate runway at Memphis [Tennessee, U.S.] International Airport after calculations showed that the airplane was too heavy to take off, as planned, on another runway.

Without the EFB software, offloading cargo would have been the only solution.[1]

More recently, however, a study conducted for the FAA by the U.S. Department of Transportation (DOT) John A. Volpe National Transportation Systems Center identified two accidents and 67 other events associated with EFB use (see "Accidents Involving EFBs," p. 22). The study reviewed National Transportation Safety Board (NTSB) accident reports, and events reported to the U.S. National Aeronautics and Space Administration's Aviation Safety Reporting System (ASRS) by private and commercial pilots operating under U.S. Federal Aviation Regulations Part 91 ("General Operating and Flight Rules"), Part 135 ("Commuter and On-Demand Operations") and Part 121 ("Air Carrier and Commercial Operators").

Of the 67 ASRS events, 32 reports — submitted by 24 Part 91 operators, five Part 135 operators and three Part 121 operators — involved the use of an EFB chart application. Thirty reports — all from Part 121 operators — involved flight performance calculations. Five additional five reports involved "use of documents of unspecified applications."[2]

"The most common outcome in the ASRS event set was a deviation in heading, altitude or speed," the Volpe report said. "Charts were typically in use on the EFB when such deviations occurred. Two key underlying issues appear to be that zooming and panning to configure the chart display for readability can induce workload that may impact other tasks and the display could be configured such that important information was out of view and missed when needed."

For example, a report in a separate ASRS publication included a Part 91K ("Fractional Ownership Operations") jet captain's description of a speed deviation that ASRS said occurred "on departure while the crew was trying to use a portable EFB with a screen size approximately 8 in by 5 in [20 cm by 13 cm]."[3]

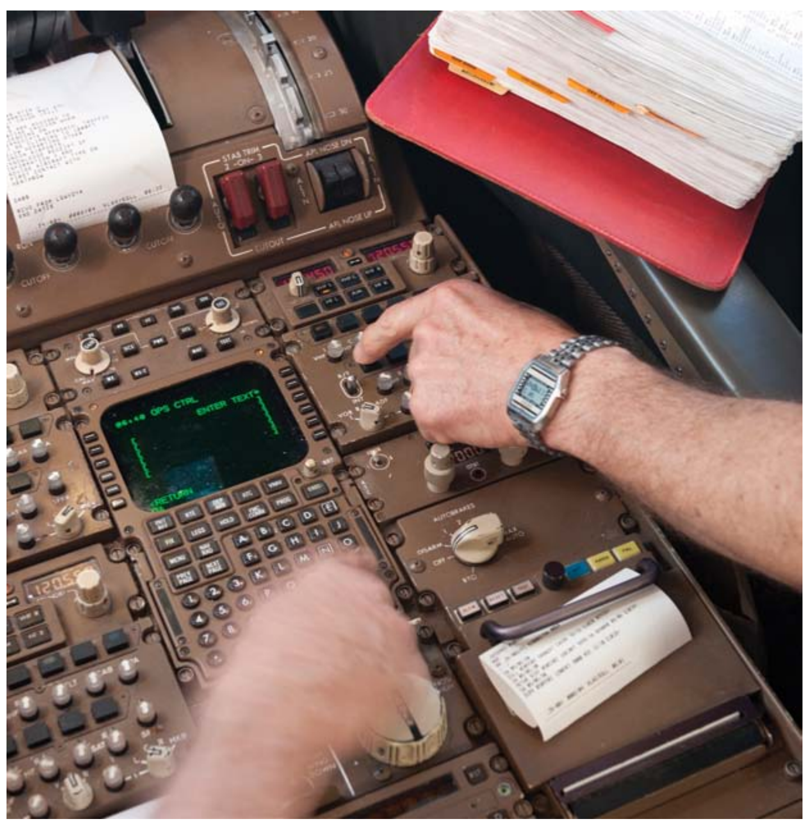
The captain said that, while on a standard instrument departure (SID) from an unidentified airport, the pilots realized only after a query from air traffic control that they had exceeded the 250-kt speed restriction by 50 kt.

"We briefed the SID in detail, but we simply didn't see the speed restriction," the captain said. "I truly believe a main cause is there is not a standard place that speed restrictions are published on the charts. … The EFBs are also a contributing factor, as it can be difficult to see the entire chart without cumbersome scrolling."

The Volpe report said that difficulties associated with flight performance calculations included "company policy deviations (e.g., takeoff from an unauthorized runway), incorrect computations and runway incursions. A variety of flight deck procedures issues are implicated. … For example, in four runway incursion reports, one crewmember was preoccupied completing calculations during taxi as the other crewmember missed a clearance restriction or hold short [instructions]. In two other cases, pilots did not set flaps for takeoff because they forgot to complete necessary checklists while they were preoccupied with the calculations."

The report noted that pilots who had little experience with EFBs said that problems using the devices played a role in 11 reported events,

EFBs have been in use since the early 1990s, when FedEx brought laptop computers onto the flight deck.



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Accidents Involving EFBs

Accident investigations have identified at least three accidents in which issues involving electronic flight bags (EFBs) were cited as contributing factors. In their discussions of EFBs, the European Aviation Safety Agency (EASA) and U.S. Department of Transportation (DOT) cite the following crashes:[1,2]

- The Dec. 8, 2005, runway overrun of a Boeing 737 after landing at Chicago Midway International Airport (*ASW*, 2/08, p. 28, and in photo, below). "Contributing to the accident were the programming and design of its on-board performance computer, which did not present inherent assumptions critical to pilot decision making," said the summary by EASA.[3] The EASA report also noted that U.S. National Transportation Safety Board (NTSB) investigators said that the airplane performance data that were programmed by the airline into the performance application were "less conservative than the performance data recommended by the manufacturer. The NTSB concluded that, if the manufacturer's recommended airplane performance data were used in the airline performance calculations, the resulting negative stopping margins would have required the pilots to divert."

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- The Oct. 14, 2004, crash of a 747-200 during takeoff from Halifax (Nova Scotia, Canada) International Airport (*ASW*, 10/06, p. 18). The crew, using an EFB takeoff performance application, calculated incorrect V speeds and thrust setting. EASA said the Transportation Safety Board of Canada (TSB) had determined that it was "likely that the flight crewmember who used the EFB to generate takeoff performance data did not recognize that the data were incorrect for the planned takeoff weight in Halifax." EASA said that the TSB also had found that the operator "did not have a formal training and testing program on the EFB, and it is likely that the user of the EFB … was not fully conversant with the software."[4]
- The July 31, 1997, crash of a McDonnell Douglas MD-11 while landing at Newark (New Jersey, U.S.) International Airport (*Accident Prevention*, January 2001). EASA said that the NTSB investigation found that "some flight crewmembers may lack proficiency in the operation of airplane performance computing devices and that confusion about calculated landing distances may result in potentially hazardous miscalculations of available runway distances after touchdown."[5]

— LW

Notes

1. EASA. *Notice of Proposed Amendment No. 2012-02*. March 12, 2012.
2. Chandra, Divya C.; Kendra, Andrew. *Review of Safety Reports Involving Electronic Flight Bags*, DOT/FAA/AR–10/5. DOT John A. Volpe National Transportation Systems Center. April 2010.
3. The airplane crashed through two fences on airport property and onto a road, striking an automobile. A young boy riding in the car was killed, and another passenger was seriously injured. Three others in the car and 18 of the 103 people in the airplane received minor injuries, and the airplane was substantially damaged. The NTSB's final report on the accident said the probable cause was the pilots' "failure to use available reverse thrust in a timely manner to safely slow or stop the airplane."
4. All seven crewmembers — the only people in the airplane — were killed in the crash, and the airplane was destroyed.
5. The five people in the airplane received minor injuries and the airplane was destroyed in the crash.

including three events involving Part 121 operators.

The ASRS report quoted the captain of an air carrier flight crew, who described his first time using an EFB:

> *Climbing to our assigned altitude of 36,000 ft, we leveled at 34,000 ft for less than a minute. Control asked us if we were climbing to 36,000 ft, I replied affirmative, and we continued the climb. I did not notice on the preflight that the first officer put [Flight Level] 340 [approximately 34,000 ft] in our cruise page. This is why it leveled. We were both heads down trying to figure out our EFBs. … It was dark and hard to see the buttons that we needed to use on the outer edge of the EFBs. This is … the only aircraft that has an operational EFB, so it is not a normal practice for us. It was the first time that I … ever used one.*[4]

The NTSB's final reports about two accidents said that the use of an EFB to calculate landing distance was a contributing cause of the accident, the Volpe report said, adding, "One issue was that assumptions underlying the performance calculations on an EFB must be presented to the crew as clearly as paper-based performance tables. A second issue was assessment of the adequacy of training and procedures for using EFB performance calculations functions."

The Volpe report concluded that pilots can be distracted from "the usual multi-tasking flight duties" while configuring an EFB display for chart readability or computing flight performance, and it recommended an intensified emphasis on the need to continue monitoring other tasks while working with EFBs.

Kevin L. Hiatt, COO of Flight Safety Foundation and a former airline captain, said that the report's conclusions should be viewed as a reminder of the need for thorough preparation and training in the use of EFBs.

"They're only as good as the training you receive," Hiatt said. "The other question is, 'Are the data current and correct?' If both of these conditions have been met, you've got a good, solid source of information. If they haven't been met, you have the potential for a serious problem."

EFBs of the Future

Today's EFBs have a wide variety of applications ranging from electronic charts, checklists and documents to performance calculations, flight planning, voice data communications and more. Among the more significant recent developments has been the emergence of the iPad, with its many accompanying software applications, as an EFB.

In the United States, the first users were general aviation pilots, who do not need FAA approval to operate iPads and other tablet computers as EFBs. The FAA must approve requests by individual commercial operators to use the devices; several of those requests from charter operators and airlines have been granted over the past few months.

Airbus CEO Tom Enders, noting that the iPad is "changing the way pilots interact with the aircraft," said early in 2012 that his company planned to offer "more operational benefits to airlines with powerful applications" to be used on iPads. "The impact of such products, from outside the world of aviation, [is] starting to dictate what people expect from us, and we can't ignore that."[5]

"The next step," Rick Ellerbrock, director of aviation strategy for Jeppesen, and Skip Hallner, Jeppesen's manager of global strategic relationships, said in Boeing's *AERO* magazine, "will be adding real-time geo-referenced information and extending data-driven technology beyond the en route phase of flight."[6]

"The future of advanced information management technologies for navigation includes a flight deck that is connected to the airline operations center with real-time data, integration of ground-based and airborne information systems and leveraging of the growing data-link capabilities of commercial airplanes. The next generation of electronic data-driven charting will extend today's digital charting by providing a seamless gate-to-gate solution. It will also include smart information layers that overlay information such as notices to airmen (NOTAMs) and new weather products such as four-dimensional 'weather cube' data being developed in support of NextGen [the FAA's Next Generation Air Transportation System]."

The EFBs of the future will take on even more, they wrote, adding that a "completely digital flight deck," is on the horizon.

Notes

1. Croft, John. "Maintenance and the Electronic Flight Bag." *Overhaul & Maintenance* Volume 10 (July–August 2004). Cited in "'Paperless Cockpit' Promises Advances in Safety, Efficiency." *Flight Safety Digest* Volume 24 (June 2005).
2. Chandra, Divya C.; Kendra, Andrew. *Review of Safety Reports Involving Electronic Flight Bags*, DOT/FAA/AR–10/5. DOT John A. Volpe National Transportation Systems Center. April 2010.
3. ASRS. "Paperless Flying — Electronic Flight Bags (EFBs)." *Callback* No. 369 (September 2010).
4. Ibid.
5. Airbus. "iPad Makes Its Way to the Airbus Cockpit." *Noticias: Airbus* No. 140 (January–February 2012).
6. Ellerbrock, Rick; Haffner, Skip. "Operational Efficiency of Dynamic Navigation Charting." *AERO* (QTR_02.12). <boeing.com/commercial/aeromagazine/articles/2012_q2/>.

Fatal V_1 Cut

BY MARK LACAGNINA

Simulated engine failure during a check ride led to a loss of control.

A training and checking captain who was administering an instrument proficiency check to a line captain in an Embraer EMB-120ER Brasilia performed a "V_1 cut" — a simulated engine failure on takeoff — "at a speed that did not allow adequate margin for error," said the Australian Transport Safety Bureau (ATSB) in its final report on the March 22, 2010, accident at Darwin Airport.

Moreover, the check captain introduced two systems failures — an improper practice during check flights — by moving the left power lever all the way to idle, rather than to a position corresponding to zero thrust, the recommended procedure. In addition to simulating an engine failure, the check captain's action disabled the twin-turboprop aircraft's propeller autofeather system. "This produces much more drag from the 'windmilling' propeller than had the propeller automatically feathered," the report said.

The check captain did not restore power to the left engine when airspeed and heading deviations exceeded tolerances for the exercise, and the line captain exacerbated the situation by increasing power from the right engine and engaging the yaw damper, the report said. The

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result was a loss of control, and the Brasilia crashed nearly inverted off the end of the runway, killing both pilots.

The pilots were employed by Airnorth. Based in Darwin, the airline conducted scheduled and charter flights throughout Australia's Northern Territory with a mixed fleet of regional jet and turboprop airplanes. The report said that both pilots were experienced flight instructors and Brasilia captains, and held supervisory positions at Airnorth.

The check captain had 5,664 flight hours, including 3,085 hours in Brasilias. He joined Airnorth in January 2006 and was appointed as a training and checking captain in June 2009. "Pilots that were checked by him reported that he gave thorough prefight briefings before each check flight and that those included the engine failure scenarios that were to be expected," the report said.

The line captain had 8,217 flight hours, including 3,749 hours in type. He was employed by Airnorth as a Brasilia copilot in 2006 and was upgraded to command status a year later.

Both pilots held Grade 1 flight instructor ratings with multiengine airplane training approvals. The line pilot had more than 1,200 hours' experience as a flight instructor and was authorized by the Australian Civil Aviation Safety Authority (CASA) to conduct command instrument rating renewals.

Less Than a Minute

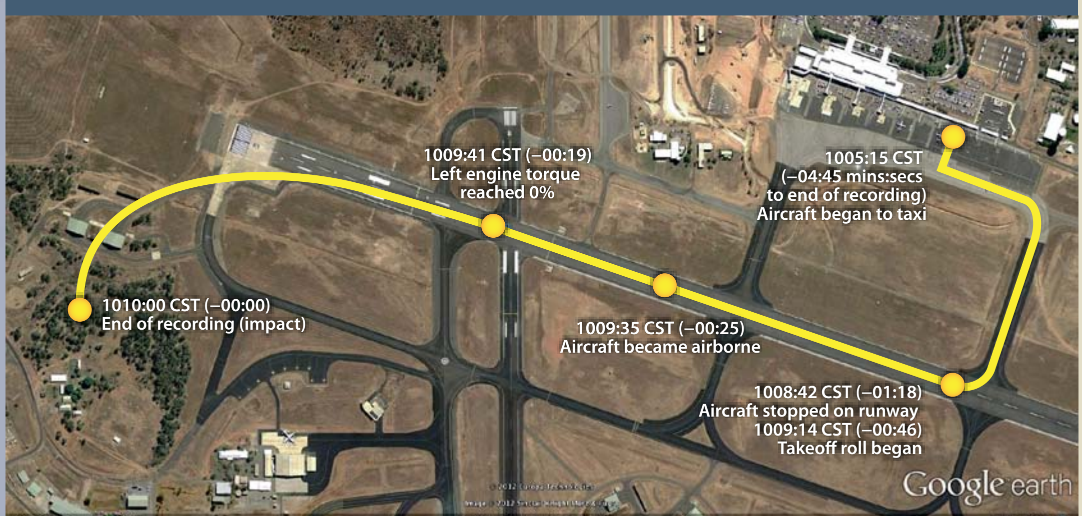
The check captain was designated as pilot-in-command (PIC) of the instrument proficiency check flight, and the line captain was the pilot flying (PF). "The pilots were reported to have planned and briefed in preparation for the check flight," the report said. "A company pilot later described seeing three columns of briefing information on the whiteboard used by the PIC." Airnorth required that briefings include the maneuvers that were to be flown, including the method the check pilot would use to simulate an engine failure on takeoff.

Before beginning the takeoff at 1009 local time, the PIC advised the airport traffic controller that an engine failure would be simulated on departure. The takeoff was begun from the point where the taxiway leading from the civilian ramp, Taxiway E2, intersects Runway 29 (Figure 1).[1] The aircraft's takeoff weight was about 20 percent below maximum, and the center-of-gravity was near the forward limit. V_1 had been calculated at 100 kt, and V_2, the takeoff safety speed, was 113 kt.

Although it labeled the exercise as a V_1 cut, the report indicates that the PIC moved the left power lever to idle immediately after the aircraft lifted off the runway and at an airspeed slightly above V_2.

"Witnesses reported that the takeoff appeared 'normal' until a few moments after the aircraft became airborne, when it was seen to roll and diverge left from its takeoff path," the report said. "They watched as the aircraft continued rolling left into a

Flight Path



Source: Adapted from Australian Transport Safety Bureau report by Susan Reed.

Figure 1

steep nose-down attitude. The witnesses lost sight of the aircraft behind trees to the south of the upwind end of the runway, from where a column of black smoke was seen shortly afterwards. … The aircraft had descended through the surrounding trees and impacted terrain in a steep 65-degree nose-down, partly inverted, right-wing-low attitude."

The accident had occurred 51 seconds after the takeoff was initiated. The Brasilia struck terrain about 500 m (1,641 ft) south of the departure threshold of Runway 29.

"The investigation found no evidence of mechanical failure, nor had local conditions contributed to the development of the accident," the report said. "Analysis of the flight data and cockpit voice recordings found that a flight condition was allowed to develop that rapidly became uncontrollable.

"Significantly, there was only a very short period of time — possibly between four and five seconds — from when the PIC first recognized that the maneuver was not being flown within prescribed tolerances to when the loss of control occurred. This was such a brief period of time that it did not allow the PIC to analyze and 'troubleshoot' the problem. The only course of action that would have avoided a loss of control would have been to immediately restore power to the left engine and to stop the exercise."

The report added, "A prompt remark from the pilot under check that he was unable to control the aircraft might have triggered such a response from the PIC."

'Exacting Maneuver'

During training and subsequent proficiency checks, pilots are required to demonstrate competency in handling a failure of the critical engine at V_1, the report said, defining V_1 as "the critical engine failure speed or decision speed."[2]

"The V_1 cut is an exacting maneuver because accurate control of the aircraft is required to accelerate to a safe flying speed, become airborne and obtain a predicted climb performance with the critical engine powered back to simulate an inoperative engine with its propeller feathered," the report said.[3] "The sequence requires an aircraft to be flown at low airspeed and with reduced performance, while controlling asymmetric thrust, at low altitude."

Embraer EMB-120ER Brasilia

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Brazil's Empresa Brasileira de Aeronáutica (Embraer) introduced the twin-turboprop Brasilia in 1985 as a regional airliner and military transport. The EMB-120 replaced the EMB-110 Bandeirante, which originally was designed as a light transport and trainer for the military but was used extensively in commercial aviation. The Bandeirante has Pratt & Whitney Canada PT6A-34 engines rated at 560 kW (750 shp) and carries two pilots and up to 21 passengers. Deliveries to military and civilian operators began in 1972, and more than 500 Bandeirantes were built before production was terminated in 1990.

Brasilias initially were powered by 1,119 or 1,194 kW (1,500 or 1,600 shp) PW115 engines driving Hamilton Standard four-blade composite propellers. The aircraft can accommodate 30 passengers, a flight attendant and two pilots. The extended-range EMB-120ER was introduced in 1993 and became the standard version the next year. The major change was an increase in maximum takeoff weight to boost usable fuel capacity to 3,308 L (874 gal).

The EMB-120ER has 1,343-kW (1,800-shp) PW118A engines. Maximum weights are 11,990 kg (26,433 lb) for takeoff and 11,700 kg (25,794 lb) for landing. Maximum climb rates at sea level are 2,500 fpm with both engines operating and 550 fpm with one engine inoperative. Cruise speeds at 25,000 ft are 313 kt, maximum, and 270 kt, long-range. Maximum range with reserves is 800 nm (1,482 km). Stall speed in landing configuration is 89 kt.

More than 350 Brasilias were built before production was terminated in 2001.

Sources: Embraer, *Jane's All the World's Aircraft*

Pilots experienced in conducting training and check flights in the aircraft told investigators that handling a V_1 cut requires careful attention to the pitch attitude and the application of substantial aileron and rudder control force to maintain lateral and directional control. Tests conducted in a Brasilia flight simulator showed that maintaining control after the left power lever was moved to idle was difficult because of the control inputs required. "The pilot flying … demonstrated that the only way to maintain sufficient aileron control was to place his left hand under the end of the left control yoke 'ram's horn' to provide the additional leverage necessary for lateral control," the report said. When aileron control force was relaxed, a rapid right roll occurred, and the roll continued despite application of full right rudder and reapplication of full right aileron, as occurred in the accident sequence.

"The sequence was repeated with the pilot not flying restoring power on the left engine just after the simulator commenced the uncontrollable left roll," the report said. "The reintroduction of power at that point demonstrated that recovery to normal flight was possible in the simulator."

Airnorth's training and checking manual included the following statement regarding simulated engine failures: "Check pilots must continuously monitor the reaction of the trainee to the loss of power by keeping one hand guarding the control column, feet resting on the rudder pedals and thrust levers guarded throughout the exercise, and must be ready to oppose incorrect control inputs or to discontinue the exercise by restoring power."

Dual Failures

Airnorth procedures complied with CASA guidelines for simulating engine failures in flight with the use of zero thrust. "The PIC had correctly demonstrated the simulation of engine failures during his training for check pilot approval," the report said. "However, on the accident flight, he selected flight idle. This meant that, instead of a simulated engine failure, the PIC had in fact simulated the failure of both the left engine and its propeller autofeather system."

Simulating more than one system failure during a check flight is prohibited by CASA and Airnorth. Investigators were unable to determine whether the PIC's selection of flight idle was deliberate or inadvertent. "It was possible that the PIC had decided to deviate from the operator's approved procedure in order to test the recognition by the candidate of the additional failure of the autofeather system, before setting zero thrust — a technique that was reported to have been used by other training and checking pilots in the industry," the report said.

When armed properly, the autofeather system automatically feathers the propeller — that is, positions the propeller blades to an angle producing minimum drag — when it senses that engine torque has dropped below about 24 percent in a Brasilia. With the system disengaged, the drag produced by the windmilling propeller decreased the aircraft's performance and controllability. "The simultaneous failure of an engine and its propeller autofeather system has much greater consequences for aircraft handling than the failure of the engine alone," the report said.

The situation worsened when the PF increased power from the right engine and engaged the yaw damper. A component of the aircraft's automatic flight system, a yaw damper commands movements of the rudder to counteract excessive yawing caused by turbulence and to dampen lateral "Dutch roll" oscillations. "The operator's flight operations manual for the EMB-120 stated that the yaw damper was not to be used for takeoff or landing, and that the minimum speed for its use during one-engine-inoperative flight was 120 kt," the report said.

The cockpit voice recording indicated that the Brasilia's heading was 20 degrees left of the runway centerline when the PIC said, "Heading, mate, disengage." Shortly thereafter, the PF said, "Yeah, disengaging." Investigators determined that the

The situation worsened when the PF increased power from the right engine and engaged the yaw damper.

statements likely referred to an agreement between the pilots to disengage the yaw damper. However, this "would have required the pilot under check to take one hand off the flight controls at a time when both hands were needed to fly the aircraft," the report said.

Strong Recommendation

In a September 2009 letter to Brasilia operators, Embraer had advised that single-engine training procedures should be initiated by moving a power lever to achieve 20 percent torque, the zero-thrust setting, and that the associated condition lever be left at maximum rpm. A note at the end of the letter said, "Nevertheless, Embraer strongly recommends that all EMB-120 training be performed in an EMB-120 simulator."

The accident aircraft, VH-ANB, was one of 21 Brasilias registered in Australia. Although an EMB-120 simulator had been installed at a Melbourne-based training facility more than a year before the accident, the instructor assigned to Airnorth had not completed requirements to conduct simulator training and check flights in the simulator. "At the time of the accident, the operator was about to transition all of its EMB-120 asymmetric training and checking to the simulator," the report said. "The accident flight was to have been one of the last training and checking flights to have involved asymmetric flight in the actual aircraft."

This article is based on ATSB Transport Safety Report AO-2010-019, "Loss of Control — Embraer S.A. EMB-120ER Brasilia, VH-ANB; Darwin Airport, Northern Territory; 22 March 2010." The report and a computer animation based on the recorded flight data are available at <atsb.gov.au>.

Notes

1. The report did not specify the takeoff distance available from the intersection or the likely reasons the pilots did not back-taxi to the approach end of Runway 29.

   A diagram in the *Darwin Airport Master Plan 2010* indicates that about half of the 3,354-m (11,004-ft) runway was available at the intersection.

2. The European Aviation Safety Agency and the U.S. Federal Aviation Administration define V_1 as "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 maximum 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 defined during performance certification at which the critical engine is assumed to fail during takeoff.

3. The *critical engine* is defined as "the engine whose failure would most adversely affect the performance or handling qualities of an aircraft." The left engine on the Brasilia is the critical engine because its propeller produces less asymmetric thrust than the right-engine propeller in an engine-out situation.

Difficult Diagnosis

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Physicians can't always identify a pilot's depression or other mental problems during an aeromedical exam.

BY LINDA WERFELMAN

Mental health problems, often difficult to diagnose during aeromedical exams, have rarely factored in airline accidents and incidents (see "Related Accidents," p. 30).

Official accident reports attribute a handful of crashes to a pilot's deliberate action, citing a "psychosomatic disorder," a suicide attempt or some unexplained motive. In some cases, those conclusions were challenged.

Most recently, the lawyer representing a JetBlue captain told a federal court that his client would plead that he was insane during a March 27 flight in which he allegedly turned off the radios, told his first officer on the Las Vegas–bound Airbus A320 that "we need to take a leap of faith" and "we're not going to Vegas," and began yelling about Jesus and terrorists.[1,2]

Related Accidents

Official reports have cited the pilot's mental condition in very few accidents. Among them are the following:

- A Japan Air Lines McDonnell Douglas DC-9 crashed into Tokyo Bay, 510 m (1,673 ft) short of the Runway 33R threshold at Tokyo International Airport, on Feb. 9, 1982. In the final seconds of the flight, as the airplane descended through 164 ft, the captain shut off the autopilot, pushed the control wheel forward and tried to reduce power to the engines. The first officer tried unsuccessfully to regain control of the airplane. Twenty-four people in the airplane were killed in the crash, and the airplane was destroyed. The captain had returned to duty in November 1981, after a year off because of a "psychosomatic disorder."[1]
- A Royal Air Maroc ATR 42 crashed in the Atlas Mountains of Morocco about 10 minutes after takeoff from Agadir on Aug. 21, 1994. All 44 people in the airplane were killed, and the airplane was destroyed. Investigators said that the pilot disconnected the autopilot and put the airplane into a steep dive. The Moroccan Pilots' Union challenged the findings.[2]
- An EgyptAir Boeing 767 crashed into the Atlantic Ocean about 30 minutes after takeoff from John F. Kennedy International Airport in New York on Oct. 31, 1999, killing all 217 passengers and crew. The U.S. National Transportation Safety Board (NTSB) said the relief first officer, alone in the cockpit, had disconnected the autopilot, moved the throttle levers to idle, pushed the elevator control forward and shut down the engines. The captain returned to the cockpit and tried unsuccessfully to recover the airplane. The NTSB said the probable cause of the accident was "the relief first officer's flight control inputs," which could not be explained. The Egyptian Civil Aviation Authority disputed the NTSB's conclusion, which it said was "not supported by any evidence of intent or motive that would explain the first officer's alleged conduct."[3]

—LW

Notes

1. Aviation Safety Network. Accident Description. <aviation-safety.net/database/record.php?id=19820209-0>.
2. Aviation Safety Network. Accident Description. <aviation-safety.net/database/record.php?id=19940821-1>.
3. NTSB. *Aircraft Accident Brief NTSB/AAB-02/01: EgyptAir Flight 990, Boeing 767-366ER, SUGAP; 60 Miles South of Nantucket, Massachusetts; October 31, 1999.*

The U.S. Federal Bureau of Investigation (FBI) said that after the captain left the cockpit for the lavatory, the first officer asked an off-duty JetBlue pilot to come to the cockpit to assist with the remainder of the flight, locked the captain out and declared an emergency.

Ultimately, passengers and flight attendants restrained the captain while the first officer landed the A320 in Amarillo, Texas, the FBI said. The captain was taken to a facility for medical evaluation and charged in a federal criminal complaint with interfering with a flight crew.

'Incredibly Difficult'

Aeromedical specialists say it is easy for a pilot's mental problems to go unnoticed during routine flight physicals.

"This is incredibly difficult to diagnose," said Dr. Quay Snyder, the president/CEO of Aviation Medicine Advisory Service and its parent company, Virtual Flight Surgeons.

"Most pilots will minimize any problems that they have," added Snyder, also the aeromedical adviser to the Air Line Pilots Association, International. "And very few medical examiners have the savvy to diagnose a problem like this."

Dr. Anthony Evans, chief of the International Civil Aviation Organization (ICAO) Aviation Medicine Section, said that "the diagnosis of a mental illness depends on a variety of aspects. … It is harder to diagnose depression than schizophrenia, for example, because in the latter, the speech/behavior may be bizarre, the individual having lost touch with reality in one way or another. For more common mental illnesses, such as depression, it can be difficult to diagnose if the individual chooses to withhold information that would lead to the diagnosis. This might be the case if the pilot knows the regulatory authority does not permit the use of antidepressants."

In the United States and many other countries, pilots are asked during aeromedical exams if they have a history of mental disorders. An affirmative answer "requires investigation through supplemental history taking," the U.S. Federal Aviation Administration (FAA) says in its *Guide for Aviation Medical Examiners*.[3]

'Appropriate Questions'

Evans said that a designated medical examiner is more likely to make an accurate diagnosis of a mental problem if "he provides an atmosphere of concern, he asks appropriate questions and the regulatory authority is known to treat such individuals in a supportive way."

The ICAO *Manual of Civil Aviation Medicine* includes several series of suggested questions intended to serve as a "starting point" in talking with pilots about depression, anxiety/panic attacks and other conditions.[4]

For example, the manual suggests that pilots be asked, orally or in writing, if during the preceding three months, they have "often been bothered by feeling down, depressed or hopeless, … by having little interest or pleasure in doing things" or by having difficulty sleeping. Pilots also should be asked if they have experienced "a marked elevation in your mood" that persisted for a week or more, the manual says.

The questions are intended primarily for pilots under age 40 who are seeking Class 1 medical certificates, which typically are required of airline pilots. The manual suggests that regulatory authorities consider allowing medical examiners to incorporate such questions into discussions with pilots about mental health — part of a recommended effort to devote more attention to the prevention and early recognition of physical and mental health problems. At the same time, the manual suggests that, for pilots younger than 40, medical examiners could omit some of the more routine examination items.

Evans said that the recommendation was incorporated into the manual because "we tend to require an almost identical medical examination throughout a pilot's career, whereas the risk of particular illnesses varies greatly, depending on age. … Performing a physical examination every year in the under-40 age group is not likely to be very productive. The time would be better spent talking to the pilot to address some of the 'soft' issues of aviation medicine, like mental and behavioral problems."

New Rules

In recent years, civil aviation authorities in some countries have modified their previous bans on the use of antidepressants to allow some pilots to fly while taking specific medications.

The FAA adopted such a policy in 2010, when it began considering, on a case-by-case basis, the special issuance of medical certificates to pilots with mild to moderate depression, provided those pilots had been treated for at least 12 months with one of four specific medications in a class of antidepressants known as selective serotonin reuptake inhibitors (SSRIs).[5]

When the FAA announced the new policy, Dr. Fred Tilton, the federal air surgeon, said that FAA officials were well aware that "there are pilots who are depressed and flying without proper treatment. We are also aware that there are pilots who have been using these medications and falsifying their medical applications." The policy changes were intended, he said, to encourage those in the first group to seek treatment and those in the second group "to come forward without fear of civil enforcement action."[6]

'Most pilots will minimize any problems that they have.'

Two years later, FAA data show that 92 applicants for medical certificates (including 20 who sought first-class certificates) had received special issuances associated with their antidepressant use. Fourteen applicants (including two who sought first-class certificates) were denied, and 25 cases (including eight first-class cases) were pending.

Snyder, whose offices deal with pilot inquiries involving all types of medical issues, said that in 2011, 18 percent of the 12,000 total inquiries dealt with mental health issues, including depression, one of the most common mental disorders.

He estimated that the percentage of pilots with depression is probably about the same as the percentage of the general public affected by the ailment.

"Everyone's susceptible to this disease," he said, noting that the number of inquiries "always spikes when there are [airline] bankruptcies and furloughs, and when corporate flight departments close or downsize."

Other countries have allowed the use of antidepressants by pilots far longer than has the United States. For example, in Australia,

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supervised use of antidepressants by pilots and air traffic controllers has been permitted since 1987, and a study published in 2007 found "no evidence of adverse safety outcomes," as long as "specific criteria" were met.[7]

The "specific criteria" included removing the pilot or controller from duty while the antidepressant was being introduced to ensure that the medication would not cause side effects that might interfere with work.

'Potential problems that can be predicted cannot be ignored, both for [the] person and the system.'

Transport Canada (TC), which conducted a lengthy study of a small number of pilots who took specific antidepressants, now says in its *Handbook for Civil Aviation Medical Examiners* that aviation personnel taking SSRIs will be considered on a case-by-case basis for medical certification.

The handbook cautions that scrutiny will be most intense for those applying for Category 1 medical certificates — required for airline transport pilots and some other commercial pilots in Canada — because they "will be in a position where the safety of the fare-paying public is front and center, and expectations about the pilot's medical competency and stability are high. While not a pure medical factor, the potential for future interruptions in the pilot's career path and disruptions to his future employer cannot be dismissed entirely. Training costs are high, and potential problems that can be predicted cannot be ignored, both for [the] person and the system."[8]

ICAO retains its recommendation that an applicant who has been treated with antidepressants should be denied medical certification "unless the medical assessor, having access to the details of the case concerned, considers the applicant's condition as unlikely to interfere with the safe exercise of the applicant's license and rating privileges."

However, the manual also recommends conditions to be met before granting medical certification to an applicant taking an approved SSRI. The applicant must be "stable on an established and appropriate dose of medication for at least four weeks," must undergo regular clinical reviews and "demonstrate symptoms of depression being well controlled," the manual says. In addition, the applicant should show no irritability or anger, have a normal sleep pattern and have resolved "any significant precipitating factors of the depression."

In an appendix to the ICAO *Manual of Civil Aviation Medicine,* an article by Evans and other leaders in aviation medicine says that, in dealing with depression, "a more effective safety strategy [would be] both to accept the use of certain selected antidepressants and to structure the routine aeromedical examination to better identify those who may benefit from psychiatric intervention than it would be to try and continue to exclude all pilots with depressive disorders and to institute additional measures to try and increase their detection."[9]

Notes

1. FBI. *JetBlue Pilot Charged With Interference With a Flight Crew*. March 28, 2012.
2. Makris, Ioanna. *JetBlue Pilot Who Had Midair Meltdown to Plead Insanity—Filing*. Reuters. April 18, 2012.
3. FAA. Guide for Aviation Medical Examiners. <faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide>.
4. ICAO. Doc 8984, *Manual of Civil Aviation Medicine — Third Edition*, Part 1, Chapter 2. Montreal. 2012.
5. The medications are fluoxetine (Prozac), sertraline (Zoloft), citalopram (Celexa) and escitalopram (Lexapro).
6. Tilton, Fred. "Understanding the New Antidepressant Policy." *Federal Air Surgeon's Medical Bulletin* Volume 48 (No. 2) 2010.
7. Ross, James; Griffiths, Kathleen; Dear, Keith; Emonson, David; Lambeth, Len. "Antidepressant Use and Safety in Civil Aviation: A Case-Control Study of 10 Years of Australian Data." *Aviation, Space, and Environmental Medicine* Volume 78 (August 2007): 749–755.
8. TC. TP 13312, *Handbook for Civil Aviation Medical Examiners*. "Psychiatry (SSRIs)."
9. Evans, Anthony D.; Watson, Dougal B.; Evans, Sally A.; Hastings, John; Singh, Jarnail; Thibeault, Claude. "Safety Management as a Foundation for Evidence-Based Aeromedical Standards and Reporting of Medical Events." *Aviation, Space, and Environmental Medicine* Volume 80 (June 2009): 511–515.

The 2009 crash of Colgan Air Flight 3407 near Buffalo, New York, U.S., reverberated in April as training and safety specialists debated its effects on initial pilot qualifications, the adequacy of airline pilots' hand-flying skills and adding hours to recurrent flight simulator training. Some predicted during sessions of the World Aviation Training Conference and Tradeshow (WATS 2012) in Orlando, Florida, U.S., that derivative regulatory changes will have unintended consequences. Others credited public pressure on legislators in the United States with breakthrough decisions on air transport safety issues.

"We are focused on fostering the kinds of behaviors that lead to professional conduct," said Michael Huerta, acting administrator of the U.S. Federal Aviation Administration (FAA). Some of the latest industry upheaval has surrounded updates to certification and qualification for airline pilots through a rule proposed in February (*ASW*, 3/12, p. 9), which Huerta termed "the most significant overhaul in crew training in the last 20 years."

"Not only do we want to require [that first officers hold an airline transport pilot (ATP)] certificate, but we propose to greatly increase the training to achieve it," Huerta said. "For example, we believe it is necessary to have both academic and flight training in critical operating skills. [The rules also] would require pilots to demonstrate their skills in real scenarios … rather than have the pilot executing a recovery in a highly choreographed event." A similar philosophy is

Focus on automation in flight training devices and increase manual flying in full flight simulators, presenters said.

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BY WAYNE ROSENKRANS | FROM ORLANDO

Silver Linings

Public pressure forced controversial regulatory changes, but U.S. officials see new risk-reduction benefits.

being applied to training dispatchers and flight attendants (see "Guaranteed Competence," p. 42).

Corridors of Power

Understanding the continued influence of the Colgan accident on aviation rulemaking requires familiarity with contemporary political dynamics of Washington, said John Allen, director, FAA Flight Standards Service. Government leaders, many in new positions when the accident occurred, and families of the passengers and crewmembers pressed for substantive changes to mitigate risks they perceived in airline industry practices.

'Unintended consequences … are [requiring] quite a bit of effort.'

The FAA in short order was directed to complete 22 studies and task force reports to Congress, the National Transportation Safety Board and other entities; initiate eight rulemaking processes and create two databases. Again this year, a February congressional reauthorization of funding for the agency included further Colgan-derived rulemaking and study requirements, he said.

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"There are some very positive things out of this, even though we are very cautious on legislating safety," Allen said. "But there are unintended consequences that we are trying to work through, and they are [requiring] quite a bit of effort."

Among responses to the changes, the FAA has narrowed its scope of rulemaking for mandating safety management systems (SMS) at major airlines. "If operators have a robust SMS, that means that they have programs for data collection tools, statistics and transparency to show the regulator how well they are managing their safety," Allen said. "They are capturing the risks and the hazards, they are mitigating them, they're getting a positive response, and they're being forthright about it. … FAA inspectors are more efficient and more effective [if] they don't have to waste time [in low-risk areas or] trying to ferret out whether there are unseen risks and hazards."

Adoption of SMS has prompted reconsideration of some deeply ingrained FAA policies. "I'm not sure that our enforcement posture is serving safety very well right now," he said. "We have over 4,000 enforcement actions in the pipeline, over 1,000 of them [more than] three years old. [Having] too many enforcement actions inhibits our attention to the significant ones. We also have a culture [of] inspectors who reflexively — because they don't have guidance to say otherwise — initiate enforcement action [whenever they see a violation of regulations]. We are amending our guidance to provide a mechanism for our inspectors to work in a collaborative fashion to do the right thing for safety … to be judicious in our enforcement [yet apply penalties] when it is appropriate."

Regarding first officer qualifications, the FAA's senior leaders agree with the strong industry and academic view that quality of experience — not just flight hours — establishes "the quality of the pilot," Allen said. "The legislation requiring the ATP is self-enacting, which means that the requirements become effective no later than July 31, 2013, regardless of any rulemaking action by the FAA."

Scheduled completion at the end of July of a notice of proposed rulemaking on professional pilot development, concerning mentoring programs, has been delayed.

Valuing Manual Flight Skills

Aircraft automation has been instrumental to air transport safety gains, said Jacques Drappier, a captain and senior adviser training, Airbus. Therefore, caution should be exercised in drawing conclusions about the causal role of automation in accidents, he said.

"Without automation … reduced vertical separation minimum and required navigation performance approaches would just be impossible," Drappier said. "Continued efforts from all aviation manufacturers to further enhance the safety and economy of flight will bring more automation. But nothing is perfect, [and] maybe there have also been some side effects. One could be the loss of manual flying skill, and one may be an overreliance on automation."

Some avenues for further scientific research into the question include measuring the effects of practice and the causes of skill erosion, poor quality ab initio training and level of experience before promotion of first officers to captains. "Hand-flying, in most cases nowadays and especially in the long hauls, is limited to one minute after takeoff and about two or three minutes in approach," Drappier said. "But in some respects, automated aircraft may require a higher standard of basic stick-and-rudder skills [because they are not practiced often]. These skills are still necessary today when, at certain moments, there are abnormal situations or extreme weather conditions. The transition between smooth autopilot [flight] and a hair-raising situation can be very abrupt in modern cockpits."

Loss of control–in flight and runway excursion events cannot be assumed to be attributable to flight crews' use of automation. "Are we really looking at … erosion of our manual flying skills, or are we looking at an issue of airmanship?" he said. "When [Airbus] looked at cases where flying skill was blamed, often the real cause of the accident was a lack of situational awareness, lack of airmanship or disregard of rules. … It is too easy to blame automation."

Anecdotal evidence at Airbus, however, does not support the assertion that significant numbers of active airline pilots have "lost" these skills. "What we see in our training centers is a few pilots who are a little bit rough on the edges, but the majority are still very capable and are doing a fine job in hand flying," Drappier said.

Flight training adhering to U.S. or European evidence-based training principles does not necessarily address manual handling proficiency for abnormal or difficult situations such as upset prevention and recovery or crosswind landings. "We need dedicated sessions," he said, citing a decision by Emirates to introduce four hours of additional simulator sessions per pilot in 2012 dedicated to manual flying proficiency. "Every three months or every six months, their pilots are back in the simulator to do flight director-off, autothrust-off [sessions such as] manual flying of patterns," Drappier said. "I am sure that, if we take this problem seriously, [other airlines] will come to the same conclusion: [Pilots] need more [of this flying] time."

Airbus suggests that even pilots with a solid foundation of hand-flying proficiency from earlier training should have manual handling skills developed or refreshed during type rating training. "We believe that at least two sessions' worth of manual flying are needed during a type conversion," he said. "We must use time in the full flight simulator to do handling, and push the automation exercises into flight simulation training devices. We also need to put more effort into the recurrent [hand-flying experience], where in recent years we've seen a reduction in overall time spent in the simulator."

Memorization Overdose

Mike Carriker, a captain, aeronautical engineer and chief pilot, new airplane product development, Boeing Commercial Airplanes, told attendees that time spent designing airplanes has made him wary of persistent-but-obsolete pilot training practices.

The first reform should be to stop requiring rote memorization from books, Carriker said. "No place — in 50,000 hours of analysis of failures in the 787 — was there anything [to suggest, for example,] a better outcome if a crewmember had recalled that the airplane has a 15-kVA electrical system."

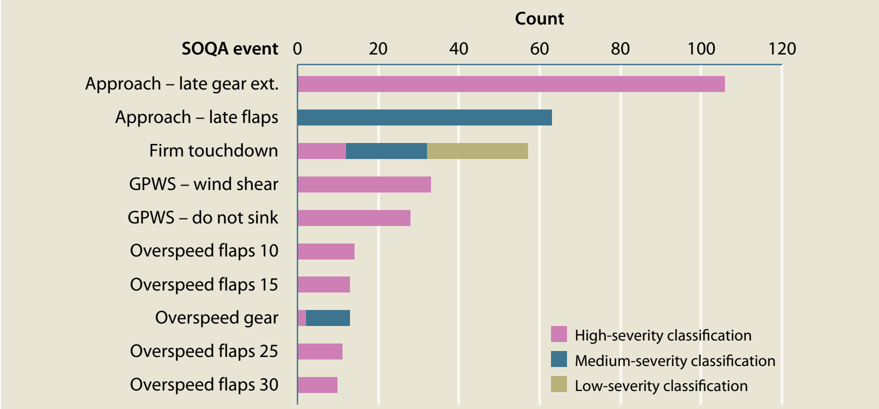
Far more important than conserving a tradition of memorization is accelerating advances in airline pilot training and adapting to the learning strengths/preferences of multiple generations, he said. This includes "turning the airplane loose," that is, taking full advantage of the latest technology for precise flight paths.

"[A current Boeing] airplane possesses the capability to [utilize] billions of dollars worth of satellites and a multimillion-dollar, multisensor, integrated FMS [flight management system that provides] up/down, left/right guidance to the end of every runway in the world — with indication of deviation from the path and warning for excessive

Carriker (top) and Huerta

Wayne Rosenkrans

Simulator Operations Quality Assurance: Top 10 Events



DoD = U.S. Department of Defense; SOQA = simulator operations quality assurance; GPWS = ground-proximity warning system; ext. = extension

Note: A full flight simulator, designed for military versions of the Boeing 737, was used in a CAE SOQA-feasibility study for the DoD. Each event represents a deviation by the flight crew from a standard operating procedure. During 115 of 246 simulator flights, 416 SOQA events (ranked as high, medium or low severity) were detected, captured and analyzed. These flights included 135 takeoffs, 111 landings, 27 wind shear exercises and 29 engine-out exercises. "Top 10 events" is a standard report from the SOQA capture and analysis station connected to the simulator.

Source: CAE

Figure 1

deviation," he said. "The airline industry has to turn that [technology] on."

Simulator Operations Quality Assurance

Flight data–driven flight training has been demonstrated recently in feasibility research for the U.S. Department of Defense (DoD) involving a Boeing 737 full flight simulator and military versions of this aircraft type, said Lou Németh, chief safety officer, CAE. The inspiration is flight operational quality assurance (FOQA) programs, typically collecting 1,500 variables (also called *parameters*) 11 times a second during routine flights for subsequent analysis.

"We use computer algorithms to see if the pilots are performing as they were trained, and to see if the aircraft is performing the way it was engineered and maintained to fly," Németh said. "The simulator operations quality assurance [(SOQA) research now addresses the questions] 'Is there value in SOQA data to look the training system as a whole, to see if it's performing as it should?'; 'Do SOQA data match the realities that we are seeing from FOQA data?' and 'Is there a correlation between FOQA and SOQA data?'"

SOQA basically comprises a full flight simulator, a data capture station, automated reports, analyses transmitted to the training manager, and data visualization/animation capability. "We're monitoring the system, not necessarily the individual pilot performance," he said.

Nevertheless, one simulator session during the SOQA feasibility research underscored the system's ability to clarify risks when a pilot and/or an instructor is ambivalent about the seriousness of errors — or possibly even denies that errors in the simulator would have had serious safety consequences during a real flight.

A simulator-flown approach northbound into Colorado Springs, Colorado, U.S., specified a right turn in the published missed approach procedure to avoid the Rocky Mountains. In one observed event, however, with the simulator's crash-inhibit function selected for unrelated reasons, miscommunication between the pilots led the pilot flying to turn left toward charted terrain, and the error was not detected until audible terrain alerts activated.

Shortly after this session, the crew and instructor told Németh that their error had been resolved. "The crew said, 'We got pretty close, but we saved the day at the last moment, and we did not [strike] the terrain,'" he recalled. "I said, 'Oh, really?' In actuality, as seen from the animation, they 'flew through' a mountain." The SOQA data replay with animation and data visualization showed controlled flight into terrain. "The visualization tool made it very clear to the instructor, and the students came away with entirely new behaviors because they could [relive] the problem from the outside looking in," Németh added.

One common deviation, for example, involved violations of the procedure for setting approach flaps. Most frequent was late extension of landing gear during approach and landing (Figure 1). "We also wanted to see pilots land the airplane [with touchdown] just above 1 g [that is, one times standard gravitational acceleration], but the data showed a number of landings at 2 g to 3 g and one at about 5 g to 6 g," he said.

As in an actual hard landing, the touchdown may not be perceived by pilots or instructors as a significant exceedance. "We don't know [which hard landings] should require retraining unless we have the analytical basis to decide. [The SOQA] system will give us that information. The student and client benefit from a more precise indication of performance — and know they're going to be treated impartially."

To read an enhanced version of this story, go to <flightsafety.org/aerosafety-world-magazine/may-2012/wats2012-pilot>.

Flight Safety Foundation officially rolled out its new student membership in April.

New Chapters

Chief Operating Officer Kevin Hiatt and Director of Communications Emily McGee visited Purdue University to launch the inaugural Flight Safety Foundation Student Chapter at the College of Technology's Department of Aviation Technology. Chapter adviser Stewart Schreckengast, associate professor in the Aviation Technology Department, invited the Foundation to participate in its annual career fair and meet with the chapter officers and potential members.

The visit revealed the importance of this new effort. At the career fair, enthusiastic students from around the world stopped to talk about their work and how to get involved directly in safety efforts. The FSF team toured the Department of Aviation Technology's facilities and met with professors and instructors. Local TV filmed the announcement of the launch and ran a story that evening.

The Foundation benefits from reaching out to these up-and-coming aviation safety professionals, and the students benefit from having access to all the resources that the Foundation can offer.

Purdue students already are planning chapter-wide projects in aviation safety that will be further developed under the guidance of the technical staff at the Foundation. Some of this research could be presented at future International Air Safety Seminars, where attendees would have a unique opportunity to hear from the next generation of safety professionals about the cutting-edge research being done in academics.

Emily McGee

Schreckengast and Hiatt with Scott Winter, student chapter president, and Gary Bertoline, dean of Purdue University's College of Technology

The Foundation still is shaping this new membership category and is developing academic-specific benefits and opportunities for the students. It expects to see students become directly involved in Foundation safety research, either through traditional on-site internships or through work projects taking place at the universities. Like all members of the Foundation, students will have access to seminar proceedings, new products and the soon-to-be-launched member-only website. The Foundation is developing a student-only LinkedIn page to allow for direct interaction among students around the world.

The student membership category is open to any student at any accredited school. While the Foundation encourages the formation of student chapters, individual students are welcome to join. Efforts will begin in the next few months to target other U.S.-based universities and global schools with aviation programs, and the Foundation has set a goal of at least 10 student chapters by the end of 2012.

Information and a membership application for this new membership category can be found at <flightsafey.org>. Questions can be directed to <membership@flightsafety.org>.

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BY ROBERT I. BARON

How much are we *really* learning from accidents?

Double Trouble

Accident investigations yield useful information. But is all this information actually being fed back to the system and acted upon?

The primary objective of accident investigations is to determine the causal factors and to use that information to prevent that type of accident from occurring again. However, the same types of accidents still occur.

Through no fault of the accident investigation agencies around the world, the industry is not doing a very good job of assimilating their findings into effective training examples in the classroom.

Although the sequence of factors leading up to an accident may be complex, the final triggering mechanism itself often is simple — such as taking off with ice on the wings or intentionally descending below landing minimums when a go-around should be conducted. In most cases, these triggering events can be ascribed to fundamental decision errors by the crew.

These are what I label *thematic accidents*. Four such thematic accidents, with almost identical probable causes, occurred over a 21-year period (Table 1, p. 40). The probable causes are extracted verbatim from the official accident reports.

The first of these four accidents occurred in 1987, the most recent in 2008. Each was attributable to deficiencies in checklist usage, adherence to standard operating procedures and cockpit discipline. Each crew failed to set the flaps/slats for takeoff and, in each case, the takeoff configuration warning system was inoperative for unknown reasons. If the warning systems had been functional, these accidents could have been prevented.

This shows how much trust we bestow on a defense that should warn of impending danger. Unfortunately, in each of the accidents, that defense was not available. Additionally, in the Northwest Flight 255 (1987) and Delta Air Lines Flight 1141 (1988) accidents, there were flagrant violations of the "sterile cockpit" rule. The Northwest pilots were chatting about non-flight-related items during taxi (in lieu of executing the proper "Taxi" and "Before Takeoff" checklists). In the Delta accident, the pilots and a flight attendant riding in the jumpseat were discussing the dating habits of flight attendants and — in reference to being recorded by the cockpit voice recorder — how they needed to leave something for their wives and children to listen to in case they died.

Why, after the first accident in 1987, did we not learn enough to prevent the same type of accident? In fact, it was just one year later that the almost identical Delta accident happened. It could be argued that, despite the shock factor of Northwest 255, the full investigation into that crash was still not complete. Then, it appears, from 1988–2005, there was a "latent period" for this type of accident.

Was it because of lessons learned? Maybe the significance of the Northwest and Delta accidents finally got the attention of global airlines — or maybe not; in 2005, the same accident occurred again (Mandala Airlines Flight 091), and again in 2008, with the crash of Spanair Flight 5022.

The Spanair accident occurred although there had been *three almost identical accidents* to learn from over the previous 21-year period. This was just one of numerous recurring accident themes that could have been chosen.[1]

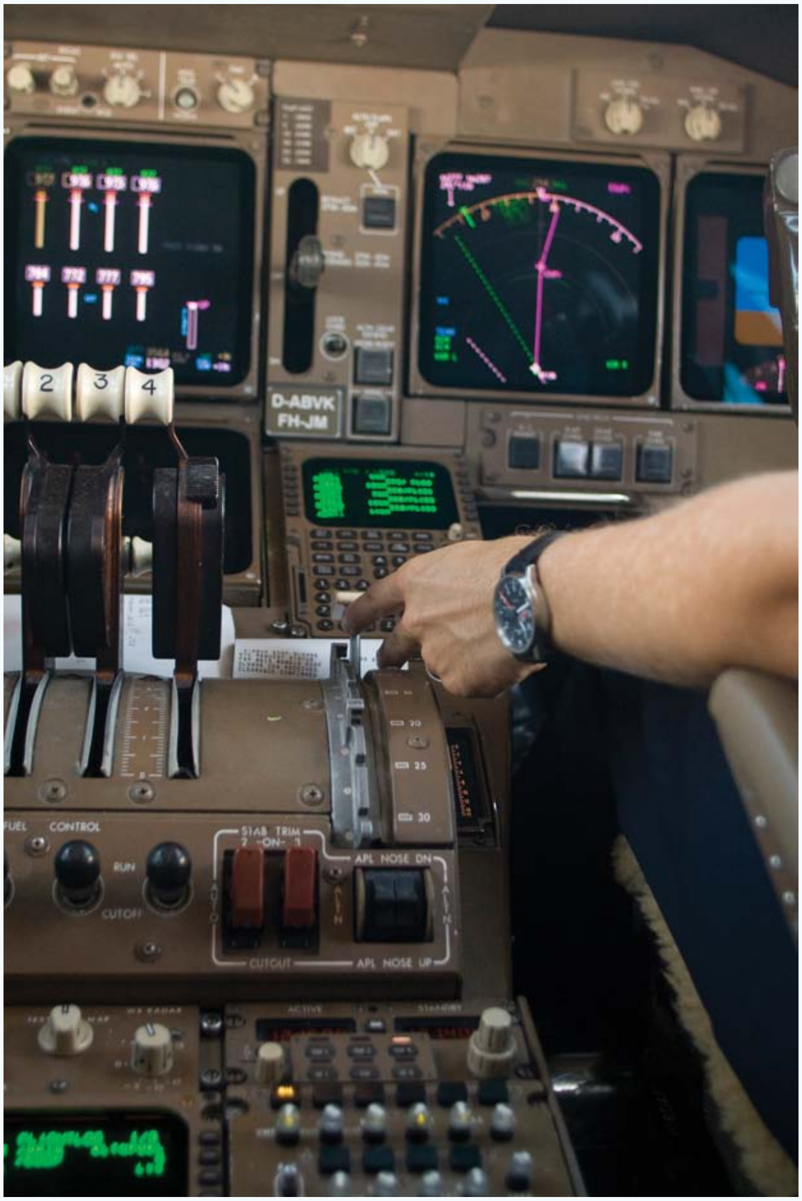
True, major accidents of the past *have* been catalysts for important safety initiatives such as ground-proximity warning systems, smoke detectors and automatic fire extinguishers in lavatories and cargo holds, on-board wind shear detection equipment and crew resource management (CRM). But, while these initiatives have made a remarkable improvement in safety, we still need to shore up the human performance aspects of flight operations. Each of the aforementioned accidents was caused by a lapse in human performance.

The following recommendations are offered to overcome the apparent gap between the rich data available from accident reports and the effective assimilation of those data. The recommendations focus on the recurring accident theme highlighted in this article.

Air Traffic Control

Military air traffic controllers have long used the "check gear down" reminder for pilots of landing aircraft. This has prevented a number of gear-up accidents. The same type of reminder should be considered for civil aviation, particularly airline operations. Why not make it a requirement for

There had been three almost identical accidents to learn from over the previous 21-year period.



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Selected Accidents Involving Flaps/Slats Incorrectly Set for Takeoff

1987: Northwest Flight 255 (McDonnell Douglas DC-9); Crashed shortly after takeoff at Detroit Metro Airport; 156 fatalities

The U.S. National Transportation Safety Board (NTSB) determines that the probable cause of the accident was:

The flight crew's failure to use the taxi checklist to ensure that the flaps and slats were extended for takeoff. Contributing to the accident was the absence of electrical power to the airplane takeoff warning system, which thus did not warn the flight crew that the airplane was not configured properly for takeoff. The reason for the absence of electrical power could not be determined.

Source: NTSB Aircraft Accident Report: NTSB/AAR-88/05

1988: Delta Flight 1141 (Boeing 727); Crashed shortly after takeoff at Dallas-Fort Worth International Airport; 14 fatalities

The NTSB determines the probable cause of this accident to be:

(1) The captain and first officer's inadequate cockpit discipline, which resulted in the flight crew's attempt to take off without the wing flaps and slats properly configured; and (2) the failure of the takeoff configuration warning system to alert the crew that the airplane was not properly configured for the takeoff.

Source: NTSB Aircraft Accident Report: NTSB/AAR-89/04

2005: Mandala Airlines Flight 091 (Boeing 737); Crashed shortly after takeoff at Polonia International Airport in Medan, Indonesia; 149 fatalities

The National Transportation Safety Committee of Indonesia (NTSC) determines that the probable causes of this accident are:

- The aircraft took off with improper takeoff configuration, namely with retracted flaps and slats, causing the aircraft [to fail] to lift off.
- Improper checklist procedure execution had led to failure to identify the flap in retract position.
- The aircraft's takeoff warning horn was not heard on the … CVR [cockpit voice recorder]. It is possible that the takeoff configuration warning horn was not sounding.

Source: NTSC Aircraft Accident Report: KNKT/05.24/09.01.38

2008: Spanair Flight 5022 (McDonnell Douglas MD-82); Crashed shortly after takeoff at Barajas Airport in Madrid, Spain; 154 fatalities

The Comisión de Investigación de Accidentes e Incidentes de Aviación Civil of Spain (CIAIAC) has determined that the accident occurred because:

- The crew lost control of the aircraft as a result of a stall immediately after takeoff, because they did not have the correct plane configuration for takeoff (by not deploying the flaps and slats, following a series of errors and omissions), coupled with the absence of any warning of the incorrect configuration.
- The crew did not recognize the indications of stall, and did not correct the situation after takeoff, and — by momentarily retarding the engine power and increasing the pitch angle — brought about a deterioration in the flight condition.
- The crew did not detect the configuration error because they did not properly use the checklists to select and check the position of the flaps and slats during flight preparation, specifically:
  - They failed to select the flaps/slats lever during the corresponding step in the "After Start" checklist;
  - They did not cross-check the position of the lever and the state of the flaps/slats indicator lights during the "After Start" checklist;
  - They omitted the flaps/slats check under "Takeoff Briefing" (taxi) checklist; [and]
  - The visual inspection carried out in execution of the "Final Items" step of the "Takeoff Imminent" checklist — no confirmation was made of the position of the flaps and slats, as shown by the cockpit instruments.

The CIAIAC determined the following contributory factors:

- The absence of any warning of the incorrect takeoff configuration because the TOWS [takeoff warning system] did not work. It was not possible to determine conclusively why the TOWS did not work.
- Inadequate crew resource management, which did not prevent the deviation from procedures and omissions in flight preparation.

Source: CIAIAC Aircraft Accident Report: A-032/2008

Table 1

air traffic controllers to add the phrase "check configuration" when the pilots receive their takeoff clearance? I would bet that this simple, additional safety net would have prevented most of the accidents mentioned.

Flight Attendant Awareness

Flight attendant training should include an increased awareness of misconfiguration issues. Because flight attendants still are walking through the aisles during the pre-takeoff cabin check, and the aircraft by this time should have flaps extended for takeoff, they are in an excellent position to detect a misconfiguration. However, it should be made clear to the flight attendants that *not all* aircraft require flaps to be extended for takeoff. Ensure that the information is aircraft-specific.

Focused Flight Crew Training

Although some links in the accident chain can be traced to the organizational level, the responsibility for prevention of these types of accidents still lies squarely on the flight crews, as they are the last line of defense. Thus, an approach consisting of more focused flight crew training and awareness is appropriate. All four accident examples occurred due to deficiencies in human performance — centered primarily on handling interruptions, sterile cockpit procedures and checklist usage — involving unprofessional behavior and lack of discipline.

Some of these deficiencies are *externally propagated*, or beyond the pilot's control, such as interruptions, the effects of which can be addressed with good threat-and-error management skills. Other deficiencies may be *internally propagated*, for example, when crews violate the sterile cockpit rule. In this case, the pilots have full volition, and thus control, of their behaviors. Additional focus should be aimed at these types of internally propagated behaviors.

More Effective Use of Accident Reports

My final recommendation is to enhance learning by making more, and better, use of the rich data available from accident reports. Thematic accidents should receive special attention. This can be accomplished by using relevant case studies and crafting a learning module that not only stimulates the pilots' attention, but also enhances *retention.* I have seen, and heard of, too many CRM courses that simply rehash the Tenerife runway disaster and/or the American Airlines crash near Cali, Colombia.

While in no way diminishing the importance of learning valuable lessons from these accidents, I believe that they have been studied to excess. We need to be more forward-thinking and focus on current accidents whose causes are more elusive. I am confident that CRM and threat-and-error management trainers can craft more effective learning modules that produce better retention and transfer to the real world. I wrote "learning modules" rather than "training modules" because the emphasis is on *learning* from other crews' errors and misfortunes. We are not simply training to prevent accidents; we want to develop better critical thinking and error-avoidance skills.

We are not simply training to prevent accidents; we want to develop better critical thinking and error-avoidance skills.

Robert Baron, Ph.D., is the president and chief consultant of The Aviation Consulting Group. He has assisted a multitude of aviation organizations in the development of their human factors, safety management systems, CRM, and line-oriented safety audit training programs. Baron is also an adjunct assistant professor at Embry-Riddle Aeronautical University and teaches courses on aviation safety and human factors subjects.

The author gratefully acknowledges Kimberly Szathmary for her review and input.

Note

1. Space does not allow for a discussion of the research related to the pre-departure and taxi phases of flight. See, however, the work of R. Key Dismukes and his colleagues at NASA Ames Research Center's Flight Cognition Laboratory, <humansystems.arc.nasa.gov/flightcognition>. Dismukes et al. have conducted extensive studies related to, among others, *checklist usage, interruptions, concurrent task demands*, and *prospective memory*, each being highly relevant to all the accidents presented in this article. An increased understanding of these factors is imperative in preventing further accidents of these types.

Investment by airlines in voluntary structural changes over the past few years has ratcheted up the knowledge, skills and self-confidence of tens of thousands of cabin safety professionals, several airline and regulatory specialists said in April. They told sessions of the World Aviation Training Conference and Tradeshow (WATS 2012) in Orlando, Florida, U.S., that a high priority has been crewmember competence that would last between training events.

The International Civil Aviation Organization (ICAO) has stepped up its involvement in cabin safety issues, compared with recent years, and has a significant amount of relevant guidance material in development, said Martin Maurino, safety and efficiency support officer, ICAO. "Our main focus right now is developing competency-based cabin crew training," he said, briefing WATS 2012 attendees on the latest draft. "Competency refers to a combination of skills, knowledge and attitudes to perform a task according to a standard."

ICAO's current guidance manual — Doc 7192, Part E-1, *Cabin Attendants' Safety Training* — dates from January 1996, he said. "Our overarching initiative will raise awareness internationally about the importance of cabin crew safety training, and then, in the actual material, we want to provide detailed guidance," Maurino said. "We're developing the framework for cabin crew competencies and rewriting this manual to fit that framework. We would like to see [ICAO's] baseline competencies set the bar internationally. We're not going to dictate the aircraft-specific procedures; it will be up to each operator to prove to their civil aviation authority that their crews are competent. … Today's cabin crewmember's role is everyday safety, not just responding when things go horribly wrong. Cabin crews are there to prevent accidents and incidents."

Advanced Qualification

In the United States, the Federal Aviation Administration (FAA) offers airlines the option to voluntarily participate in its advanced qualification program (AQP) for flight attendant training in place of conventional training, said Doug Farrow, FAA AQP program

In scenario-based training to proficiency, airlines burnish flight attendants' skills as risk managers.

GUARANTEED COMPETENCE

BY WAYNE ROSENKRANS | FROM ORLANDO

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manager, and Maria Teresa Cook, in-flight training AQP manager for United Airlines. There are now 45 AQP programs for flight attendants and pilots at about 30 U.S. airlines.

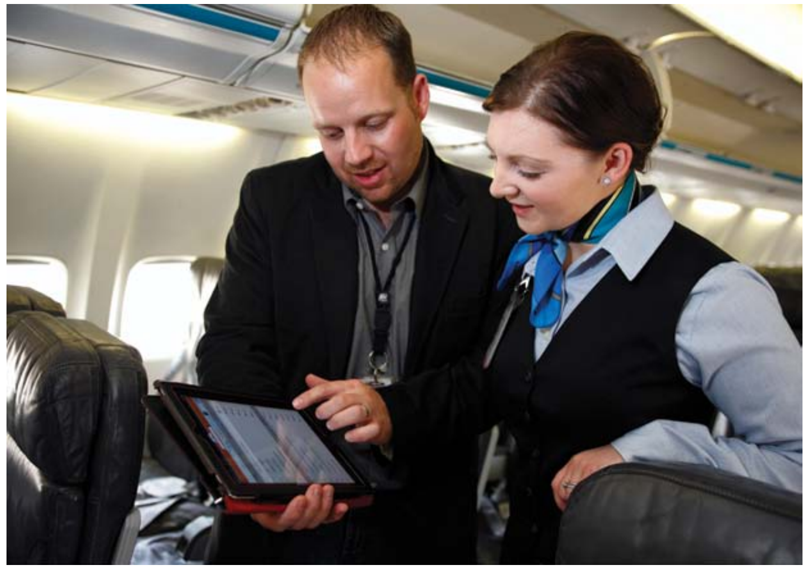
Farrow and Cook cited the United Airlines and Continental Airlines merger. "Subsidiary United flight attendants had to undergo regulatory training prior to being able to serve as crewmembers on the Continental [air operator] certificate," Cook said. "The problem was that traditional regulatory requirements provide little allowance for flight attendants' previous experience." AQP contains provisions for the analysis of entry-level workforce qualifications that consider demographic information, including past experience.

Because these companies had no immediate plans for United flight attendants to begin flying on Continental aircraft, there was "a perfect opportunity to utilize AQP," Cook said. "AQP really allows customization and innovation … training that is particular to the work group and to the needs of workers … already qualified on more than one aircraft type."

AQP quickly has become the "new normal" for both pilots and flight attendants, the FAA's Farrow said. "About 75 percent of [U.S. flight attendants] are either training under AQP now in their recurrent courses or [their airlines] are in the application process and will use AQP training relatively soon," he said. Operational data will tell the FAA if the airlines have targeted the training at the areas of highest risk.

Training Per Audits

Even after exercising great care in designing conventional or AQP-based training, actual line operations periodically reveal performance shortcomings, said Kris Hutchings, manager in-flight safety, WestJet. "In Phase 3 of our SMS in 2007, we developed our cabin operations safety audit program … a proactive way to identify hazards aboard the aircraft and to look for opportunities for continuous improvement," Hutchings said. These audits tie into the quality control elements of operational quality assurance, where the focus is safety processes and procedures rather than individual people, he said.



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WestJets' Kris Hutchings (top, left) and Angeline Ljungberg, auditor in-flight safety, rely on Apple iPad-based software (below) to consistently capture predefined parameters and narrative observations during in-flight audits.

WestJet performs open audits, closed audits and combinations. Transport Canada reviews the audit results to assess the SMS. Details of the process are available to any company crewmember via the airline's website. Results now go to the audited aircraft crew about a week after the audit.

Comparison of audit results with safety reports on issues such as door operating errors, errors in oxygen acceptance and handling of dangerous goods also aid the corrective process, he said. "Audit analysis ties into our fatigue risk management program," Hutchings said. "We had some issues a few years ago with doors being opened in the armed mode [although] we never had an inadvertent slide deployment. … The majority were happening on single-leg days or one-day pairings, which went against everything we had been thinking. Those flight attendants might not be thinking ahead [as they would for a trip with] four or five legs."

One WestJet corrective action plan addressed audit results indicating that galley equipment sometimes was not stowed and secured per procedure when not in use, causing injuries (Table 1, p. 44).

Settling Scores

Emphasis on proving competence during training and maintaining proficiency long after training has made a huge impact on flight operations, said Myrna Andrews, manager in-flight AQP,

Cabin Operations Safety Audit: Securing the Galley

Action	Responsible person	Time for completion
Short-Term Corrective Action Plan		
Increase flight attendants' awareness of why the aircraft galleys must be secured when not in use.		
Action	**Responsible person**	**Time for completion**
Include this topic in the flight attendant briefing sheet on the flight release.	Manager, in-flight operations	30 days
Engage the onboard operations team and onboard training groups through a monthly meeting to generate online awareness.	Manager, onboard operations	30 days
Issue a safety alert to all flight attendants.	Manager, in-flight safety	30 days
Long-Term Corrective Action Plan		
Update the 2012 training program to include a re-education element on the importance of securing the galley.		
Action for this training program	**Responsible person**	**Time for completion**
Add a discussion topic to the third day of the cabin service portion of the program to increase understanding of the term *secure* and the potential consequences of an unsecured galley.	Manager, cabin services	30 days
Include an evacuation drill scenario with an unsecured galley.	Manager, in-flight instructional design	90 days
Supplemental actions		
Research video options to depict incidents involving unsecured galleys for the 2013 training program.	Manager, in-flight instructional design	90 days
Develop a poster campaign to increase issue awareness.	Manager, in-flight safety	60 days
Review and amend, as needed, the flight attendant manual sections related to securing the galley.	Manager, in-flight standards and procedures	90 days
Establish a line check procedure to increase accountability and timely feedback about procedural noncompliance.	Director, in-flight operations	180 days

Note: The audit and follow-up process includes audit-finding forms showing missed elements, root cause analysis (human factors/organizational factors) and a bi-annual check of effectiveness of the corrective action plans.

Source: Adapted from WestJet

Table 1

SkyWest Airlines. Before AQP, the airline was not "really testing the flight attendants' proficiency level, we were testing their ability to mimic. As a ground instructor, [I would ask myself,] 'Why am I showing this person how to do this? I will not be on the aircraft if this person needs to do this.'"

Outdated practices sometimes prove to be detrimental to building real competence, some airlines have concluded. "For the test on every drill, we used to give flight attendants a practice opportunity beforehand," said Megan Hallenberg, manager in-flight curriculum development, SkyWest Airlines. "We would show them how to do it, let them practice and then do the testing. With AQP [today, before a training session begins,] we want flight attendants to come in and demonstrate their proficiency."

The airline's four-point grading scale and associated *reason codes* are essential to data-driven assessment of individuals and programs. "The data help us pinpoint where we need to train," Andrews added. Grading also accommodates threat and error management. "Maybe the flight attendants made some errors, for example, but they corrected these in a timely manner, or they momentarily deviated from the qualification standard, but they came back to the standard," she said. Grading now reflects that their skills were clearly effective.

Previously, any deviation from standard practice, even a small error, forced instructor-evaluators to make trainees repeat the drill or event, Hallenberg said. "Today, if they recover, they pass," she said. "That is a better learning environment for everybody, and it's making flight attendants more proficient overall."

Merging Cabin Expertise

Integrating cabin crewmembers during the merger of Southwest Airlines and AirTran Airways began by placing a conceptual partition between the two groups, then laying requirements for members of both groups to cross it only under specified conditions. In March, the FAA authorized operation of both airlines under the Southwest air operating certificate.

"One of the issues was new aircraft types: The Boeing 737-800 from the Southwest side being introduced in the AirTran fleet and the 717 being introduced across the partition into the Southwest fleet," said Larry Parrigin, manager of curriculum and program development, Southwest Airlines. "Extended overwater flights and international operations were something new for Southwest Airlines."

"The basic operational language also was different … such as *forward entry door* versus

L1 door," said Paul Kirkley, manager in-flight training, AirTran Airways. Some differences thought to be simple, such as different cabin lighting settings, also took unexpected effort to adopt, he said.

Some issues did not become apparent until the merging of flight attendant manuals. "It will take about 2 1/2 years to get everyone moved over from the AirTran side to the Southwest side," Kirkley said. So AirTran gradually has been incorporating Southwest material into its manual revision cycle.

For AirTran flight attendants, "we are reducing our initial training program down to the essentials," Parrigin said. "We are looking at the transition training as an extended recurrent training course for them." Essentially, procedures for in-flight emergency situations such as fire fighting, cabin decompression and turbulence were found to have relatively few differences. "The major differences are in our [normal] daily operational details," he said.

One example of a change with safety implications has been the introduction of cart service aboard Southwest 737-800s, which involves specific risks for the cart-inexperienced Southwest flight attendants and different risks for AirTran flight attendants who have extensive cart experience — but not aboard this aircraft type.

In the merger of US Airways and America West, the US Airways SMS had not been implemented fully when the company followed its processes to mitigate anticipated risks of the changes involved, said Stephen Howell, director in-flight services training, US Airways.

An SMS better enables airlines to make hard choices about jettisoning familiar safety procedures while integrating disparate cabin crews. "Airlines can try to [either subjectively select] or to dig very deeply from a [safety] data perspective to determine which procedures would be most effective, and would be able to help to successfully merge operations," Howell said. "Once we establish which policies and procedures to choose, we have to mitigate the risks associated with them. For example, [proposing] carts on the 737-800 [implies willingness to] mitigate the risks of doing so."

US Airways SMS processes were applied, for example, prior to the decision to introduce a red strap aboard the company's Airbus fleet as a visual deterrent to flight attendants who might inadvertently grab the door control handle instead of the arming lever, which is in close proximity. In 2011, after this initiative was put in place, only one of eight inadvertent slide deployments occurred aboard this Airbus fleet, and that event involved an overwing exit, not a main cabin door.

Grab Your Flashlight

The flexibility of AQP also enhanced safety during the Delta Air Lines–Northwest Airlines merger, said Michelle Farkas, general manager, advanced qualification program, Delta Air Lines. She credits AQP for the new opportunity to divide associated training into separate parts called *integration qualification* and *aircraft qualification.* On May 1, 20,000 flight attendants from both pre-merger airlines were scheduled to begin flying together under one set of work rules.

Techniques to smooth this integration included gap analysis and reverse gap analysis in comparing all cabin safety policies and procedures, and an "adopt-and-go" methodology of choosing, wherever safe and feasible, either an entire Delta procedure or an entire Northwest procedure instead of creating hybrid procedures.

One challenging hybrid procedure emerged from a disconnect between the two flight attendant groups. "The pre-merger Delta philosophy was that, when it is time to conduct an evacuation, [and after activating] the emergency light switch, automatically grab your flashlight," Farkas said. "The pre-merger Northwest philosophy was 'Be situationally aware — that is, if you need the flashlight, grab it and go.'" This difference became apparent in an AQP data analysis showing an unusually large percentage of procedural deviation codes among pre-merger Northwest flight attendants when they performed evacuation drills.

"So things taught in initial training are not so obvious when conducting a merger," Farkas recalled. "During our merger, we were looking at current policies and procedures [focusing on issues such as cabin] door and window operations," she said. During the ensuing debate over flashlights, mini-evacuation demonstrations were conducted on three Northwest aircraft types — before their transfer to the Delta air operating certificate — and the Delta cabin safety specialists noted how retrieving flashlights could consume seconds of the nominal 15-second timeframe to open 50 percent of the floor-level exits and have 50 percent of the exit slides ready for use, especially when deploying the upper deck slide of a 747.

Policy, procedures and training specialists from Delta, the FAA and Northwest concurred on a policy basing flashlight retrieval on situational awareness, but with no one penalized during performance demonstrations either for automatically grabbing the flashlight or for not grabbing the flashlight.

To read an enhanced version of this story, go to <flightsafety.org/aerosafety-world-magazine/may-2012/wats2012-cabin>.

Embracing Skill Enhancement

BY WAYNE ROSENKRANS

ATSAP reports exceed expectations as program refinements overcome FAA managers' initial objections.

By several indications, the Air Traffic Safety Action Program (ATSAP) of the U.S. Federal Aviation Administration's (FAA's) Air Traffic Organization is moving beyond the initial growing pains of this voluntary, non-punitive safety reporting method for air traffic control (ATC). The volume of ATSAP reports already dwarfs that of an older parallel program, and the quality and significance of report content have been praised by independent safety analysts (*ASW,* 3/12, p. 43).

Recent refinements to ATSAP include efforts to improve strained working relationships, particularly around the notion of imposing — in a punitive sense — remedial study and practice for inadvertent noncompliance and operational errors by controllers. Last year, David Conley, president of the FAA Managers Association (FAAMA) and manager of tactical operations, Southwest United States, FAA, told a congressional committee that while FAAMA was "pleased to see this steady report [increase in ATSAP]," some members of the association were struggling with a frustrating adjustment to perceived curbs on their authority to assign skill-enhancement training[1] and were concerned about potentially diminished personal accountability among their employees.[2] "ATSAP is an important change … a work in progress that requires the closest attention from managers across the FAA, as well as the fullest cooperation of our employees and their unions," Conley said.

A new Air Traffic Organization policy order,[3] effective in 2012, now supplements and clarifies the 2008 memorandum of understanding (MOU) between the FAA and the National Air Traffic Controllers Association (NATCA), a document that Conley cited.

"Historically, [ATC] facility management handled performance deficiencies if they were identified through the post-accident or incident investigation of known safety events," Conley said. "If an employee performance deficiency was observed during these investigations, then skill-enhancement [training] could be assigned. … Unfortunately, [reports accepted by ATSAP event review committees (ERCs)] are creating practical barriers for their use in the performance-management process. In some instances, managers find their hands tied with process constraints that prevent them from using their experience and intuition to coach, mentor and train controllers toward correcting deficiencies. Before managers can take action, they are instructed to wait for the recommendations of [an ERC,] whose members are evenly comprised of both labor and management participants."

Several anecdotal examples illustrated what managers considered "barriers" to their long-established methods of risk mitigation. "[FAAMA] received a report in one case where an employee, a new public hire who certified on [the person's first ATC] position after training for several months, was involved in a loss of separation nine days after certifying, and filed an ATSAP report," Conley said. "The manager requested skill-enhancement training immediately after the event to correct the deficiency. Through the ATSAP process, the ERC … did not reach a consensus on what occurred, and the [request for] skill-enhancement training was denied. The employee involved in this safety incident received no training and no corrective action. This should be a concern for each of us."

The latest policy order, however, clarifies what types of safety checks and remedial actions ATC facility managers can initiate while awaiting an ERC's decision about skill-enhancement training, reminding them that no decertification or disciplinary action can be taken for events covered by an ERC-accepted ATSAP report. The facility manager must "conduct performance skills checks or operational skills assessments associated with an event/problem covered by an accepted ATSAP report only when performing a covered event review or when approved or directed by the ERC.

"As appropriate, or at any time at the request of the employee, [managers can] perform a 'safety check' … an undocumented observation period to confirm the employee's self-confidence to provide air traffic services after a safety event. … Management must coordinate with the ATSAP ERC any issues arising during a safety check that would preclude the employee from resuming normal duties."

The policy order also contains clarification about relatively new employees. Regarding employees covered by ATSAP and receiving on-the-job training, the order says, "The protective provisions in the applicable MOU apply to all employees. Employees receiving [on-the-job training] for initial qualification training are required to reach the standards necessary to achieve a position of facility certification, and ATSAP will not interfere in that process."

Uneven Understanding

At the time of the testimony in 2011, FAAMA cited confusion about ATSAP among some managers, and Conley later in the year raised the issue with a safety official at the Air Traffic Organization. "Misperceptions about what is permitted in performance management under ATSAP continue to be prevalent, and we encourage the FAA to step up training for managers in this area," Conley had told the congressional committee. "Poor field training and, in some cases, attitudes have resulted in a victim mentality where some managers yielded all their tools because one effort to address performance became constrained."

'In some cases, attitudes have resulted in a victim mentality.'

© Chris Sorensen Photography

Conley reported on FAA responses to both concerns by the safety official in an interview published by FAAMA.[4] Joseph Texeira, vice president of the Air Traffic Organization's Office of Safety, was quoted as saying that ATSAP ERCs have supported the managers who carefully study safety events; engage with the ATSAP report submitters to assess what occurred and the person's thought processes, skills and knowledge; and effectively articulate their own perspective and recommendations. Texeira also attributed early frustration of managers with ATSAP to the new requirements for them to justify their proposed assignments of skill-enhancement training by identifying the specific skills and knowledge to be covered based on evaluations and specific reasons. The FAA's enhancements to the ongoing education of ATC managers and supervisors about ATSAP will include the top lessons learned in the previous 12 months, he added.

Gaming ATSAP

FAAMA in 2011 also had expressed concern about "the potential erosion of personal accountability if there are not limits on a controller's or a technician's ability to file multiple ATSAP reports without some form of consequence." Conley said, "While we believe the [FAA] is going in the right direction on changing the safety culture, under the ATSAP program, individual controller performance … has become difficult to manage. … As the comfort level with the ATSAP program grows among the controller workforce, it could be used as a way to avoid perceived punitive action as opposed to meeting its goals of pointing out vulnerabilities in the system, followed by appropriate corrective action. … [We have an] unacceptable situation where someone in a facility can report [a] risk that the facility management may never learn about [instead of] turning that data into usable information for field facilities."

The policy order partly addresses these issues by stating that ERCs must take responsibility for determining, on a case-by-case basis, the disposition of "repeated similar instances" of the ATSAP report submitter's noncompliance with ATC directives. The submission of an ATSAP report via the program's website — as required "within 24 hours of the end of the employee's duty day on the day of occurrence or within 24 hours of becoming aware of a possible noncompliance" — exempts the submitter from disciplinary action and certificate action per terms of the MOU, but also involves ongoing cooperation with the ERC's investigation and decision to assign skill-enhancement training.

Facility managers even have been directed to remind employees that they may file ATSAP reports and must provide them time to do so.

Lessons Learned

One indicator of ATSAP progress and benefits is that, since September 2010, NATCA has published the *ATSAP Alert* and *ATSAP Briefing Sheet,* detailing insights and actions to reduce risk in ATC. The publications have addressed conflicting data on flight plans and flight progress strips for reduced vertical separation minimum operations; ATC procedural drift in phraseology for taxi instructions; failures to ensure that pilots have accepted responsibility to "maintain visual separation"; balancing safety with latitude for developmental controllers to gain experience near the completion of their on-the-job training; unfamiliar risks in conducting opposite-direction operations; ATC assistance to airlines investigating non-safety-critical resolution advisories from traffic-alert and collision avoidance systems; adapting to an airline's new climb profiles; avoiding phraseology that could dissuade pilots from voluntary safety reporting; confusing ATC phraseology about "full length" of a runway when thresholds have been displaced by construction activity; loss of separation during interruptions of controllers' logical sequence of tasks; and ATC procedural deviations intended to benefit military flights.

Also, in October 2011, FAAMA signed a consultative relationship agreement with the FAA that facilitates periodic discussion of managers' advice and concerns, such as progress on resolving concerns about ATSAP.

Sometimes overlooked is the specific requirement that, rather than seek to avoid skill-enhancement training, controllers should take advantage of it — an attitude that the FAA's Texeira called "embracing correction." Essentially, ATSAP report submitters forfeit their protection — and their cases may be reopened or referred to the Air Traffic Organization and/or Air Traffic Safety Oversight Service — "if they fail to complete the recommended skill enhancement in a manner satisfactory to all members of the ERC," the MOU says.

Notes

1. The FAA defines *skill enhancement* as "individually focused education and training designed to address an identified qualification issue of an employee in a skill or task."
2. Conley, David S. Written testimony submitted to the House Transportation and Infrastructure Committee, U.S. Congress. Feb. 9, 2011.
3. FAA. Air Traffic Organization Policy Order JO 7200.20, *Voluntary Safety Reporting Programs,* effective Jan. 30, 2012.
4. FAAMA. "David Conley's Conversation With Joseph Texeira." *Managing the Skies,* May–June 2011.

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BY RICK DARBY

Good News About Africa

The African accident rates and numbers were down in 2011.

The View From IATA

The Africa region had considerably fewer accidents in 2011 compared with 2010, and the Commonwealth of Independent States (CIS) had fewer accidents as well. Africa's rate of hull losses was reduced from 7.41 per million flights to 3.27 per million flights in the same period. The data are found in the International Air Transport Association (IATA) *2011 Aviation Safety Performance* report.[1]

For Western-built jets worldwide, the 2011 rate of hull losses per million flights was 0.37 in 2011, compared with 0.61 in 2010[2] (Table 1, p. 50). That represented a year-over-year improvement of 39 percent. Unusually, the hull loss rate was higher for IATA member airlines (0.41 per million flights) than for the industry as a whole (0.37 per million flights) in 2011.

"According to the 2011 industry rate, if you were to take a flight every day, odds are you could go more than 7,000 years without [a hull loss] accident," IATA said in its report.

The Asia-Pacific region in 2011 had its lowest rate for Western-built jet hull losses, 0.25 per million flights, for the seven-year period beginning in 2005. The Europe region's equivalent rate was 0.00 versus 0.45 the previous two years. The North America region held steady at 0.10 in both 2010 and 2011.

Both the IATA member and industry rates for hull loss accidents involving Western-built jets have been on a generally improving trend in the 11-year period 2001–2011, although in each category the rate rose in the middle and late years of the past decade (Figure 1, p. 50).

Considering all aircraft types, Eastern- and Western-built, total accident and fatal accident

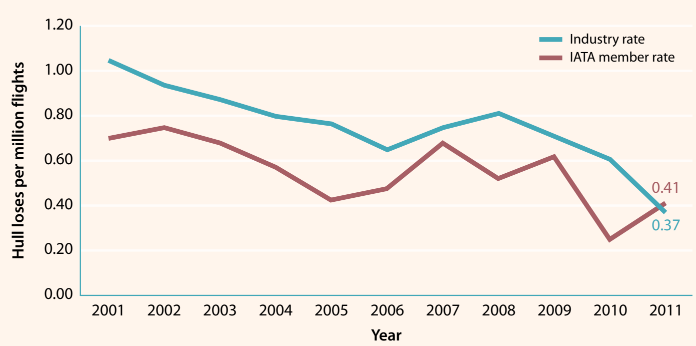
Western-Built Jet Hull Losses per Million Flights, 2005–2011

Region	2005	2006	2007	2008	2009	2010	2011
Africa	9.21	4.31	4.09	2.12	9.94	7.41	3.27
Asia-Pacific	1.00	0.67	2.76	0.58	0.86	0.80	0.25
Commonwealth of Independent States	0.00	8.60	0.00	6.43	0.00	0.00	1.06
Europe	0.33	0.32	0.29	0.42	0.45	0.45	0.00
Latin America and the Caribbean	2.59	1.80	1.61	2.55	0.00	1.87	1.28
Middle East and North Africa	3.84	0.00	1.08	1.89	3.32	0.72	2.02
North America	0.19	0.49	0.09	0.58	0.41	0.10	0.10
North Asia	0.00	0.00	0.88	0.00	0.00	0.34	0.00
Industry	0.77	0.65	0.75	0.81	0.71	0.61	0.37
IATA member airlines	0.43	0.48	0.68	0.52	0.62	0.25	0.41

Source: International Air Transport Association

Table 1

Western-Built Jet Hull Loss Rate per Million Flights, 2001–2011



Source: International Air Transport Association

Figure 1

Accidents, All Aircraft Types, Eastern- and Western-Built

	2010	2011
Total accidents	**94**	**92**
Accidents with IATA members	26	34
Western-built jet hull losses	17	11
Fatal accidents	23	22
Fatalities	786	486

IATA = International Air Transport Association

Source: International Air Transport Association

Table 2

numbers changed little between 2010 and 2011 (Table 2). Fatalities, however, were 38 percent lower in 2011 compared with 2010. In 2011, 24 percent of the total number of accidents were fatal.

Thirty-seven percent of all accidents involved IATA members in 2011, versus 28 percent in 2010. Even so, the IATA member rate for all 2011 accidents, 1.84 per million flights, was better by 23 percent than that for the industry as a whole, 2.40.

Operators that participated in the IATA Operational Safety Audit (IOSA) program, an evaluation of airline operational management and control systems, showed a safety advantage. The IOSA operator total accident rate of 1.73 per million flights was 52 percent better than the 3.8 for non-IOSA operators.

"The total accident rate for African airlines that are on the IOSA registry was almost equivalent to the world average, while the accident rate for airlines that are not on the IOSA registry was more than five times as high," the report says. "The same trend occurred in the CIS, where the accident rate for IOSA-registered airlines was more than five times better than the rate for non-IOSA-registered airlines."

Again looking at total accidents involving Eastern- and Western-built aircraft, Africa showed the greatest improvement year-over-year: 18 accidents in 2010, eight in 2011 (Table 3). While this difference may not be as significant as a longer-term trend would be, a reduction of 10 accidents in the space of a year in one of the world's riskiest areas seems promising.

The Middle East and North Africa region, as well as North America, had fewer accidents in 2011 than the previous year. In the Asia-Pacific, CIS, Europe, and Latin America and Caribbean regions, the accident numbers rose in 2011 from 2010.

"Of the 92 total number of accidents in 2011, 79 [were] passenger flights, 10 cargo flights and three ferry flights," the report says. Jets were involved in 55 accidents, turboprops in 37.

Runway excursions were prominent among accident categories, the report says.

"Runway excursions, in which an aircraft departs a runway during a landing or takeoff, were the most common type of accident in 2011 (18 percent of total accidents)," the report says. "This is slightly reduced from 2010, when runway excursions accounted for 21 percent of the total accidents, reflecting industry efforts to reduce their frequency.[3]

"Despite industry growth, the absolute number of runway excursions decreased from 23 in 2009 to 20 in 2010 and 17 in 2011. Eighty percent of runway excursions occurred during landing. Unstable approaches — situations where the aircraft is too fast, above the glideslope or touches down beyond the desired touchdown point — and contaminated runways are among the most common contributing factors to runway excursions on landing."

Ground damage accidents, such as collisions during taxiing, were 16 percent of the accident total in 2011, an increase from 11 percent in 2010.

FSF Runway Excursion Database Updated

Flight Safety Foundation published a runway excursion database as part of its report, *Reducing the Risk of Runway Excursions: Report of the Runway Safety Initiative*, covering the period from January 1995 through March 2008.[4] The database — created by Safety Management Specialties — has now been updated to the end of 2010.

"Eighteen accidents occurring in the 2008–2010 period were added to the takeoff runway excursions database," the new report from Safety Management Specialists says. "Two additional records from 2007, not previously included, were also added. The takeoff runway excursions database now consists of 130 accident records for the period 1995–2010."

Accidents, All Aircraft Types, Eastern- and Western-Built, by Region

Region	2010	2011
Africa	18	8
Asia-Pacific	12	13
Commonwealth of Independent States	9	13
Europe	12	15
Latin America & The Caribbean	12	15
Middle East & North Africa	10	8
North America	18	17
North Asia	3	3

Source: International Air Transport Association

Table 3

Landing excursions, which — as IATA notes — occur in larger numbers than takeoff excursions, have also been updated. "The landing runway excursions database was supplemented with an additional 86 accident records for the 2008–2010 period, as well as 11 newly identified accidents from 2007," the report says. "This brings the total number of landing runway excursion accident records to 520 for the period 1995 through 2010."

Of the 86 landing runway excursion events over the 2008–2010 period, there were:

- 41 runway overruns and 45 runway veer-offs;
- 12 fatal accidents, resulting in 239 on-board fatalities;
- Nine unstabilized approaches, 27 stabilized approaches, and 50 accidents in which the quality of the approach could not be determined;
- 16 accidents in which conducting a diversion or go-around was appropriate, but apparently not considered;
- Five events in which a diversion or go-around was considered but not conducted;
- 22 accidents involving long landings;
- Five accidents involving landing with excessive speed;
- Nine hard or bounced landings;

'Eighty percent of runway excursions occurred during landing.'

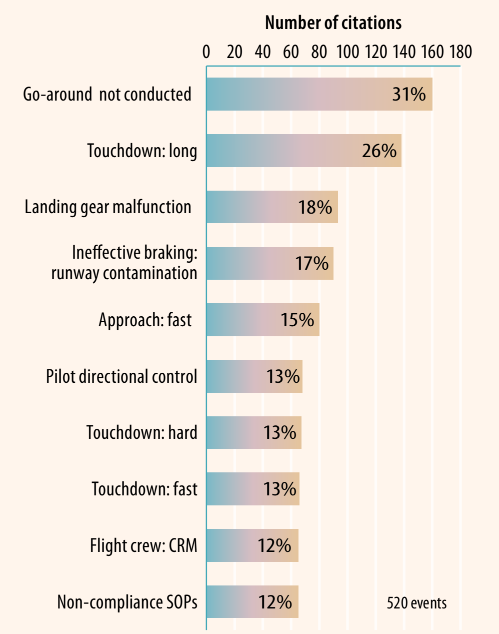
- 14 events involving crosswinds and nine events involving tail winds as relevant factors; and,
- 37 accidents involving wet runways and 15 involving runways contaminated with snow, slush or ice.

The relative contributions of factors involved in landing excursions are consistent in the latest supplement to the database with those in the earlier version, the report says. For the complete 1995–2010 database, "go-around not conducted" and "touchdown: long" were at the top of the list (Figure 2).

There were "very strong associations (greater than 50 percent) with several pairs of factors" in the complete database of landing excursions: "For instance, 'go-around not conducted' is highly correlated with 'unstabilized approach.' This interaction reiterates a common theme accentuating go-arounds as an important mitigator for landing runway excursions. There is also a strong association between 'unstabilized approach" and "touchdown long/fast." This interaction is less incisive, because long, fast landings are inherent elements of an unstabilized approach."

Runway conditions were cited in 79 percent of landing excursions, although (counterintuitively) "wet" and "dry" conditions were cited almost equally, with "dry" conditions a third more common than the combined categories of "slush/snow/ice" and "standing water" (Figure 3).

Landing Excursions, Top Causal and Contributing Factors, 1995–2010

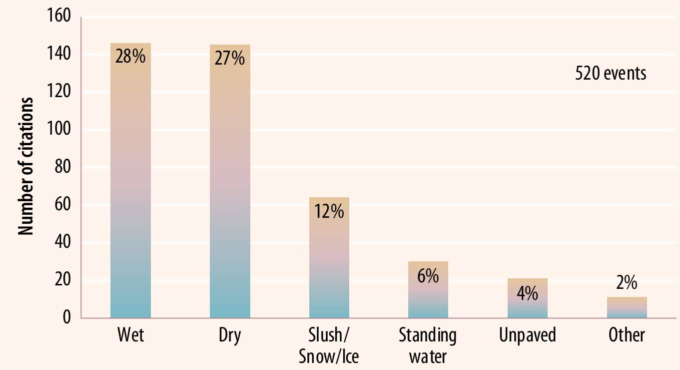


CRM = crew resource management; SOP = standard operating procedures

Source: Flight Safety Foundation and Safety Management Specialties

Figure 2

Landing Excursion Runway Conditions, 1995–2010



Source: Flight Safety Foundation and Safety Management Specialties

Figure 3

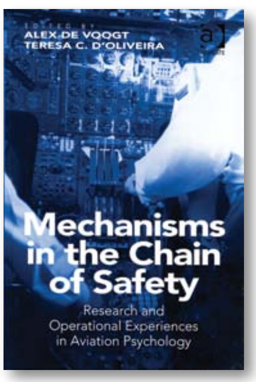
Notes

1. The report is available at <bit.ly/yZXK9Q>.
2. A hull loss is "an accident in which the aircraft is destroyed or substantially damaged and not subsequently repaired for whatever reason, including a financial decision by the owner," the report says. Flight Safety Foundation believes that hull losses are not the best metric for operational safety, being more relevant to insurers' actuarial calculations. The Foundation prefers the term *major accident*, with defined criteria, for the most severe type of aircraft accident.
3. IATA's *Runway Excursion Risk Reduction Toolkit* analyzes runway excursion accident data and recommendations for operators, pilots, airports, air traffic management, air traffic controllers and regulators to address the risk of runway excursions.
4. The report is included in the FSF *Approach and Landing Accident Reduction (ALAR) Tool Kit*.

Chain Reactions

Mechanisms in the 'safety chain' are keys to effectiveness.

BY RICK DARBY



BOOKS

Input, Coping, Control

Mechanisms in the Chain of Safety: Research and Operational Experiences in Aviation Psychology

Alex de Voogt and Teresa D'Olivera, editors. Surrey, England and Burlington, Vermont, U.S.: Ashgate, 2012.180 pp. Figures, tables, references, index.

Aviation psychology has studied three main themes in the past hundred years, says Alex de Voogt in his introduction: personnel selection, or finding people who are the best fit for the industry's tasks; safety, particularly in terms of the pilot's role; and the interaction of people in a team, most notably in crew resource management. Despite the development and application of findings in all these themes, they continue to attract researchers.

"Selection methods are continuously studied, particularly in the area of air traffic control," de Voogt says. "Theories on safety are still evolving, and many aspects of aviation safety are in continuous need of attention. In addition, research on crew resource management is still gaining attention."

The papers in this book involve all three themes, but not as stand-alone topics. "Over time, these studies have been integrated and part of a single focus," de Voogt says.

The themes are organized as what the editors call "mechanisms," processes that determine effectiveness.

Input mechanisms "refer to the beginning of the chain — selection. Pilots or air traffic controllers enter a process of learning and training, assessment and evaluation. Learning processes feed into selection and crew performance."

Chapters in the book related to input mechanisms concern integration of crew resource management studies into pilot training methods; "prospective memory" — the ability to remember and perform tasks when needed without being prompted — in air traffic control; and analysis of individual air traffic controller "learning curves" during on-the-job training.

Coping mechanisms are "a behavioral tool used by pilots and crew to offset or overcome stress and adversity. Research on coping mechanisms has helped to understand pilot error and challenges in crew resource management."

Chapters discuss flight crew "adaptation," the ability to identify the relevant aspects of a new situation and adjust their strategies accordingly; pilot stress sources and coping behaviors; evaluating manual flying skill decay; and "anticipatory processes," the ability to predict how a situation will develop and respond proactively rather than reacting as events unfold.

Control mechanisms "refer to the environment in which people operate, including the organization, the safety systems and the safety climate in which people perform."

Under this heading are chapters about error detection during normal flight operations; the role of the global positioning system in accidents and incidents; a proactive integrated risk assessment technique; and safety reporting systems as a foundation for a safety culture.

De Voogt says, "Three types of mechanisms show the entanglement of selection, safety and crew resource management research. [In the book] research on stress is in the company of studies on flying skill, risk assessment techniques side with a study on safety culture, and studies on selection are joined by a chapter on learning curves."

The following summary of one chapter, necessarily omitting much of the discussion, offers a sample of the book's content.

One coping mechanism is a pilot's ability to revert to manual flying skills in lieu of, or in combination with, automation. Normal flight in modern transport category aircraft is almost exclusively automated except for takeoffs and the last moments before landing. But, as the four authors from Cranfield University in the United Kingdom note, "there are occasions when reversion to basic manual control is essential or preferable. Pilots may be forced to control the aircraft manually during abnormal situations, such as when recovering from unusual attitudes outside the automation's limits of authority or during automation failures."

'Significant control activity may not be reflected in large changes in the aircraft's attitude.'

Licensed pilots must be able to demonstrate their hand flying ability in recurrent training and simulator checks. "However, simulator time is valuable to an airline," the authors say. "There are numerous items in addition to manual flying ability which must be assessed during these brief sessions. … Consequently, the amount of time dedicated to manual handling may be minimal."

Of course, flight data recorders and analysis reveal how much the flight deviated from procedures and parameters such as tracking the glideslope and localizer of an instrument landing system (ILS). Shouldn't that make it easy to evaluate the flying pilot's manual flying skill? No, the authors say, because the control of an aircraft is "hierarchical." That is, the flight path cannot be *directly* controlled; it can only be controlled by "lower-order surrogates." For example, altitude can be controlled via elevator input, heading through aileron and rudder input, the authors say.

It is easy to measure the end product of the pilot's inputs — the aircraft's flight path — which is what ultimately matters. However, the authors say, it is crudely correlated with pilot hand flying skill.

"Unfortunately, in a large conventional transport aircraft, the relationship between control input, aircraft attitude and flight path variation is mediated by factors such as inertia, control power and the relatively high stability of the machine," the authors say. "Unlike [in] smaller aircraft, there is often a significant delay between control input and the larger aircraft's response. Consequently, further control inputs after the initial input may serve to cancel it out or reinforce the initial input before it has taken effect.

"As a result, significant control activity may not be reflected in large changes in the aircraft's attitude, and less so in its flight path. … Consequently, two pilots may describe similar flight paths but control the aircraft in a very different manner. It is, therefore, unlikely that basic flight path measures alone will have the sensitivity required to investigate fine variations in manual flying skills."

As a better alternative, they suggest directly measuring the pilot's control inputs in large aircraft through a process called "frequency-based measures." They cite a study of 12 trainee pilots undergoing a 40-hour jet orientation course on the Boeing 737NG: "The results showed that variation in the flight path was reduced as the cadet pilots progressed through the course. However, at the later stages of the course, the control strategy changed and was characterized by more frequent but smaller-amplitude control inputs."

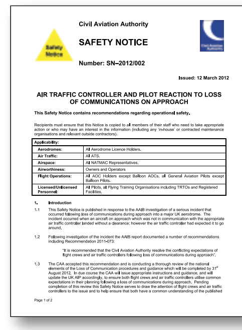
In another study, of pilot deviations from the optimum flight path while flying an ILS approach, the deviations in the flight path were minor — even in asymmetric thrust conditions. But when the control inputs were measured, "it was revealed that very different control strategies were employed between the symmetric and the asymmetric approaches. … The significant differences in the pilots' performance could only be determined by the manner in which they controlled the aircraft and not from simply investigating the relatively coarse, flight path–derived measures."

Concerns are often expressed about pilots of large transport category airplanes losing their "edge" in manual flying because they do so little of it. (The authors say that this depends somewhat on the carrier, its equipment, its routes and its operational principles: "Two of the most prominent low-cost carriers in the U.K. have distinct operational philosophies, one encouraging routine manual flight over use of the [automation] and the other the exact opposite.")

In a study involving 66 professional airline pilots, "[researchers] examined the relationship between pilots' manual handling performance and their recent flying experience, using both traditional flight path tracking measures and frequency-based control strategy measures." The study identified "significant" relationships between recent flying experience and manual control strategy.

"The results showed that flight path–derived measures were again relatively insensitive to the amount of recent flying undertaken by the pilots," the authors say. "In the ILS segment of flight, only the glideslope standard deviation of error showed any significant correlation with recent manual flying experience … . However, the inner-loop parameters [those involving "pre-programmed" behavior independent of feedback from, for example, instruments and the outside view] proved to be much more sensitive to recent flight experience, with several frequency-based measures showing a significant association. During the straight-and-level and ILS flight segments, the analyses demonstrated that pilots who had flown more sectors in the previous week tended to use lower-frequency control inputs in pitch and exhibited a narrower spread of pitch input frequencies to the control system." In other words, they got the job done with less effort. Presumably, that would also allow them to concentrate more attention on situational awareness.

REGULATORY GUIDANCE



Civil Aviation Authority

SAFETY NOTICE

Number: SN–2012/002

Issued: 12 March 2012

AIR TRAFFIC CONTROLLER AND PILOT REACTION TO LOSS OF COMMUNICATIONS ON APPROACH

This Safety Notice contains recommendations regarding operational safety.

Recipients must ensure that this Notice is copied to all members of their staff who need to take appropriate action or who may have an interest in the information (including any 'in-house' or contracted maintenance organisations and relevant outside contractors).

Applicability:	
Aerodromes:	All Aerodrome Licence Holders.
Air Traffic:	All ATS.
Airspace:	All NATMAC Representatives.
Airworthiness:	Owners and Operators
Flight Operations:	All AOC Holders except Balloon AOCs, all General Aviation Pilots except Balloon Pilots.
Licensed/Unlicensed Personnel:	All Pilots, all Flying Training Organisations including TRTOs and Registered Facilities.

1. Introduction

1.1 This Safety Notice is published in response to the AAIB investigation of a serious incident that occurred following loss of communications during approach into a major UK aerodrome. The incident occurred when an aircraft on approach which was not in communication with the appropriate air traffic controller landed without a clearance; however the air traffic controller had expected it to go around.

1.2 Following investigation of the incident the AAIB report documented a number of recommendations including Recommendation 2011-073:

"It is recommended that the Civil Aviation Authority resolve the conflicting expectations of flight crews and air traffic controllers following loss of communications during approach".

1.3 The CAA accepted this recommendation and is conducting a thorough review of the national elements of the Loss of Communication procedures and guidance which will be completed by 31st August 2012. In due course the CAA will issue appropriate instructions and guidance, and will update the UK AIP accordingly, to ensure both flight crews and air traffic controllers utilise common expectations in their planning following a loss of communications during approach. Pending completion of this review this Safety Notice serves to draw the attention of flight crews and air traffic controllers to the issue and to help ensure that both have a common understanding of the published

Page 1 of 2

Failure to Communicate

Air Traffic Controller and Pilot Reaction to Loss of Communications on Approach

U.K. Civil Aviation Authority (CAA) Safety Notice SN-2012/002. March 12, 2012.

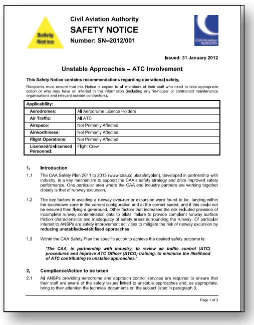
Following the investigation of an incident when an approaching aircraft was not in communication with the appropriate controller and landed without a clearance — the controller had expected a go-around — the U.K. Air Accidents Investigation Branch recommended that the CAA "resolve the conflicting expectations of flight crews and air traffic controllers following loss of communication during approach."

A full review is pending, but this notice "serves to draw the attention of flight crews and air traffic controllers to the issue and to help ensure that both have a common understanding of the published procedures." While the rules cited in the notice apply only in the United Kingdom, the suggestions may be of interest to pilots and controllers generally.

"Loss of communication on approach presents a complex challenge, and air traffic controllers must be acutely alert to the possibility that the aircraft may either land without a landing clearance or go around," the notice says. "Controllers should use all tools at their disposal to contribute to their situational awareness and should continue to make 'blind' transmissions to the subject aircraft, as it may have experienced only partial communications failure, and such transmissions can assist that crew's situational awareness. Transmitting blind should also help alert other pilots to the situation."

In the cockpit, flight crews "should note that air traffic control might not be aware of the loss of communications, so [they] should *not* anticipate that appropriate measures to facilitate a landing have been implemented. Therefore, flight crews should be alert to the possibility that vehicles, personnel and/or other traffic may be occupying or entering the runway."

Unstable Relationships



Civil Aviation Authority
SAFETY NOTICE
Number: SN–2012/001

Issued: 31 January 2012

Unstable Approaches – ATC Involvement

This Safety Notice contains recommendations regarding operational safety.

Recipients must ensure that this Notice is copied to all members of their staff who need to take appropriate action or who may have an interest in the information (including any 'in-house' or contracted maintenance organisations and relevant outside contractors).

Applicability:	
Aerodromes:	All Aerodrome Licence Holders
Air Traffic:	All ATC
Airspace:	Not Primarily Affected
Airworthiness:	Not Primarily Affected
Flight Operations:	Not Primarily Affected
Licensed/Unlicensed Personnel:	Flight Crew

1. Introduction

1.1 The CAA Safety Plan 2011 to 2013 (www.caa.co.uk/safetyplan), developed in partnership with industry, is a key mechanism to support the CAA's safety strategy and drive improved safety performance. One particular area where the CAA and industry partners are working together closely is that of runway excursion.

1.2 The key factors in avoiding a runway over-run or excursion were found to be landing within the touchdown zone in the correct configuration and at the correct speed, and if this could not be ensured then flying a go-around. Other factors that increased the risk included provision of incomplete runway contamination data to pilots, failure to provide compliant runway surface friction characteristics and inadequacy of safety areas surrounding the runway. Of particular interest to ANSPs are safety improvement activities to mitigate the risk of runway excursion by **reducing unstable/de-stabilised approaches.**

1.3 Within the CAA Safety Plan the specific action to achieve the desired safety outcome is:

'The CAA, in partnership with industry, to review air traffic control (ATC) procedures and improve ATC Officer (ATCO) training, to minimise the likelihood of ATC contributing to unstable approaches.'

2. Compliance/Action to be taken

2.1 All ANSPs providing aerodrome and approach control services are required to ensure that their staff are aware of the safety issues linked to unstable approaches and, as appropriate, bring to their attention the technical documents on the subject listed in paragraph 3.

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Unstable Approaches — ATC Involvement

U.K. Civil Aviation Authority (CAA) Safety Notice SN-2012/001. Jan. 31, 2012.

The CAA and industry partners are working together closely on preventing runway excursions, the notice says.

"The key factors in avoiding a runway overrun or excursion were found to be landing within the touchdown zone in the correct configuration and at the correct speed, and if this could not be ensured, then flying a go-around," the notice says. "Other factors that increased the risk included provision of incomplete runway contamination data to pilots, failure to provide compliant runway surface friction characteristics and inadequacy of safety areas surrounding the runway. Of particular interest to ANSPs [air navigation service providers] are safety improvement activities to mitigate the risk of runway excursion *by reducing unstable/de-stabilized approaches*."

Elaborating on that theme, the notice continues:

"Modern turbojet and turboprop aircraft are designed to have highly efficient, low-drag aerodynamic characteristics. This helps reduce fuel consumption but does result in such aircraft needing longer distances for descent and deceleration. Aircraft in flight, particularly large aircraft, possess a great deal of energy that must be dissipated appropriately during descent, landing and rollout. Aircraft must meet certain criteria on approach to be able to land safely, and managing an aircraft during the descent and approach phases essentially becomes a task of energy management. Landing long or landing at excessive speeds can result in an overrun, and excessive sink rates or failure to capture the correct vertical profile can contribute to hard landings or controlled flight into terrain. In a destabilized approach, the rapidly changing and abnormal condition of the aircraft may lead to loss of control."

A stable approach can become unstabilized by inappropriate controller actions such as:

- "Distance (time) provision where insufficient track miles are provided for the flight crew to achieve the correct vertical profile and/or aircraft energy during descent;
- "Changes of runway [that] can increase flight deck workload and can significantly affect track mileage to touchdown and may not allow sufficient time for the crew to re-plan the approach;
- "Changes in the type of approach, particularly from precision to nonprecision [that] can affect the planned descent profile. Typically a nonprecision approach requires the aircraft to be stabilized in the landing configuration by the final approach fix. It also requires more preparation and planning by the crew;
- "Vectoring that does not allow the correct descent profile to be flown in relation to the instrument landing system (ILS), and vectoring which causes the aircraft to intercept the glide path before the localizer. Most aircraft will not lock into the glide path in this condition, causing the aircraft to 'fly through' the glide path;
- "Incorrect track distance to touchdown, resulting in flight crew being unable to calculate their descent and speed profile; [and,]
- "Inappropriate use of speed control which adversely affects the crew's capability to manage the aircraft's energy and its descent profile."

Out of the Loop

Controller was unable to communicate with pilots on a collision course.

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

Faulty Frequency Changes

Airbus A319, Boeing 747. No damage. No injuries.

The flight crew of the A319, which was approaching Anchorage, Alaska, U.S., from the north, did not establish radio communication with the airport traffic (tower) controller when instructed to do so by the approach controller. The flight crew of the 747, taking off to the west, changed to the departure control radio frequency without having been instructed to do so by the tower controller. Thus, when the A319 initiated a go-around and turned into the path of the 747, the tower controller was unable to communicate with either crew.

Air traffic control radar data showed that the airplanes came within 100 ft vertically and one-third of a mile (a half kilometer) laterally, said the report by the U.S. National Transportation Safety Board (NTSB).

The near-midair collision occurred at Ted Stevens International Airport at 0010 local time on May 21, 2010. Visual meteorological conditions (VMC) prevailed, with surface winds from 290 degrees at 6 kt, 10 mi (16 km) visibility and a few clouds at 2,500 ft.

The airport has three runways. Runway 07R/25L was closed for construction, and Runway 25R and Runway 14 were in use. The runways intersect near the end of Runway 25R and at the extreme end of Runway 14 (which has since been redesignated as Runway 15).

The A319, with 133 passengers and five crewmembers aboard, was on a visual approach to Runway 14, and the 747, with two pilots aboard, was departing from Runway 25R for a cargo flight.

The A319 was about 5 nm (9 km) from the runway threshold when the tower controller cleared the 747 crew for takeoff. The tower controller then prompted the approach controller to instruct the A319 crew to change from the approach control radio frequency to the tower frequency. The Airbus was 2 nm (4 km) out when the approach controller issued that instruction. "The A319 acknowledged the instruction but did not contact the tower," the report said. "The tower controller made several attempts to establish communications with the A319 without success."

The Airbus was at 600 ft and about 1 nm (2 km) from the threshold of Runway 14 when the crew told the approach controller that they had encountered a tail wind and were conducting a missed approach. The approach controller told them to fly a heading of 190 degrees and to maintain 2,000 ft.

"Immediately after the A319 began the missed approach, the tower called approach control and asked if he was talking to the A319," the report said. "The approach controller advised the tower controller that the A319 reported a 'wind shear' and was going around. The tower controller asked the approach controller to put the A319 on a heading of 160 [degrees] due to the 747 departing Runway 25R. The approach controller responded that he was going to turn the A319 'all the way to the right.'"

The approach controller had misunderstood the tower controller's request to issue a heading of 160 degrees to the A319 crew; he believed the tower controller was going to turn the 747 to that heading. As a result, the approach controller told the A319 crew to turn right to a heading of 300 degrees and advised them that a 747 was departing from Runway 25R and would be turning southbound. The crew acknowledged the heading assignment and said that they did not have the 747 in sight. The 747 crew actually was maintaining the runway heading, 250 degrees.

The approach controller also believed that the A319 would be able to complete the turn while remaining north of Runway 25R. However, the controller had "failed to account for the aircraft's groundspeed," which was 180 kt, the report said. "The above-average approach speed of the A319 resulted in the airplane overflying Runway 25R instead of turning inside the runway."

The airplanes flew parallel courses momentarily before their flight paths converged.

The airplanes flew parallel courses momentarily before their flight paths converged. The report noted that the A319 crew received a traffic-alert and collision avoidance system (TCAS) resolution advisory to descend but did not state how the crew responded to the advisory.

The tower controller had recognized the developing conflict and had radioed the 747 crew to turn left to a heading of 190 degrees. He repeated the instruction twice, but there was no response because the 747 crew was no longer on his radio frequency. "At the time of the event, the [tower] controller was not able to communicate with the A319 or the 747," the report said.

Pilot Exercises 'Wrong Motor Skill'

Airbus A300. No damage. No injuries.

Preparations for a flight from London Gatwick Airport to Crete with 335 passengers and 12 crewmembers on July 26, 2011, proceeded normally until the copilot moved the slats/flaps lever from the 0/0 position to 15/15 after the engines were started. The electronic centralized aircraft monitor generated a slat fault message, and the flight crew tried unsuccessfully to reset the system according to the quick reference handbook (QRH) procedure, said the report by the U.K. Air Accidents Investigation Branch (AAIB).

The crew then radioed company engineers, who advised that several reset attempts likely would be required to clear the slat fault. "This process involved tripping and resetting the relevant circuit breakers and then moving the slats/flaps lever to check if the slats operated," the report said. With the commander operating the circuit breakers and the copilot moving the slats/flaps lever, the fault eventually cleared.

The report said that the copilot had "developed and exercised a new motor skill" when he cycled the slats/flaps lever between 0/0 and 15/15, bypassing the 15/0 position, six times before the fault cleared. Normally during takeoff, the lever is moved from 15/15 to 15/0, then to 0/0 after airspeed increases.

Before departure, "the pilots discussed the possibility of the fault recurring on takeoff and reviewed the appropriate procedure, the first item of which was to cycle the slats/flaps lever," the report said.

Shortly after the A300 lifted off the runway, the copilot called, "Positive climb," and the commander, the pilot flying, replied, "Gear up." The copilot responded by moving the slats/flaps lever from 15/15 to 0/0.

"The distraction of the slat problem and the preoccupation with the possibility of a slat malfunction on departure had mentally predisposed him to exercise the wrong motor skill and to retract the slats and flaps despite his intention to operate the landing gear lever," the report said.

The commander did not immediately detect the copilot's mistake. He saw unexpected airspeed indications and confirmed that the appropriate pitch attitude and power settings for takeoff were being maintained. Then he noticed that the landing gear handle was still in the "DOWN" position and repeated the "gear up" call.

"The copilot informed the commander that he had inadvertently retracted the slats and then selected the landing gear lever up," the report said. "The stall warning system activated twice during the following 10 seconds [as the aircraft accelerated to the normal climb speed], and on both occasions the commander reduced the aircraft pitch attitude in response to the warning. The aircraft maintained a positive rate of climb throughout."

Angle-of-attack had increased from 5.6 degrees to about 8.0 degrees when the slats and flaps were inadvertently retracted, and airspeed had decreased from 176 kt to 166 kt before increasing again. "The aircraft accelerated to the normal climb speed, and the flight proceeded without further incident," the report said.

Heat Destroys Engine Nacelle

Boeing 777-200. Substantial damage. No injuries.

While departing from Singapore with 202 passengers and 12 crewmembers for a flight to London the afternoon of June 14, 2010, the flight crew received several engine indicating and crew alerting system (EICAS) messages about limited N_1 (fan speed) and the abnormal thrust being produced by the right engine.

"During the climb, the crew interrogated the system and established that the event had been transient," the AAIB report said. "The crew elected to continue en route while evaluating the situation. Possible causes [of the transient event] were considered to be a bird strike, fan damage, spurious indications or a failure within the EEC [electronic engine control] or associated systems."

Initially, the only unusual indications were that right-engine N_1 was 3.5 percent higher than left-engine N_1, while compressor speed, fuel flow and exhaust gas temperature were lower. Vibration levels were normal.

About four hours into the flight, the EICAS indicated that the right EEC had changed from the normal mode to the alternate mode. "This was not a cause for alarm for the crew, as they had suspected EEC issues," the report said. Per the QRH, the crew switched the left EEC to the alternate mode, also.

As the flight progressed, the crew determined that the thrust settings and fuel flows were higher than expected for cruise, and they planned diversions to alternate airports if the 777 could not be landed at Heathrow with the required reserves.

Nearly nine hours into the flight, "the relief crew heard a 'thud' and felt a slight movement of the aircraft," the report said. "They then noticed that the required thrust setting and fuel flow had reduced, and that the fuel state, although not showing insufficient for London, had stopped deteriorating."

An exterior panel had come loose, creating drag for several hours before detaching.

The noise also had awakened the commander from his rest. He initially believed the noise had been produced by a compressor stall, but the absence of further noises or abnormal engine indications and the reduction in the required thrust setting and fuel flow suggested that an exterior panel had come loose, creating drag for several hours before detaching.

The crew declared an urgency, diverted to Amsterdam, Netherlands, and landed the 777 without further incident. A visual inspection of the aircraft showed that "the right aft inner nacelle was severely damaged and largely missing, with further minor airframe damage," the report said, noting that some nacelle debris had been found on the runway at Singapore.

"Examination indicated that the nacelle damage was due to thermal disbond originating from the HP3 duct area," the report said. "There have been a number of separate but similar events in other airlines, and the airframe manufacturer has issued a series of service bulletins to reduce the rate of occurrence."

High Fuel Flow Traced to Spoilers

Airbus A380. No damage. No injuries.

The A380 was en route from Singapore to Melbourne, Australia, the morning of May 16, 2011, when the flight crew noticed that fuel consumption was about 600 kg (1,323 lb) per hour higher than planned. "The crew considered a possible fuel leak, but a high fuel flow was deemed the most likely reason," said the report by the Australian Transport Safety Bureau.

The discrepancy built to approximately 3,800 kg (8,378 lb) over six hours, and the crew decided to divert to Adelaide because of possible delays at Melbourne, where the runways were undergoing maintenance. The A380 was landed without further incident, and "a subsequent inspection of the aircraft found no evidence of fuel system leaks or any engine anomalies that would account for excessive fuel use," the report said. "The aircraft was released back into service without any component replacement or system upgrades. None of the subsequent flights presented fuel discrepancies of note."

'All of the aircraft's flight spoilers were deflected slightly into the airstream.'

Further analysis of recorded data by Airbus and by the airline that operated the aircraft showed that the speed brake (spoiler) lever had been set to an angle of 3.6 degrees for more than four hours during the incident flight. "As a result, all of the aircraft's flight spoilers were deflected slightly into the airstream, creating additional drag and increasing the fuel burn during the flight," the report said.

A crew advisory normally is generated when the speed brake lever is set to an angle of 5.0 degrees. "To reduce the likelihood of a reoccurrence of the event, Airbus plans to reduce the alerting position of the speed brake lever angle from 5.0 degrees to 2.4 degrees," the report said.

Gear Handle Not Full Down

Gulfstream 200. Minor damage. No injuries.

The flight crew received indications that the landing gear was extended but not locked during a visual approach to Westchester County (New York, U.S.) Airport the morning of May 27, 2011. "Sounds associated with landing gear transit were heard; however, the landing gear cockpit indications displayed three red lights," the NTSB report said.

The crew conducted a go-around and entered a holding pattern to perform the appropriate checklist procedure. However, before they completed the procedure, which calls, in part, for the landing gear to be cycled, a right hydraulic system overheat warning was generated by the EICAS. The crew then completed the appropriate checklist procedure for the hydraulic system malfunction and returned to the landing gear malfunction checklist. They were unable to cycle the landing gear, however, because pressure in the right hydraulic system, which powers the gear, had fallen from the normal 3,000 psi to 1,500 psi.

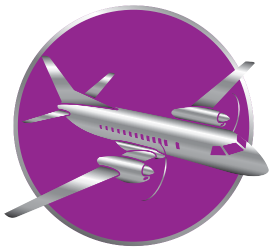
"The flight crew subsequently performed the emergency gear extension checklist items and utilized the emergency gear blow-down bottle," the report said. "The resultant cockpit indications were nose gear green, but the right and left main landing gear remained red." The airplane was flown past the airport traffic control tower, and controllers told the crew that all three landing gear appeared to be extended.

Nevertheless, the crew declared an emergency and diverted the flight to Stewart International Airport in Newburgh, New York, which has a longer runway. The right main landing gear collapsed shortly after touchdown, and "the airplane then settled on its right wing and slid to a stop on the runway," the report said. The pilots and their passenger were not hurt.

"During postaccident examination of the airplane, the landing gear selector handle was found 1/8 to 1/4 in [3 to 6 mm] from the full-down position," the report said. "Subsequent ground testing revealed that when the landing gear selector handle was positioned full-up, followed by full-down, the landing gear cycled successfully, indicating that if the flight crew had placed the handle in the full-down position, the landing gear would likely have operated normally."

With the landing gear extended but not locked, a hydraulic bypass had occurred, resulting in the increased hydraulic fluid temperature and decreased pressure. "The hydraulic bypass was most likely the reason that the landing gear did not lock when the emergency gear extension procedure (blow down) was followed," the report said, noting that the manufacturer subsequently modified the "Emergency Landing Gear Extension" checklist to include procedures for a situation in which the gear does not extend and lock after a blow-down.

TURBOPROPS



Broken Bracket Jams Elevator

ATR 72. Minor damage. No injuries.

The airplane was en route to Dallas–Fort Worth (Texas, U.S.) International Airport with 41 passengers and four crewmembers the night of Dec. 25, 2009, when the flight crew received a pitch mistrim caution message. "In accordance with checklist procedures, they disconnected the autopilot and discovered that fore and aft movement of both control columns was stiff," said the NTSB report, issued in March 2012. "They could move the elevator controls a maximum of 1 in [3 cm] pitch-up and pitch-down."

The pilots completed the "Jammed Elevator" checklist twice, without success. "While coordinating with their company's maintenance operational control, they slowed the airplane to 180 kt and found that they had regained increased control of the elevator," the report said.

However, elevator control again felt stiff when the crew configured the ATR 72 for landing. They declared an emergency and conducted a go-around. "During the second landing attempt, the flight crew still had both control columns partially jammed," the report said. "They performed a shallow approach to a smooth landing."

Examination of the airplane revealed that the elevator had been partially jammed by down-limit-stop L-brackets that had fractured and separated from their hinge fittings. "The fractures were consistent with fatigue failure and were caused by a combination of improperly installed shim stacks, poor alignment of the L-brackets and cyclic stresses acting on the lower stop, which were generated by the repeated improper use of the gust lock system," the report said.

The gust lock must be engaged when the airplane is parked or is being taxied. However, recorded flight data showed numerous instances in which the gust lock had not been engaged after landing. "Therefore, the elevators were allowed to slam against the lower stops," the report said.

'Sleet Storm' Douses Engines

Britten-Norman Turbine Islander. No damage. No injuries.

The pilot was conducting his fifth "lift," with eight skydivers aboard, at Swansea (Wales, U.K.) Airport the morning of Aug. 27, 2011. "The weather conditions had been similar throughout the previous lifts, with about four oktas of cloud cover, the cloud being organized in lines, with clear air in between," the AAIB report said.

The climb was conducted in clear air to about 8,000 ft, and the pilot began a wide turn to position the Islander over the airport for the parachute drop. During the turn, the aircraft entered the side of a cloud, where outside air temperature was 0 degrees C. "The pilot reached down to select the engine anti-ice 'ON,'" the report said. "Before he could do so, the aircraft was enveloped in what the pilot described as a 'sleet storm.'"

Both engines ingested ice and flamed out. The pilot established the aircraft in a glide at 120 kt and completed the turn toward the airport. "The aircraft descended out of the cloud at about [7,000 ft], and the pilot selected the igniters 'ON' and the power levers to idle. Both engines relit immediately." The pilot landed the Islander without further incident.

"This incident illustrates the speed with which such a power loss can occur and that it can be total if power plant anti-icing is not selected 'ON' before such icing conditions are entered," the report said.

Frozen Flight Controls

Piaggio P180 Avanti. No damage. No injuries.

After about 1.5 hours in cruise at 26,000 ft the morning of Dec. 13, 2010, the flight crew began a descent to their destination, Port Columbus (Ohio, U.S.) International Airport, where the surface temperature was minus 9 degrees C (16 degrees F). At about 15,000 ft, the yaw damper automatically disengaged, but the autopilot remained engaged.

"The captain instructed the first officer, who was the pilot flying, to check the freedom of the flight controls," the NTSB report said. "The first officer found the ailerons, elevator and rudder to be 'frozen' in place."

Both pilots exerted pressure on the controls until they "broke free with a 'snap,'" the report said. "The flight controls remained 'stiff and sticky' for the remainder of the flight. … On the ground, the flight controls and the nosewheel steering became inoperative. The flight crew used differential power and braking to taxi to the ramp."

Maintenance technicians found a buildup of ice in the belly of the fuselage and around the primary flight control cables and pulleys in that area.

The U.S. Federal Aviation Administration subsequently issued emergency airworthiness directive 2011-01-53, advising Avanti owners of three incidents of P180 flight control restrictions due to ice formation and requiring functional checks of fuselage drain holes.

PISTON AIRPLANES

CFIT in Deteriorating Weather

Piper Chieftain. Destroyed. Two fatalities.

The airplane departed from Goose Bay, Newfoundland and Labrador, Canada, the morning of May 26, 2010, to deliver a passenger and cargo to Cartwright. Rather than choosing an alternate route, the pilot flew a direct course to Cartwright, which took the Chieftain over mountainous terrain where marginal VMC prevailed, said the report by the Transportation Safety Board of Canada. The aircraft operator was certified to conduct charter flights only under day visual flight rules.

The last radio transmission from the pilot was a position report 60 nm (111 km) west of Cartwright at 0905 local time. A search was launched about an hour later, but it was hampered by adverse weather and the absence of an emergency locator transmitter signal, the report said.

The wreckage was found two days later about 100 ft below the crest of a 3,600-ft, snow-covered mountain. "The aircraft initially struck the ground … in a wings-level, horizontal attitude," the report said, noting that there was no sign of a pre-impact malfunction. The accident was classified as controlled flight into terrain (CFIT).

Control Lost During Autopilot Test

Cessna 310R. Destroyed. One fatality.

Following the installation of electronic flight instrument systems and a new autopilot in the airplane, functional check flights revealed a pitch divergence (porpoise) when the autopilot was engaged. After troubleshooting again was performed by avionics technicians the morning of March 11, 2011, the commercial pilot departed from Smyrna, Tennessee, U.S., for another check flight.

"Shortly after departure, the airplane entered a rapid, full-power, near-vertical descent from 2,700 ft above ground level to ground impact," the NTSB report said. The elevator trim actuator was found in the full-nose-down position.

The report said that a factor in the accident was "the pilot's decision to perform a test flight on a system for which he lacked a complete working knowledge."

A technician who had participated in a previous check flight said that the pilot had exerted back pressure on the control wheel with the autopilot engaged, inadvertently causing the autopilot to trim the elevator full-nose-down. The pilot responded by switching off the autopilot and trim master switches, "then attempting to trim the airplane with the electric trim that he had just disabled."

"According to the technician, the pilot yelled at him to turn the [autopilot] system off, and the technician responded that it was off," the report said. The pilot then used the manual trim system to alleviate the control forces.

"After the flight, I told [the pilot] he needed to go back and get in the books and learn to operate the system," the technician said. "He seemed very disoriented with the new technology."

The pilot conducted the subsequent check flight alone. "Based on the available evidence, it is likely that after autopilot engagement, the airplane pitched down [and] the pilot pulled back on the yoke in an effort to arrest the airplane's descent," the report said. "As a result, the autopilot would have commanded the trim further toward the nose-down position. Such a scenario would require a greater and ever-increasing physical effort by the pilot to overcome the growing aerodynamic force that would result from the nose-down pitch and increasing speed of the airplane.

"The pilot may have removed one hand from the yoke to again reach for the panel-mounted trim and/or autopilot master switches. … He may have lost his single-handed grip on the control yoke, and the airplane descended in an unrecoverable nose-down attitude."

Hydraulic Leak Disables Gear

Piper Chieftain. Substantial damage. No injuries.

During final approach to Providenciales Airport in the Turks and Caicos Islands the night of April 2, 2011, the pilot received an indication that the landing gear was not extended and locked. He flew by the airport traffic control tower, and a controller reported that the gear appeared to be only partially extended, the AAIB report said.

The pilot entered a holding pattern and attempted unsuccessfully to manually extend the landing gear. He then was instructed by the controller to divert to JAGS McCartney Airport on Grand Turk, "to avoid blocking the [Providenciales] airport's single runway and causing delays to scheduled airline flights," the report said.

A controller at the Grand Turk airport also told the pilot that the landing gear was only partially extended. The pilot prepared his five passengers for a gear-up landing and closed the fuel selector valves just before touchdown. The Chieftain came to a stop near the right edge of the runway. There was no fire, and the occupants exited through the main cabin door.

Examination of the aircraft revealed that a hydraulic line leading to the right main landing gear door actuator had failed. The resulting loss of hydraulic fluid had prevented the normal and emergency gear-extension systems from functioning properly.

HELICOPTERS

Fuel Exhausted on Pleasure Flight

Fairchild Hiller 1100. Destroyed. Four fatalities.

The private pilot was conducting his first flights with passengers on May 23, 2010, after completing training in the helicopter. He had 100 flight hours, including 12 hours in type. The passengers had won raffle tickets for local pleasure flights from the pilot's private helisite in Morbach, Germany.

Witnesses who saw the helicopter returning to the helisite on its third flight heard a sound, identified by investigators as an engine flameout, before it descended rapidly to the ground.

"The accident occurred following a failed autorotation, or the failure to initiate an autorotation, after the engine stopped due to fuel exhaustion," said the report by the German Federal Bureau of Aircraft Accident Investigation.

Drooping Conduit Snags Vertical Fin

Bell OH-58C. Substantial damage. Two minor injuries.

The pilot had hover-taxied the police helicopter from its hangar at an airport in Panama City, Florida, U.S., numerous times without event. However, while doing so the afternoon of May 27, 2011, the pilot heard a loud bang when the helicopter was almost out of the hangar.

"He started to lower the collective but could not control the helicopter," the NTSB report said. The main rotor blades and tail rotor drive shaft separated, and the tail boom was twisted about 120 degrees when the helicopter struck the ground and came to rest on its left side. The pilot and observer sustained minor injuries.

Investigators determined that a coiled electrical conduit secured above the hangar door frame likely had become loose after the helicopter's main rotor passed below and then had detached, uncoiled and drooped below the door frame, snagging the helicopter's vertical tail fin.

Preliminary Reports, March 2012

Date	Location	Aircraft Type	Aircraft Damage	Injuries
March 1	Isla Grande de Chiloé, Chile	Piper Navajo	destroyed	8 fatal
The Navajo struck a mountain shortly after departing from Melinka in rain, fog and strong winds for a flight to Quellón.				
March 1	Egelsbach, Germany	Cessna Citation X	destroyed	5 fatal
Night instrument meteorological conditions (IMC) prevailed when the Citation crashed in a wooded area on final approach.				
March 3	Detroit, Michigan, U.S.	McDonnell Douglas MD-88	substantial	144 none
The MD-88 was being taxied to a gate when its left wing tip struck and overturned an unoccupied shuttle bus.				
March 5	Yellowknife, Northern Territories, Canada	Lockheed L-188A Electra	minor	5 none
The Electra veered off the runway on landing after the flight crew was unable to extend the right main landing gear.				
March 5	Terceira, Azores, Portugal	Airbus A340-313X	none	288 none
The A340 was en route from France to Colombia when a burning odor from a short circuit in a crew rest area permeated the cabin. The flight crew conducted an emergency descent to 2,000 ft and diverted to Terceira.				
March 5	Anchorage, Alaska, U.S.	Learjet 35A	substantial	6 none
The flight crew's forward visibility was impaired when the windshield iced over just before touchdown. The air ambulance then veered off the runway and struck a snow bank.				
March 8	Comayagua, Honduras	Rockwell Commander 500S	destroyed	2 fatal
Witnesses saw the airplane flying low before it struck trees during a cargo flight from San Pedro Sula to Tegucigalpa.				
March 8	Ronaldsway Airport, Isle of Man	BAE Systems Jetstream 31	substantial	14 none
Investigators found that stress corrosion cracking caused the right main landing gear to fail and the airplane to veer off the runway on landing.				
March 12	Gulf of Mexico	Bell 206L-3 LongRanger	substantial	1 none
The helicopter had been tied down overnight on an offshore oil platform. The pilot neglected to disconnect one of the four tie-downs, and the LongRanger rolled onto its right side during the subsequent takeoff attempt.				
March 13	Ketchikan, Alaska, U.S.	de Havilland Beaver	substantial	1 serious, 1 minor
The floatplane crashed in IMC about 23 mi (37 km) from Ketchikan while returning from a mining site.				
March 13	Atlanta, Georgia, U.S.	Boeing 737-700	substantial	2 none
Maintenance technicians had problems with the braking system while testing the 737's engines. The airplane overran the taxiway and traveled down an embankment.				
March 14	Jos, Nigeria	Bell 427	destroyed	12 fatal
Seven people in the police helicopter and five on the ground were killed when the aircraft crashed into a house during a surveillance flight.				
March 15	San Juan, Puerto Rico	Convair 340	destroyed	2 fatal
The cargo airplane crashed in a lagoon shortly after the flight crew declared an emergency on takeoff because smoke was coming from an engine.				
March 15	Franklin, North Carolina, U.S.	Cessna Citation 501	destroyed	5 fatal
Witnesses heard engine noise increase after the Citation touched down about halfway down the 5,000-ft (1,524-m) runway and bounced. The airplane then banked right and crashed off the side of the runway.				
March 22	Puerto Aguirre, Chile	Beech King Air 350	destroyed	8 fatal
The King Air struck a mountain during a night air ambulance flight from Punta Arenas to Santiago de Chile.				
March 28	Broken Bow, Nebraska, U.S.	Beech E55 Baron	destroyed	1 fatal, 2 serious
The Baron crashed in a cornfield during an attempted emergency landing at the airport.				
March 29	Wau, South Sudan	Fokker 50	substantial	5 minor, 50 none
The landing gear collapsed after the Fokker touched down on a runway that was being repaved.				
March 31	Tokyo, Japan	Boeing 777-200	substantial	308 none
The tail struck the runway when the flight crew initiated a go-around because of strong gusts. The 777 subsequently was landed without further incident.				

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

The Foundation would like to give special recognition to our Benefactor, Patron and Contributor members. We value your membership and your high levels of commitment to the world of safety. Without your support, the Foundation's mission of the continuous improvement of global aviation safety would not be possible.

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