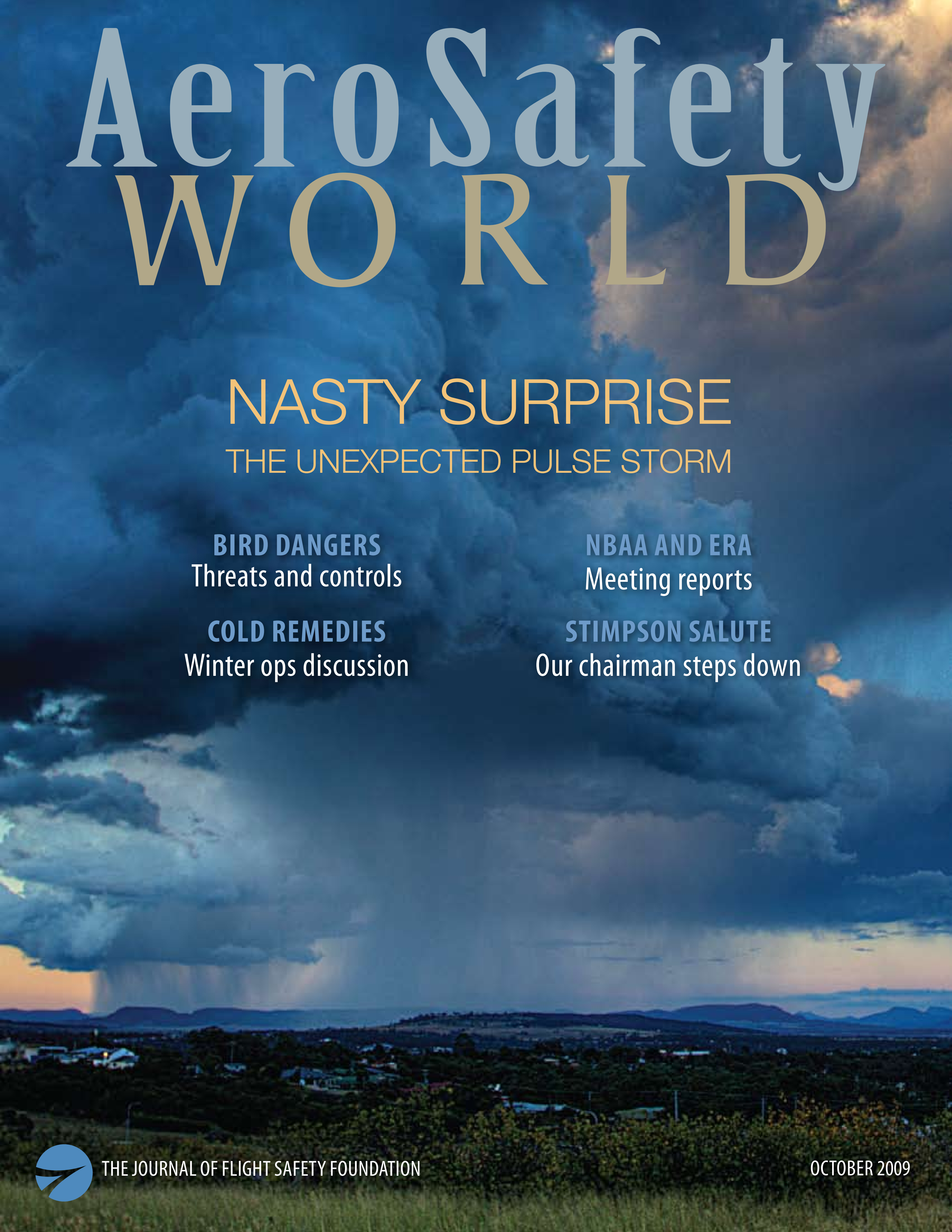

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THE JOURNAL OF FLIGHT SAFETY FOUNDATION

OCTOBER 2009

MISSED Opportunity

There is an interesting piece of legislation working its way through the United States Congress as I write this. It is called the Aviation Safety Bill, written in response to the tragic crash near Buffalo, New York, of a Bombardier Q400 early this year that killed 50 people, an accident that revealed things about the airline industry that shocked a lot of people. The legislation targets a number of issues regarding data collection, reporting and training. Many of the proposed changes make sense, but there is one part of the bill that I believe seriously misses the mark.

That troubling part is a new requirement that a pilot must have an airline transport pilot (ATP) license and 1,500 hours of flight time before he or she can serve as a first officer on an air carrier aircraft, even one operated by a regional airline. To those who have become pilots in North America, this provision may not seem shocking; for quite a few years, it has taken that level of experience to get a job with a major airline anyway, and often with a regional. But this will not always be the case, and won't be in the future, and that's what worries me.

First, licenses and hours do not say much about pilot qualification and competencies. Regulators have never set the competency bar for entry to an airliner flight deck. The license just gets you in the door. The decision to let you enter the flight deck typically is made by a check airman, often using an entirely different set of standards than the regulator who issues the license.

The interesting problem is that those vital industry gate-keeping standards are largely invisible, and are subject to marketplace pressures. When the supply of qualified personnel dries up during good times, economic pressures build and standards decline silently through hundreds of incremental decisions. Of course, in every company there are some great people who fight this deterioration, but sometimes they lose the fight.

The expansion of the global aviation industry has taken a hit in the last couple years, but it is a temporary condition. There are 2 billion people in school in the developing world that are going to find their way into the middle class and demand air transportation. When economic growth resumes, unemployed yet qualified aviation people will become rare, taking their portable skills to the places of highest demand, and highest pay. Soon, airlines will need to hire many more pilots than exist in the market, at least those with 1,500 hours. During the past 50-plus years, standards have had to be lowered when demand exceeded the supply of high-time pilots, and those standards have never really been tested.

The Aviation Safety Bill seeks to raise the bar for pilot proficiency, but it is pulling the wrong lever. Requiring an ATP for everybody in the right seat will not make the world safer. Regulations can't fix this one. The real lever that controls pilot competence is hidden from view and is controlled by the industry. Maybe we need to admit that now, so we can deal with it in the future.

William R. Voss
President and CEO
Flight Safety Foundation

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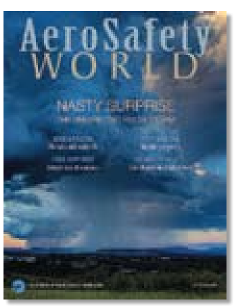

About the Cover
Pulse storms are dangerous but rarely forecast.
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Distraction

Core aviation safety interests are being threatened by what probably should be considered an oddball yet unsafe event that has little to do with the risks that threaten lives every day.

That's one way of looking at the immediately infamous overflight of the destination airport by a pair of pilots in the United States who claimed to be so engrossed in fiddling with a new crew-scheduling program on their laptops that they apparently forgot they were flying an airliner.

Coming just a couple of weeks after a family in Colorado, U.S., claimed that their young son had crawled into and released a homemade helium balloon, the flight of the errant Northwest Airlines A320 initially sounded like almost as much of a hoax as the balloon fiasco is now said to have been, but sadly, it was not.

Alarms rang 'round the world when the overflight story was reported, with all sorts of urgent questioning of the role of automation in the cockpit today and the effectiveness of U.S. Federal Aviation Administration (FAA) oversight of the industry. One gadfly who makes it her business to scare the American public witless every time an airplane hiccups, and apparently in the unaccustomed position of trying to sound reasonable, actually said the flight was not in danger of a midair collision — which was largely true thanks to the air traffic control system — because the on-board collision avoidance system would automatically steer the airplane around any potential danger — which, the last time I checked, it will not.

Further, when the level of automation used to allow this overflight was little more than a track-holding autopilot, we find ourselves being threatened, if press reports are to be believed, by 50-year-old technology.

While those claims are simply silly, the truly scary aspect of the event's aftermath was the two-step response to the pilots' action, or lack thereof.

First, because the cockpit voice recorder offered no independent information about what was actually going on in the cockpit, the pilots were interviewed by the U.S. National Transportation Safety Board to get the story straight. When their laptop saga came out, the FAA issued an emergency revocation of the pilots' licenses. Since these guys clearly weren't going to be flying in the foreseeable future, the only possible emergency that favored revocation over suspension involved the threat to the FAA's public credibility.

Second, the pilots' union got involved, pointing out that the revocation was a premature action. This reasonable position was then followed by the logic-bending statement that since the basis for the revocation was information the pilots gave up voluntarily, then all pilots might reconsider participating in any program involving voluntary participation, such as aviation safety action programs (ASAP). This is somewhat like me setting my own garage on fire because my teenage son got a speeding ticket.

Everyone involved with this issue needs to take several deep breaths and step away from the heat. Punishment of the offending pilots seems justified, but it should be done in an orderly manner. However, regardless of how the FAA behaves, inflicting collateral damage on safety reporting systems would seem to be the last thing any safety-oriented organization would want to do, or should do.

J.A. Donoghue

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

OCT. 1–2 ➤ Safety Management System Overview Workshop. ATC Vantage. Orlando, Florida, U.S. <registrations@atcvantage.com>, <www.atcvantage.com>, +1 727.410.4759.

OCT. 4–7 ➤ 54th ATCA Annual Conference and Exposition. Air Traffic Control Association. Washington. Claire Rusk, <claire.rusk@atca.org>, <www.memberservicecenter.org/irmweb/wc.dll/vaaleatca?id=vaaleatca&doc=events/event&kn=25>, +1 703.299.2430.

OCT. 5–8 ➤ Improving Flight Simulator Engineering and Maintenance. ARINC. Cairo, Egypt. Sam Buckwalter, <sbuckwal@arinc.com>, <www.aviation-ia.com/fsemc>, 800.633.6882; +1 410.266.2008.

OCT. 7–8 ➤ International Winter Operations Conference. Air Canada Pilots Association and Canadian Society of Air Safety Investigators. Toronto. Capt. Barry F. Wiszniowski, <bwiszniowski@acpa.ca>, <www.winterops.ca>, 800.634.0944, +1 905.678.9008.

OCT. 7–8 ➤ AQD Customer Conference. AQD Superstructure Group Safety and Risk Management. Louisville, Kentucky, U.S. Liz Swanston, <liz.swanston@superstructuregroup.com>, <www.superstructuregroup.com>, +64 (0)4 3850001.

OCT. 11–14 ➤ ACI–NA 18th Annual Conference and Exhibition. Airports Council International–North America. Austin, Texas, U.S. Victoria Houghton, <vhoughton@aci-na.org>, <www.aci-na.org/austin09/welcome.html>, +1 202.861.8080.

OCT. 13–14 ➤ Specialized Family Assistance Center Training for Aviation Accidents. Fireside Partners. Cincinnati. <info@firesideteam.com>, <www.firesideteam.com>, +1 302.747.7127.

OCT. 19–21 ➤ 47th Annual Symposium. SAFE Association. San Diego. Jeani Benton, <safe@peak.org>, <www.safeassociation.com>, +1 541.895.3012.

OCT. 19–20 ➤ Accident and Incident Investigation for Airport Professionals. American Association of Airport Executives. Arlington, Virginia, U.S. Stacey Renfroe, <stacey.renfroe@aaae.org>, <www.aaae.org/meetings/meetings_calendar/mtgdetails.cfm?Meeting_ID=090907>, +1 703.824.0500, ext. 196.

OCT. 19–23 ➤ 53rd Annual Meeting of the Human Factors and Ergonomics Society. San Antonio, Texas, U.S. <info@hfes.org>, <www.hfes.org/web/HFESMeetings/09annualmeeting.html>, +1 310.394.1811.

OCT. 20–22 ➤ NBAA2009: 62nd Annual Meeting and Convention. National Business Aviation Association. Orlando, Florida, U.S. Donna Raphael, <draphael@nbaa.org>, <web.nbaa.org/events/amc/2009>, +1 202.478.7760.

OCT. 25–30 ➤ Beyond Your Wildest Expectations: 2009 Congress and Expo. National Safety Council. Orlando, Florida, U.S. <info@nsc.org>, <www.nsc.org/weekly_articles/Congress_2009.aspx>, 800.621.7619, +1 630.285.1121.

OCT. 26–28 ➤ National Safety Conference: Leadership and Safety — The Command Perspective. Coalition of Airline Pilots Associations. Dallas. <capapilots@capapilots.org>, +1 202.756.2956.

OCT. 26–28 ➤ U.S. and Sub-Saharan Africa: Partners in Aviation Conference. MFM Trade Meetings. Atlanta. Pamela Peseux, <ustda@trademeetings.com>, <www.trademeetings.com/ssMeetingDetails.asp?meetingId=203>, 866.636.4729; +1 301.776.6509.

OCT. 26–28 ➤ Air Medical Transportation Conference. Association of Air Medical Services. San Jose, California, U.S. Natasha Ross, <nross@aams.org>, <www.aams.org/Content/NavigationMenu/EducationMeetings/AMTC2009/default.htm, +1 703.836.8732.

OCT. 26–29 ➤ 2nd CEAS 2009 European Air and Space Conference. Council of European Aerospace Societies. Manchester, U.K. <www.ceas2009.org>, +44 (0)20 7670 4345.

NOV. 1–2 ➤ 2nd Middle East Safety and Business Transformation Seminar. Civil Air Navigation Services Organisation. Jeddah, Saudi Arabia. Anouk Achterhuis, <events@canso.org>, <www.canso.org>, +31 (0)23 568 5390.

NOV. 2–5 ➤ 62nd Annual International Air Safety Seminar. Flight Safety Foundation, International Federation of Airworthiness and International Air Transport Association. Beijing, China. Ahlam Wahdan, <wahdan@flightsafety.org>, <www.flightsafety.org/aviation-safety-seminars/international-air-safety-seminar>, +1 703.739.6700, ext. 102.

NOV. 5–6 ➤ Human Factors in Aircraft Maintenance Workshop. Grey Owl Aviation Consultants. Las Vegas. Richard Komarniski, <richard@greyowl.com>, <www.greyowl.com>, +1 204.848.7353.

NOV. 5–7 ➤ Aircraft Owners and Pilots Association Aviation Summit. AOPA. Tampa, Florida, U.S. Chris Dancy, <chris.dancy@aopa.org>, <www.aopa.org/summit/>, +1 800.872.2672.

NOV. 8 ➤ Local Runway Safety Team Training. International Federation of Air Line Pilots' Associations. Las Vegas. Gideon Ewers, <gideonewers@ifalpa.org>, <www.ifalpa.org/ifalpa-training.html>, +44 1932 579 041.

NOV. 10–11 ➤ European Aviation Training Symposium. Halldale Media. Prague, Czech Republic. Jeremy Humphreys, <Jeremy@halldale.com>, <www.halldale.com/EATS.aspx>, +44 (0)1252 532009.

NOV. 10–12 ➤ 1st CANSO Caribbean and Latin America Conference. Civil Air Navigation Services Organisation. Willemstad, Curaçao. Anouk Achterhuis, <anouk.achterhuis@canso.org>, <www.canso.org/caribbeanlatinamerica>, +31(0) 23 568 5390.

NOV. 10–13 ➤ Bird Strike Prevention Workshop for the East African Community. AviAssist Foundation and Kilimanjaro Airports Development Co. Arusha, Tanzania. Tom Kok, <tom.kok@aviassist.org>, <www.aviassist.org>, +260 (0) 955 711205.

NOV. 15–17 ➤ ATAC 2009 Annual Conference and Tradeshow. Air Transport Association of Canada. Quebec City. Danielle Lavoie, <dlavoie@atac.ca>, <www.atac.ca/en/events/agm/index.html>, +1 613.233.7727.

NOV. 15–19 ➤ Dubai Airshow 2009, Airport Expo. F&E Aerospace, Dubai Airports, the Government of Dubai and the United Arab Emirates Armed Forces. Dubai, U.A.E. Jan Stewart, <dubaiairshow.aero/>, +971 4 286 7755.

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

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Flight Safety Foundation is an international membership organization dedicated to the continuous improvement of aviation safety. Nonprofit and independent, the Foundation was launched officially in 1947 in response to the aviation industry's need for a neutral clearinghouse to disseminate objective safety information, and for a credible and knowledgeable body that would identify threats to safety, analyze the problems and recommend practical solutions to them. Since its beginning, the Foundation has acted in the public interest to produce positive influence on aviation safety. Today, the Foundation provides leadership to more than 1,170 individuals and member organizations in 142 countries.

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Safety News

Contradictory Requirements


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Contradictory guidance from the U.S. Federal Aviation Administration (FAA) about on-condition maintenance must be resolved to ensure that operators are consistent in their handling of the maintenance programs, the U.S. National Transportation Safety Board (NTSB) says.

The NTSB, in a letter accompanying several related safety recommendations to the FAA, said the FAA should reconcile conflicting statements in two advisory circulars (ACs): AC 120-17A, "Maintenance Control by Reliability Methods," and AC 120-16E, "Air Carrier Maintenance Programs."

In AC-120-17A, the FAA refers to "hard time, on-condition or condition monitoring" as "the primary aircraft maintenance processes." In AC 120-16E, the FAA says that air carriers "should not use terms such as hard time, on-condition or condition monitored in [their] maintenance schedule" and that "these terms represent obsolete 1960s methodology [and] are vague."

"The NTSB is concerned about the differing guidance that is provided to operators," the safety board said in its letter to the FAA. "Therefore, the NTSB recommends that the FAA resolve the differences … in regard to FAA philosophy and use of on-condition maintenance programs. Further, once the differences … are resolved, the NTSB recommends that the FAA review existing on-condition maintenance programs to ensure that they are compatible with the most current accepted philosophy."

The recommendations were issued as a result of the NTSB investigation of the Nov. 8, 2005, crash of a Business Air Embraer 110P1 after takeoff from Manchester-Boston Regional Airport in Manchester, New Hampshire, U.S. The pilot of the unscheduled cargo flight was seriously injured and the airplane was destroyed in the crash into a department store's garden center.

The NTSB said that the probable cause was the pilot's "misapplication of flight controls following an engine failure." Contributing factors included "the failure of the sun gear, which resulted in the loss of engine power," the NTSB said, adding that contributing factors in the sun gear failure were "the engine manufacturer's grandfathering of previously recommended but less reliable maintenance standards, the … FAA acceptance of the engine manufacturer's grandfathering, the operator's inadequate maintenance practices and the FAA's inadequate oversight of the operator."

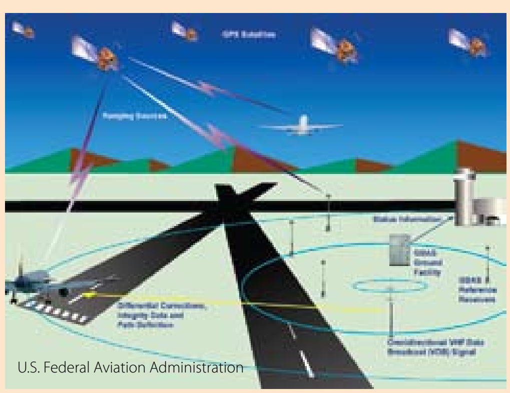
GPS-Based Landing System Approved

The U.S. Federal Aviation Administration (FAA) has approved the first ground-based GPS (global positioning system) augmentation system in the United States, to be implemented early in 2010 in Memphis, Tennessee.

Approval of the Smartpath Precision Landing System, manufactured by Honeywell, "marks the successful completion of a partnership between the FAA and Airservices Australia to build and certify a ground-based augmentation system (GBAS)," said FAA Administrator Randy Babbitt. "We expect GBAS to become an asset to airports around the world."

Another system is expected to be installed in Sydney, Australia.

GBAS works by augmenting GPS signals to provide precision approach guidance to runways. The FAA said use of GBAS in descent and approach operations will allow for increased capacity at crowded airports. The current system provides for precision approach guidance to 200 ft above the runway surface; within a few years, improvements will allow for descent to the runway surface in zero-visibility conditions, the FAA said.


U.S. Federal Aviation Administration

Safety Platform

A single safety oversight body should be created to take responsibility for standardizing policies and technical certifications among operators in all Central American countries, the Latin American and Caribbean Air Transport Association (ALTA) says.

The provision was one of several included in a safety resolution adopted at the ALTA Airline Leaders Forum and annual general meeting in October.

The resolution said the safety oversight body should be responsible for "standardized policy alignment and technical certification of all operators of Central American countries"; development of "unified standards and processes" in regulations and standard operating procedures related to aircraft, personnel, airways and other related areas; implementation of comprehensive interstate relations; and continued cooperation in improving safety.

Contaminated Halon

A "considerable" amount of the halons used in aircraft fire-suppression equipment may not meet specifications, the U.K. Civil Aviation Authority (CAA) says.

The CAA said that both Halon 1211, which is used in portable fire extinguishers in aircraft cabins and flight decks, and Halon 1301, which is used in extinguisher systems for engines, auxiliary power units, cargo holds and lavatory trash receptacles, are affected (*ASW*, 9/09, p. 29).

The CAA said that it is working with the European Aviation Safety Agency (EASA) to determine whether the problem presents safety risks and what steps will be taken.

Because the problem may involve a large quantity of equipment, removal of the affected extinguisher systems is not practical, the CAA said in communications to owners and operators, maintenance companies, production organizations and pilots.

Companies that have been supplied with the suspect halons have been notified and asked to "identify extinguishers filled from the suspect batches, and one filled from each batch will have the Halon tested against the relevant standard," the CAA said. "This will allow the total quantity of contaminated Halon and the amount of contamination in each batch to be determined."

The agency said it would provide updated information as it becomes available to affected owners and operators.

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Icing Cautions

The U.K. Air Accidents Investigation Branch (AAIB), citing an April 9, 2008, incident in which the elevator of a BAE Systems Jetstream 4102 was jammed by accumulating ice, has recommended that the manufacturer review the icing information to ensure that pilots have adequate instructions on how to respond to in-flight icing-related control problems.

The incident occurred after departure from Aberdeen, Scotland, as the airplane climbed through 9,000 ft for a flight to Vágar, one of the larger islands in the Faroe Islands. The flight crew used "changes in power and higher forces on the elevator controls to descend into warmer air, where the ice melted," the AAIB said in its final report on the incident.

None of the 13 people in the airplane was injured in the incident, and the airplane was not damaged.

Weather before departure had included snow and freezing conditions, and the airplane was not appropriately deiced and anti-iced, the report said. The commander initially planned for the airplane to be deiced before departure but later said that fluid deicing probably was not necessary; instead, he asked ground crewmembers to sweep off any ice or snow and observed them sweeping the wings, the report said.

The report added that it was "highly likely" that ice or slush was on the airplane's horizontal tail surfaces before takeoff, "and that, as the aircraft entered colder air at altitude, this contamination caused the mechanical pitch control to become restricted."

The AAIB recommended that BAE Systems review the Jetstream 41's emergency and abnormal checklist "to ensure that it includes adequate instructions and advice for flight crews who encounter in-flight control problems associated with airframe ice."

A second recommendation called on the company to review checklist advice "concerning flap extension following failure of the aircraft's ice protection systems, or when ice is present on the airframe, to ensure that advice and instruction relating to flap extension is optimized for safety."

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Safety Course

The Netherlands Aviation College has conducted a government safety inspectors course in Zambia that also provided training to senior pilots in the hope of increasing their appreciation of the responsibilities of the Zambian Department of Civil Aviation.

The course was taught in early October by instructors from the college, one of eight training centers worldwide that has been endorsed by the International Civil Aviation Organization to provide these classes.

Dominic Sichinga, Zambian permanent secretary of communications and transport, said that the session was "part of the commitment of the government of the Republic of Zambia to ensure it meets its international aviation safety oversight obligations."

The Netherlands Aviation College typically teaches its classes in Hoofddorp, the Netherlands; this session was offered in Zambia through the efforts of the Avi-Assist Foundation as part of its campaign to make best safety practices available to aviation professionals in Africa.

—Tom Kok

Runway Incursions Decline

The number of serious runway incursions at U.S. airports declined 50 percent in fiscal year 2009, which ended Sept. 30, compared with the previous 12-month period, the U.S. Federal Aviation Administration (FAA) says.

The FAA defines a "serious" incursion as one in which "a collision was narrowly avoided, or there was a significant potential for collision that resulted in the need to take quick corrective action."

The FAA recorded 12 serious incursions, including two involving commercial air carriers, in fiscal 2009; in fiscal 2008, 25 serious incursions were recorded, including nine that involved commercial air carriers.

"While the 50 percent reduction is remarkable, there is still much work to be done to continue to reduce the potential risk," FAA Administrator Randy Babbitt said.

The FAA intensified efforts to reduce the risk of runway incursions and wrong-runway departures after a series of close calls in 2007, when 24 serious runway incursions were recorded, including eight involving air carriers. Those efforts included training for pilots and completion of proper airport signage and markings.

The agency's continuing efforts include an international runway safety meeting scheduled for Dec. 1–3 in Washington.


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In Other News …

The Italian Air Safety Board (ANSV) is calling on safety authorities in Europe and the United States to consider asking Boeing to develop procedures by which flight crews can identify and manage problems involving bleed air check valves in CFM International CFM56-7B22 engines. The board cited a June 13, 2009, incident in which a 737-700 experienced an engine flameout on approach to Florence Airport. … The U.S. **National Transportation Safety Board** (NTSB) is investigating an Oct. 21, 2009, incident in which a Northwest Airlines Airbus A320 overflew the Minneapolis-St. Paul International/Wold-Chamberlain Airport by 150 nm (278 km). A preliminary statement from the NTSB said that the flight crew, flying at 37,000 ft en route from San Diego, claimed to have been "in a heated discussion over airline policy and they lost situational awareness."


Makaristos/Wikimedia

Critical Events in EMS Flight

About 5 percent of patients on emergency medical services (EMS) flights experience a "critical event" during flight, according to a study in the *Canadian Medical Association Journal*.

The study defined a "critical event" as one involving "a major resuscitation, rapid loss of blood pressure, respiratory arrest [or] death."

The study's authors — Dr. Jeff Singh and Dr. Russell MacDonald — based their findings on the cases of 19,228 adult patients in Ontario, Canada. They said that, despite the 5 percent incidence of critical events, in-flight deaths were rare.

Compiled and edited by Linda Werfelman.

Nasty Surprise

BY ED BROTAK

Pulse thunderstorms produce dangerous wind shear conditions.

The July 2, 1994, crash of USAir Flight 1016, a McDonnell Douglas DC-9-31 at the airport at Charlotte, North Carolina, U.S., is well documented.[1] The U.S. National Transportation Safety Board found that mistakes by the flight crew and by air traffic controllers in the airport tower contributed to the accident that killed 37 of the 57 people in the airplane. At the heart of the problem, though, was the weather. Strong wind shear induced by a thunderstorm at the airport caused the pilots to lose control of the airplane during a go-around.

By the time of this accident, the threat of wind shear associated with thunderstorm downdrafts was well known and was being addressed by wind shear sensors and Doppler radar. However, the thunderstorm in this case represented a type of storm that still presents great risks to

© Chris McFerran/Flickr

aviation — a "pulse storm" that can develop quickly, without warning. It may appear benign, but suddenly can produce the type of extreme weather conditions more commonly associated with classic severe storms.

So, how is a pulse storm different? First, there are three types of thunderstorms: single-cell, multi-cell and supercell. "Cell" in this case refers to the central updraft of the storm.

Supercells are the monster thunderstorms most common in the Great Plains of the United States in the late spring. These storms always produce some type of severe weather — that is, large hail or strong straight-line winds — and are the major tornado-makers. They have a single, tilted, very powerful updraft that rotates and can last for hours.

Multi-cell storms are the most common thunderstorms. They have multiple updrafts in various stages of development. They can occur singly or with other storms in various formations such as squall lines. Although they can produce severe weather, that is much less likely than with supercells.

Single-cell storms have one vertical updraft that tends to dissipate fairly quickly. They rarely produce severe weather. These types of storms are common to the U.S. and in parts of Australia, South America, Asia and central Europe, any place with warm, moist air. Pulse storms are a subset of this category.

As the name suggests, the storm develops and then dissipates, sort of a "pulse" of energy. Although some references classify all single-cell storms as pulse storms, the U.S. National Weather Service (NWS) defines the pulse storm as the rare single-cell storm that produces severe weather. Although pulse storms seldom produce tornadoes, they can generate large hail and, most commonly, strong winds.

One of the reasons pulse storms are difficult to anticipate is that they develop in what appears to be a benign environment, not one that seemingly could support a severe storm. There are basically two situations in which thunderstorms develop — what meteorologists call "free" or "forced" convection.

Free convection produces the classic air mass thunderstorm that develops solely due to heating by solar radiation. Air mass thunderstorms are most numerous during and just after the warmest part of the day. In terms of the synoptic weather situation, nothing much is going on. These storms develop usually on the west side of a high pressure area away from any fronts or low pressure areas; the upper-level jet stream is not involved. They are most common in the summer.

Forced convection is synoptically forced; in other words, there are additional sources of lifting other than just local diurnal heating. Fronts, low pressure areas and the jet stream can be involved. They can develop at any time of the day and are most common in the spring. These storms have a much higher probability of becoming severe.

Pulse storms develop under "unforced" conditions. They are the rare severe storms unrelated to significant weather features.

Looking at the vertical structure of the atmosphere, the environment again belies the actual threat. In most severe storm situations, there are notable winds at least in the lower part of the atmosphere. Often, the winds veer with height. There is some pre-existing wind shear in the atmosphere. For pilots, it is this wind shear aloft which can be brought down and concentrated in a thunderstorm downdraft and produce wind problems near the ground. This is not the case with pulse storms. There are no significant winds aloft. The winds are generated within the storm itself. This poses a major problem in forecasting them.

Another problem with pulse storms is that they can develop very rapidly and produce severe weather not long after inception. The life cycle of a pulse storm was first depicted in 1949 as a result of the Thunderstorm Project, a research effort conducted by the U.S. Weather Bureau, as it was then called. In fact, this model of storm development is often referred to as the Byers/Braham Model, in honor of the two lead meteorologists of the project.

A pulse storm has three life stages (Figure 1, p. 14). The developing stage features a vertical updraft and a developing cumulus cloud, with no precipitation or wind at the surface. Precipitation-size water droplets develop, but they initially are held high in the cloud by the force of the updraft. Eventually, the weight of the precipitation becomes too much to suspend and it begins to fall. Some air is dragged along, producing a downdraft. Since the precipitation and sinking air are falling straight back through the updraft, the updraft begins to weaken. This is the mature stage of the storm, when there is both an updraft and a downdraft. The precipitation and the downdraft reach the surface. This is when strong winds can occur near the ground. The final, dissipating stage occurs when the updraft has been eliminated. A dissipating cloud with weakly sinking air is all that is left, with only light rain possible at the surface. From start to end, the complete process can take as little as 30 minutes.

Eventually, the weight of the precipitation becomes too much to suspend and it begins to fall.

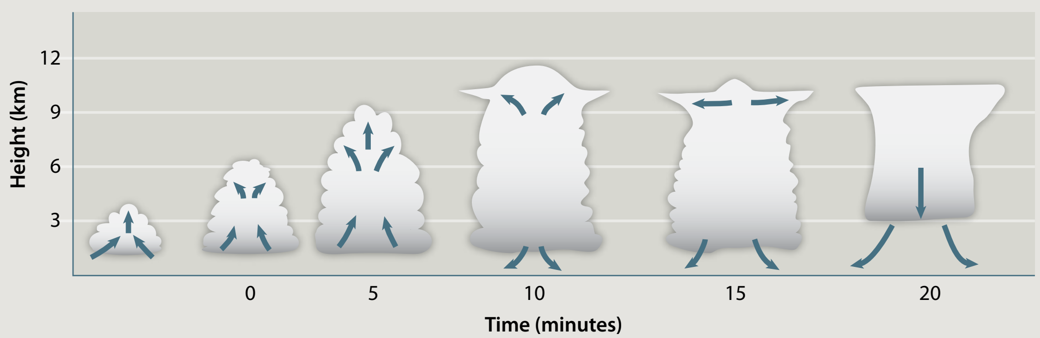
As is typical with pulse storms and other severe-weather-making thunderstorms, the highest probability of severe weather (strong winds) does not occur at the time of maximum intensity (maximum updraft strength), but somewhat afterwards. You need significant descending motions in the storm to transport the energy down toward the surface.

The difference between a pulse storm and a non-severe single-cell thunderstorm has to do initially with the strengths of the updraft and the downdraft. Pulse storms develop in a more unstable environment and have stronger updrafts. These stronger updrafts are capable of holding precipitation aloft longer. On radar displays, this "core" of the storm is higher and more reflective than in non-severe storms. But once this core begins to descend, it comes down in a rush, producing abnormally strong downdrafts. These can be classified as "downbursts" or even stronger and more concentrated "microbursts," as was the case with the USAir crash.

The situation that developed on July 2, 1994, in North Carolina illustrates the problems that are presented by a pulse storm. On the morning weather map, nothing significant was going on. The nearest front was hundreds of miles away in the Ohio Valley. The weak jet stream was well to the north. Just a warm, moist air mass was in place over the Southeast. Morning soundings showed an unstable environment but with only weak winds aloft. Nothing indicated the possibility of severe weather. It seemed like a typical summer day.

In the afternoon, showers and thunderstorms began to develop because of daytime heating. The NWS WSR-88D weather radar at Columbia, South Carolina, 77 nm (143 km) to the south of the crash scene, had a clear view of the Charlotte Douglas International Airport. At 1823 local time the radar showed a weak but growing cell near the airport. The storm's estimated top was 20,000 to 25,000 ft. By 1829, it showed as a strong low-level echo, a VIP Level 3.[2] The mid-level reflectivity was even stronger, indicating a probable thunderstorm at VIP Level 5. The top was estimated at 25,000 to 30,000 ft. By 1835, 12 minutes after first detection, the cell had maxed out — top near 30,000 ft, VIP Level 5. Indications were that the storm would shortly enter the dissipating stage, the stage when downdrafts are most likely with this type of cell.

Life Cycle of a Pulse Storm



Source: Burgess, D.W. and L.R. Lemon, 1990, "Severe Thunderstorm Detection by Radar," *Radar in Meteorology* (D. Atlas, ed.), American Meteorological Society, 619–647.

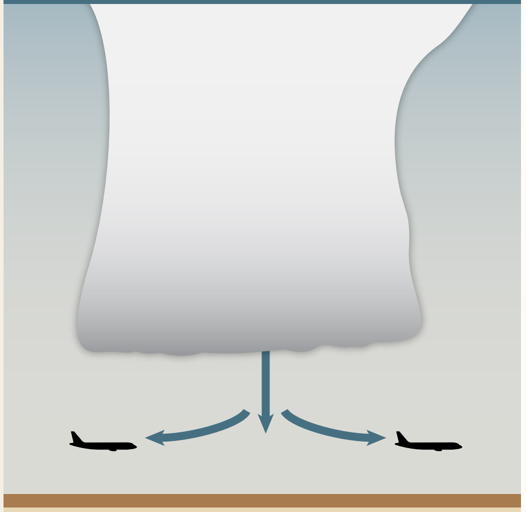
Figure 1

At 1841, two minutes before the accident, the highest radar returns were features descending through the cloud, indicating the collapse of the updraft and acceleration of the downdraft. By 1847, the cell had continued to decrease in intensity. The NWS meteorologist who testified at the public hearing saw nothing noteworthy about the storm on radar. There was nothing indicating severe weather potential. It appeared to be a typical summer thunderstorm.

The problems associated with flying through a strong thunderstorm downdraft are shown in Figure 2. As the downdraft hits the earth's surface, it spreads out in all directions. An airplane approaching this outflow first encounters strong head winds. In the case of Flight 1016, these winds were measured at 39 kt. The extra airflow over the wings increased lift and the pilots had to compensate for this. As the plane crossed through the center of the downburst, the wind quickly reversed to a tail wind. For Flight 1016, the sudden tail wind was 26 kt, giving a wind shear of more than 60 kt in a period of 15 seconds. The loss of airflow over the wing in this sort of encounter reduces lift and the plane descends unless quick adjustments are made by the pilot. Of course, wind shear near the surface most dangerously affects airplanes during takeoff or landing.

Pulse storms cannot be forecast. The best that meteorologists can do is to say whether the atmosphere is conducive to pulse storm development. When looking at current and forecast soundings, they look for signs of enhanced instability but with light winds aloft. Unstable values of the standard Lifted and Showalter Indexes[3] and high values of the more recently developed CAPE[4] would be good indicators. However, parameters that are usually helpful in forecasting severe weather, such as the SWEAT Index[5] and the helicity,[6] would be uncharacteristically small in these low-wind environments. Even in the afternoon, when it is apparent that convection will be initiated, it is difficult to pinpoint where pulse storms will develop. Minor perturbations in the environment such as weak convergence at low levels may trigger the storms. Such occurrences may be unobservable in real time and may make storm formation appear random. After the storm has developed, it is still difficult to determine its wind potential. Advanced radar analysis schemes may help with this. For the time being, early detection of the wind shear generated by pulse storms and a quick relay of this information to pilots are our best methods of preventing serious flight problems.

Thunderstorm Downdraft Affecting Flight Conditions



Source: Ed Brotak

Figure 2

Notes

1. NTSB. Accident report AAR-9503, *Flight into Terrain During Missed Approach, USAir 1016, DC-9-31, N954VJ, Charlotte/Douglas International Airport, Charlotte, North Carolina, July 2, 1994.*

2. VIP, or video integrator and processor, is a method of rating the strength of the radar return on a scale of 1–5, with 5 being the strongest return.

3. Lifted and Showalter Indexes, developed prior to computer technology, used a sounding as the basis of a quantitative thunderstorm forecast. The actual values are the differences in temperature inside a cloud and outside at 500 millibars (mb), or 18,500 ft. Negative values indicate instability and possible thunderstorms, even severe storms for values -4 and under. The difference between the two indexes is that Showalter uses 850 mb (about 5,000 ft) as the starting level; the Lifted Index can be calculated from any level, usually the layer closest to the surface.

4. CAPE, or convective available potential energy, is a measure of buoyancy that is related to the strength of the thunderstorm updraft and overall storm strength.

5. SWEAT, or severe weather threat index, is an index developed to quantify the potential for severe thunderstorms; it incorporates thermodynamics and kinematics (winds).

6. Helicity is a math term derived to represent the low-level wind shear and the tendency for a thunderstorm updraft to rotate; rotation of the updraft is key to severe weather formation.

Swissair 111

BY 'BOOMER' BOMBARDI

Sensors could have made a difference.

More than 10 years have passed since Swissair Flight 111, a McDonnell Douglas MD-11, crashed into Peggy's Cove, Nova Scotia, Canada, on Sept. 2, 1998, with the loss of all 239 aboard. The aircraft crashed due to loss of control caused by a hidden on-board fire. The flight crew had a delayed indication of the fire, and had no means of reaching or extinguishing it. A divert to Halifax was attempted but was unsuccessful because of the delay caused by the lack of timely information about the intensity of the fire.

It is an undisputed fact that the crew of Swissair 111 did not know the seriousness of the on-board fire. The flight crew of Swissair 111 did nothing wrong. Given the same circumstances and lack of vital information, my actions would have been the same as theirs. However, I maintain that if the Swissair pilots had better knowledge of the nature and intensity of the fire, and had initiated an earlier and more aggressive divert to Halifax, there would have been time to safely land the aircraft.

While this possibility has been discussed, this theory was never tested, until now. To attempt to document alternate scenarios, and put this speculation to rest, I was able to obtain the use of an MD-11 simulator to evaluate several diversion scenarios.

Some may ask, "Why use Swissair 111 as an example? There have been other smoke/fire/fumes (SFF) accidents and fatalities." My point is that an aircrew needs to know the nature and seriousness of any emergency in order to take the proper actions to deal with it. Even though corrective measures were taken in other SFF accidents, the issue of being able to identify, extinguish and monitor a hidden fire has not been resolved. Swissair 111 is the most recent example and, hence, is used in this article.

The known accident sequence began at 0110:38 local time, when the first officer mentioned an unusual odor in the cockpit. At this point the aircraft was approximately 95 nm (176 km) from Halifax. About 21 minutes later, at 0131:18, the aircraft struck the water.

It cannot be assumed that all 21 minutes would have been available for flying the airplane. The Canadian accident investigation report states that there was no response to an air traffic control radio message to Flight 111 at 0125:16, and the voice and data recorders stopped working at 0125:41. Conditions inside the cockpit and the status of the aircraft control systems in the final minutes of the flight are not known, but the aircraft may or may not have been flyable.

While the time from the first scent of the fire to the crash was 21 minutes, unknown is how much additional time the crew would have had to fly their diversion if the aircraft had been equipped with better fire sensors and warning systems, and the crew had earlier indications of the problem.

Nearly five minutes after the first scent, at 0115:10, the crew selected Halifax as the diversion target. Halifax was a Swissair-designated intermediate alternate airport, approved for MD-11 operations. At this point the aircraft was 60 nm (111 km) from Halifax. From 0115:10, Swissair 111 had approximately 16 minutes before loss of control and impact with the water.

We flew a number of simulator profiles, and for each test case, the aircraft gross weight was 501,800 lb (227,616 kg) with 112,200 lb (50,894 kg) of fuel aboard, altitude was Flight Level (FL) 330, heading was 058 degrees, and airspeed was Mach 0.82. In each case a maximum effort diversion was initiated to land as soon as possible.

Test Case No. 1

The aircraft was 95 nm from Halifax, no winds. This was the position of the aircraft when the first indication of a problem surfaced. The aircraft's configuration for the diversion was engines at idle, speed brakes out, airspeed at the maximum allowed and fuel was being dumped.

The result: The aircraft landed at normal speed on Runway 05 at Halifax approximately 16 minutes later.

Test Case No. 2

In the second simulation we were closer to the field, using the actual accident scenario in which the crew asks at 0115:36 for a diversion to Halifax when they were 60 nm away. We flew the simulator in a more aggressive descent — engines at idle, speed brakes out, gear down, fuel dumping, speeds at times exceeding maximum limits.

The result: The aircraft landed at normal speed 10 minutes, 15 seconds later. The accident aircraft struck the water approximately 15 minutes and 42 seconds after the start of the diversion at 0115:36.

Test Case No. 3

In the third simulation, starting from the same location as in Case No. 2, we added tail winds. We used a tail wind of 60 kt from FL 330 to FL 200, 30 kt from FL 200 to 6,000 ft, 10 kt from there to touchdown.

The result: The aircraft landed approximately 9 minutes, 47 seconds later, speed 169 kt. Once again, from 0115:36, Swisssair 111 struck the water approximately 15 minutes and 42 seconds later.

Test Cases No. 4 and No. 5

We flew two additional simulations with less aggressive descents, the first included delayed landing gear extension, no fuel dumping and adhering to maximum speed limits, and the second further delaying landing gear extension until the last minute to help slow down. The result of both of these scenarios is that landing was 9 minutes, 19 seconds after the beginning of the diversion.

Conclusion

These simulator data indicate that if the crew had known the seriousness of the fire and had started an aggressive diversion to Halifax, they should have been able to safely land the aircraft. The diversion could have been initiated either from 95 nm or 60 nm from Halifax.

With the results of the simulator data in hand, I met with representatives of the U.S. Federal Aviation Administrations (FAA) Fire Safety Team, from the William J. Hughes Technical Center. We discussed sensor technology as it would apply to identifying/monitoring SFF events in hidden areas of aircraft. Sensor technology has rapidly advanced since the crash of Swissair 111. The consensus of the representatives of the Fire Safety Team was that there are a variety of sensors that could be used to monitor inaccessible areas of the aircraft. However, research and testing would be needed to optimize the type and location of the sensors to ensure a timely response.

Admittedly, the unknown effect of the fire on the crew and on critical aircraft systems makes it impossible to say for certain whether sensors alone could have enabled the crew to land the aircraft. It is clear, however, that sensors and an effective extinguishing system or a means of accessing and extinguishing the fire surely would have enabled the crew to land safely.

There were several comments/recommendations pertaining to identifying, monitoring and extinguishing hidden fires in the Transportation Safety Board of Canada (TSB) report on Swissair 111.[1] The FAA was urged to conduct a comprehensive research project to examine the feasibility of systems to identify, monitor and extinguish inaccessible aircraft fires.

Data from the simulator testing clearly indicate that SFF sensors could have made the difference with Swissair 111. The time has come to be proactive instead of reactive when it comes to inaccessible aircraft fires. I can think of 239 reasons why the FAA should move forward with this research. I can't think of one reason not to.

Capt. H.G. "Boomer" Bombardi first became involved with the issue of smoke/fire/fumes (SFF) in aircraft while flying C-141 aircraft for the U.S. Air Force. Flying for a major U.S. airline, Bombardi worked on several SFF projects, eventually joining Air Line Pilots Association, International's Air Safety Committee's In-Flight Fire Project.

The FAA technical center is evaluating wireless smoke detectors (top) and flow-through air analyzers (bottom) in the cargo compartments of a Boeing 727 freighter.

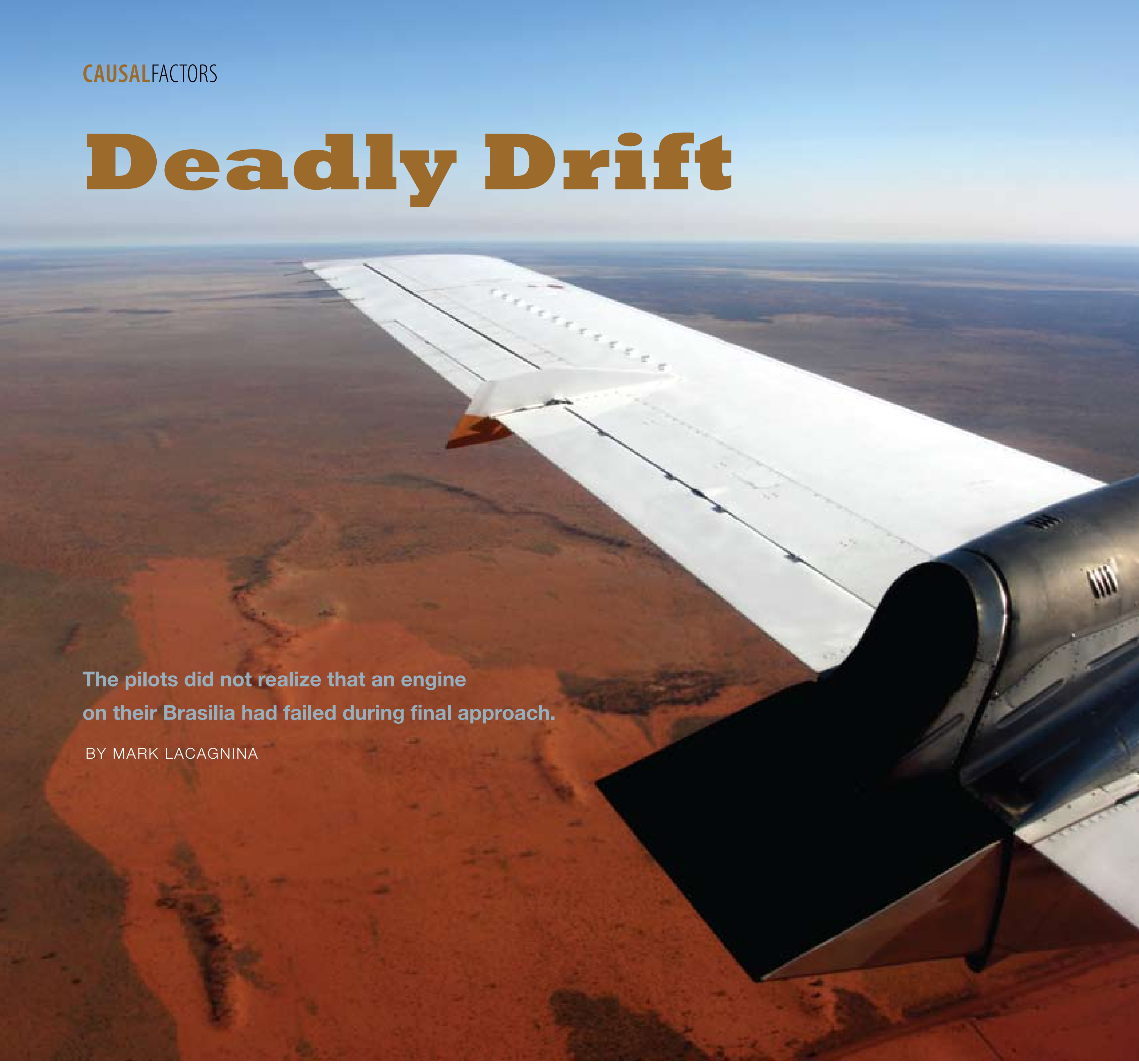
Photos: © Chris Sorensen Photography

Note

1. TSB Canada Report no. A98H0003.

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

Deadly Drift



The pilots did not realize that an engine on their Brasilia had failed during final approach.

BY MARK LACAGNINA

Deficiencies in procedures for verifying fuel quantity and the absence in Australia of a flight simulator for emergency procedures training were among the safety issues identified by the investigation of a serious incident in which the flight crew nearly lost control of their Embraer EMB-120ER Brasilia following an engine failure on final approach.

The incident occurred the morning of June 26, 2007, during a charter flight from Perth, Western Australia, to Jundee, a gold-mining community about 780 km (421 nm) northeast.

The fuel quantity indicators showed that there was 1,190 kg (2,623 lb) of fuel aboard the aircraft when it departed from Perth with 28 passengers and three crewmembers at 0639 local time. "Normal fuel consumption for the flight from Perth to Jundee was in the range of 750–900 kg [1,653–1,984 lb]," said the report by the Australian Transport Safety Bureau (ATSB).

The copilot was the pilot flying. He had 1,618 flight hours, including 1,356 hours in type. The pilot-in-command (PIC) had 3,040 flight hours, including 649 hours in type. Neither pilot had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flown turbine aircraft before they began training in the Brasilia.

The weather at Jundee was clear with light northerly winds. Jundee Airstrip was privately operated and had a 2,095-m (6,873-ft) gravel runway oriented east-west. The crew began a straight-in visual approach to the airstrip at about 0800.

The Brasilia was in landing configuration and about 400 ft above the ground when the left engine flamed out because of fuel starvation. The aircraft drifted left of the runway centerline, and the copilot applied normal yaw and roll corrections. The drift continued, and the copilot told the PIC that the aircraft was not responding to his control inputs. The PIC called for a go-around.

Neither pilot realized that the left engine had failed. "When the crew advanced the engine power levers to commence the go-around, they were startled when the aircraft yawed and rolled left aggressively in response to the engine power asymmetry," the report said.

'Significant Delay'

The copilot asked the PIC to assist him on the controls. "The crew experienced significant difficulty in controlling the aircraft's attitude and airspeed," the report said.

The stick shaker activated twice as airspeed decreased from 110 kt to 96 kt. The Brasilia turned 45 degrees left of runway heading, with bank angle increasing to a maximum of 40 degrees. Several enhanced ground-proximity warning system warnings were generated as the aircraft came within 50 ft of the ground.

"There was a significant delay before the crew configured the aircraft appropriately for one-engine-inoperative flight," the report said.

Nearly four and a half minutes elapsed between the crew's initiation of the go-around and their retraction of the flaps and landing gear, and feathering of the propeller. "They reported that there was an immediate and significant improvement in aircraft performance when the left engine condition lever was placed in the feather position," the report said.

After completing the go-around and the engine failure checklist, the crew diverted the flight to Wiluna, about 42 km [23 nm] southwest of Jundee. They landed the aircraft without further incident at 0818.

Empty Tank

Examination of the aircraft revealed that the fuel quantity indicators showed 300 kg (661 lb) remaining in the left tank and 150 kg (331 lb) in the right tank. "A physical check revealed that the right tank contained 150 kg of fuel and that the left tank was empty," the report said.

The inaccurate fuel indication was traced to the failure of a capacitance probe in the left outboard tank. The probe had been disabled by an electrical short in wiring that had been abraded from contact with the airframe.

No one had noticed that the left fuel quantity indicator was reading high. "There were clear indications that the operator's fuel quantity measurement procedures and practices were not sufficiently robust to ensure that a quantity indication error was detected," the report said.[1]

"There was evidence that flight crews did not have a proper understanding of the reasoning behind the fuel quantity check procedures and the necessity for an independent validation of the fuel quantity by a totally reliable method."

A "reliable method" existed in the form of *dripless measuring sticks*, also called *dripsticks* and *magna sticks*. They are calibrated fuel quantity measuring devices that can be manually lowered from the wing tanks. There are eight dripsticks in the Brasilia, one for each inboard tank and three for each outboard tank. Pilots must use a table to convert dripstick readings to fuel quantity in kilograms.

The report noted that the flight logs for the operator's six Brasilias showed that the dripsticks had been used to validate fuel quantities only twice — and by the same pilot — in the three months preceding the incident.

Vague Verification

The operator had established fuel quantity verification procedures based on information contained in Australian Civil Aviation Advisory

Embraer EMB-120ER Brasilia

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The EMB-120ER is the extended-range version of the Brasilia, the twin-turboprop passenger and cargo aircraft that Empresa Brasileira de Aeronáutica (Embraer) began delivering in 1985. The ER was introduced in 1991 and was the standard version until production ceased in 2000.

With accommodations for 30 passengers, the ER's maximum weights are 11,990 kg (26,433 lb) for takeoff and 11,700 kg (25,794 lb) for landing. Powered by Pratt & Whitney Canada PW118 engines rated at 1,342 kW (1,800 shp), the aircraft's long-range cruise speed at 25,000 ft is 270 kt, and maximum range is 1,629 nm (3,017 km).

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

Publication (CAAP) 234-1(1), *Guidelines for Aircraft Fuel Requirements*.

The report said that the guidelines "lacked clarity" and did not emphasize that one of the major purposes of an independent verification of fuel quantity before flight is to check the accuracy of the aircraft's gauges.

"In broad terms," the report said, "the CAAP allowed two options for establishing fuel on board:

- "Full tanks or 'a totally reliable and accurately graduated dipstick, sight gauge, drip gauge or tank tab reading,' or,
- "A cross-check by at least two different methods."

Neither option ensured an accurate verification of fuel quantity "in cases where a gauge was under- or over-reading by a constant amount or when there was a gradually increasing error," the report said.

Commercial aircraft rarely are operated with full tanks, as recommended by the first option, and the use of devices such as dripsticks is "not generally favored" by operators because it is time consuming and requires the aircraft to be on a level surface for accurate measurements, the report said.

The operator of the Brasilia used the second option provided by the CAAP. Company pilots told investigators that they generally conducted preflight fuel checks by comparing the fuel-remaining indication on the totalizer — a gauge located on the fuel-management panel — with a calculation based on the fuel-remaining figure recorded in the flight log plus any fuel added since the previous flight.

"A discrepancy of 60 kg [132 lb] or more between the indicated total fuel and the calculated total fuel figures required resolution to the satisfaction of the crew," the report said. "If the discrepancy could not be resolved, then [the dripsticks] were used to confirm the quantity in the tanks."

The operator's procedures required pilots to record in the flight log the reason for any discrepancy of 60 kg or more. The flight logs for the company's six Brasilias showed that 68 such discrepancies were recorded during the three months preceding the incident. Pilots attributed 51 of them to "APU burn" — that is, fuel consumed during operation of the auxiliary power unit. No reasons were given for the remainder of the discrepancies.

Discovering technical failures such as malfunctions of fuel quantity indicating systems requires procedures for verifying fuel quantity that are "well designed, fully understood and properly conducted by the users," the report said. "In this occurrence, none of those criteria were present."

The report noted that after the incident, the Australian Civil Aviation Safety Authority (CASA) "initiated a project to amend the guidance [in the CAAP] to provide better clarity and emphasis."

Similar Incidents

The report discussed three other incidents in which similar fuel-related engine failures occurred recently in Australian-registered commercial aircraft.

On Oct. 18, 2007, a Cessna 404's right engine lost power during a charter flight with three passengers from Beverly to Adelaide. The pilot landed the aircraft at Adelaide without further incident. The ATSB investigation determined that faulty wiring had caused the fuel quantity indicator to over-read.[2]

On Feb. 5, 2007, the crew of a Boeing 747-300, en route on a positioning flight from Jakarta, Indonesia, to Melbourne shut down the no. 3 engine after noticing that the boost pump low-pressure warning light had illuminated and the fuel quantity indicator for the no. 3 tank was reading zero. The crew continued the flight to Melbourne and landed without further incident. Investigators determined that an electrical problem and/or water contamination had caused the fuel gauge to malfunction.[3]

On Sept. 23, 2005, a low-fuel warning light for the left tanks in a Fairchild Metro III illuminated during a flight with 16 passengers from Thangool to Brisbane. The crew believed it was a false warning because the gauge showed sufficient fuel, but they diverted the flight to Bundaberg as a precaution. The left engine flamed out as the Metro neared the airport, but an uneventful landing was conducted. Investigators found that the fuel quantity indicating system had not been recalibrated properly during maintenance performed before the incident flight.[4]

"In each case, the practices used by the flight crew to establish fuel quantity before flight did not detect erroneous fuel quantity indications," the report said. "The operators involved subsequently amended their procedure to include physical (e.g., dripstick) checks as a mandatory part of the procedures for establishing the quantity of fuel on board the aircraft."

The report said that the incident at Jundee likely would not have occurred if the crew had used the dripsticks to verify fuel quantity before takeoff, or if the Brasilia had been equipped with an independent low-fuel-level warning system, which was not required by certification or operating standards.

The incident likely would have been avoided if the aircraft's dripsticks had been used to verify fuel gauge readings.

Australian Transport Safety Bureau

'Unable to Function'

Neither of the Brasilia pilots had previously experienced a power loss on short final approach. The aircraft's behavior after power was increased to initiate the go-around at Jundee likely appeared to be "abnormal and without reason," the report said.

"It was likely that the aircraft's behavior alarmed and focused each crewmember to the extent that they were unable to function effectively as a unit in the areas of decision making and task sharing. There was a delay in the crew's diagnosis of the situation. The aircraft was at or near the limits of its performance envelope for a significant period after the go-around was initiated."

A flight simulator is the only means of safely training for critical emergencies such as an engine failure on approach, the report said. "Importantly, in addition to being exposed to the full range of emergency situations, pilots are able to practice crew coordination in those situations."

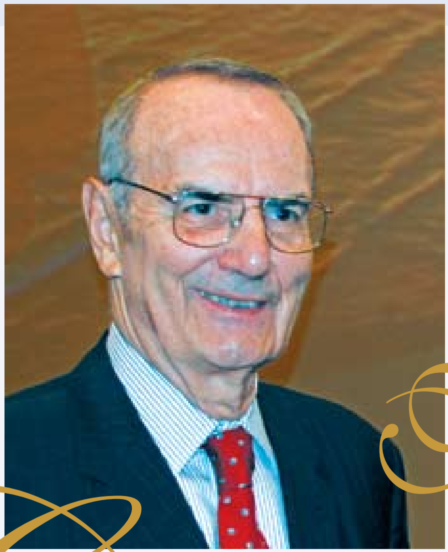
However, there was no Brasilia flight simulator in the country when the pilots were in training, and CASA did not require simulator training. "At the time of the occurrence, there were 22 EMB-120 aircraft on the Australian civil aircraft register," the report said.

A Brasilia flight simulator was installed in the Ansett Aviation Training facility at Melbourne in March 2009. "Subsequently, under the guidance of CASA, all Australian EMB-120 operators began conducting flight crew endorsement [training] and some recurrent training in the simulator," the report said.

This article is based on ATSB Transport Safety Report AO-2007-017, "Fuel Starvation, Jundee Airstrip, WA — 26 June 2007, VH-XUE, Empresa Brasileira de Aeronáutica S.A., EMB-120ER."

Notes

1. Media reports identified the operator as Skippers Aviation.
2. ATSB Report AO-2007-049 (*ASW*, 6/09, p. 61).
3. ATSB Report BO/200700368 (*ASW*, 10/08, p. 57).
4. ATSB Report BO/200504768 (*ASW*, 1/08, p. 60).



Tremendous Contributions

Amb. Edward W. Stimpson, Flight Safety Foundation's chairman and a leader in the aviation industry for four decades, has been awarded the 2009 FSF–Boeing Aviation Safety Lifetime Achievement Award.

"Ambassador Stimpson is the epitome of the type of person this award seeks to recognize," said Foundation President and CEO William R. Voss. "His work at the General Aviation Manufacturers Association (GAMA), his service to the International Civil Aviation Organization (ICAO) and his years of dedication to Flight Safety Foundation have left an indelible mark on aviation safety."

James F. Albaugh, executive vice president of The Boeing Co. and president and CEO of Boeing Commercial Airplanes, said, "This award is a testament to his tremendous contributions on behalf of the world's aviation community and the flying public."

Throughout his career, Stimpson has been conscious of the "day-to-day maintenance of ethics," Voss said. "No matter what else has been on the table, in his mind, safety has had to be in the forefront."

For example, Voss said, Stimpson's dedication to safety was apparent at ICAO, when he worked to ensure that economic sanctions against Iran would have no effect on aviation safety, and at GAMA, when his efforts kept on track the development of guidance material about wind shear, even during a time of economic uncertainty in the industry.

As chairman of the Foundation's Board of Governors, Stimpson headed the independent review team appointed by U.S. Transportation Secretary Mary Peters to examine the U.S. Federal Aviation Administration's (FAA's) safety culture and its approach to safety management. The team issued its report, *Managing Risks in Civil Aviation*, in September 2008 (*ASW*, 11/08, p. 10). Included were 13 recommendations, among them a call for the retention of the FAA's voluntary safety reporting programs and the analysis of program data "at a higher level" to identify safety trends and patterns.

Before he was elected chairman of the Board of Governors in February 2005, Stimpson served five years as the U.S. representative to the Council of ICAO — a position that carries the rank of ambassador. Those five years spanned the terrorist attacks of Sept. 11, 2001; in their aftermath, Stimpson was instrumental in the expansion of the ICAO aviation security program.

During his time at ICAO, Stimpson also led the U.S. delegations to numerous international meetings, including three ICAO Assemblies; at the September 2004 Assembly, he was elected first vice president of the Assembly.

Stimpson was president of GAMA, which represents more than 50 manufacturers of aircraft and component parts, for 25 years. In that role, he was influential in advocating passage of the General Aviation Revitalization Act of 1994, which alleviated product liability costs that had burdened the industry. He had joined GAMA in 1970, the same year the organization was founded.

In 1996, he was elected vice chairman of GAMA and led the organization's "Be a Pilot" program, the most extensive campaign in history to encourage people to learn to fly. GAMA said that, over a 10-year period, "Be a Pilot" registered 260,000 prospective students for introductory flight lessons.

Before his work with GAMA, Stimpson was an assistant FAA administrator, in charge of congressional relations.

Throughout his career, Stimpson has served on advisory boards in government and the aviation industry, including an RTCA (formerly the Radio Technical Commission for Aeronautics) policy board, the Mitre Corp. aviation advisory board, the FAA research and development advisory committee and the U.S. National Aeronautics and Space Administration Task Force on General Aviation Technology.

Stimpson also was a member of the board of Embry-Riddle Aeronautical University for more than 20 years, including seven years as chairman.

He has received many of the aviation community's most prestigious awards, including the Wright Brothers Memorial Trophy, the U.S. Transportation Department Meritorious Achievement Award and the FAA Extraordinary Service Award.

Stimpson is a graduate of Harvard University and holds a master's degree in public administration from the University of Washington. He also holds a private pilot certificate. He and his wife, Dorothy, live in Boise, Idaho.

The FSF–Boeing Aviation Safety Lifetime Achievement Award, presented annually beginning in 2002, recognizes individuals for their "lifetime commitment and contribution to enhancing aviation safety."

Amb. Edward W. Stimpson (seated) displays the FSF–Boeing Aviation Safety Lifetime Achievement Award. Standing (left to right): William R. Voss, FSF president and CEO; Dorothy Stimpson; Steven M. Atkins, The Boeing Co.; and Kenneth P. Quinn, FSF general counsel and secretary.

Rick Darby

COLD REMEDIES

Presenters at a winter operations conference offered guidance for aviation's most difficult season.

BY RICK DARBY | FROM TORONTO

For artists, photographers and anyone with an eye for beauty, winter has its attractions. For aviation professionals involved with winter flying, the season brings the need for extra vigilance and adherence to proven operational practices. Held in Toronto, the International Winter Operations Conference, themed "Safety Is No Secret," aimed to reduce the mysteries surrounding winter aviation's special demands.

The Air Canada Pilots Association/Association des pilotes d'Air Canada (ACPA) and the Canadian Society of Air Safety Investigators sponsored the event. Barry Wiszniowski, a captain, air safety investigator and chair, ACPA Technical and Safety Division, was the chief organizer (see sidebar, p. 27).

"For an inspector of accidents in a Nordic country, this was a valuable conference," said Edith Irgens, inspector of accidents, Accident Investigation Board Norway. "It covered most of the challenges we experience up north: contaminated runways, weather, snow clearing, de- and anti-icing, airframe icing and aerodynamics, runway excursions and safety areas, cabin safety and even some of the challenges of a winter accident investigation."

The keynote speaker was Robert "Hoot" Gibson, mission commander aboard the space shuttles *Challenger*, *Columbia*, *Atlantis* and *Endeavour*. The *Challenger* was destroyed shortly after launch when an O-ring seal failed. Investigation found that the unusually cold weather, outside the range of previous operations, was a leading causal factor in the failure of the seal.

Dave Mastel, manager, Area Control Centre operations, NAV Canada, described the preparations his organization makes before a major winter storm. They can be described under three headings, he said. First, planning — strategic and tactical; second, execution — communications, ground operations and traffic management initiatives; and third, monitoring, including follow-up debriefings.

He offered "rules of thumb" for ground control during snow or icy conditions. Establish separate arrival and departure traffic flows if feasible; minimize runway crossings; be aware of, and respect, anti-icing fluid holdover times; keep the time between brake release and departure to one hour; and ask pilots for single-engine taxiing. For wet runways, he recommended a maximum crosswind component of 15 kt including gusts; for contaminated runways, he said controllers should use the one most directly into the wind; in either case, there should be no tailwind.

Chicago O'Hare International Airport must cope with winter weather while maintaining 178 aircraft gates, 13 mi (21 km) of runway and 48 mi (77 km) of taxiways. George Lyman, Chicago Department of Aviation general manager of airfield operations, described the planning and coordination needed.

Weather forecasting is obtained from six different sources, he said. The airport is divided into airside and landside snow operational areas, with four snow removal manuals published annually. Snow alerts to airport personnel are as detailed as possible, including wind direction, temperature, expected snow accumulation, expected duration of the storm and type of snow.

For the most severe storms, as many as 196 workers are on the job to keep the airport open. A total of 199 vehicles — deicers, brooms, plows, sanders, etc. — are available. The airport uses new technology, including three-in-one equipment, a combination of plow, broom and blower in a single unit.

Jacques Leroux, account executive with Dow Chemical, emphasized that anti-icing fluids protect for a limited period, measured as holdover time (HOT). Depending on the type of fluid, the HOT can range from 20 to 80 minutes. He described the procedures for receiving, testing and storing fluids, noting, "The spray operator should be trained to notice and report anything unusual about the fluid as it is applied, such as abnormal foaming or the agent being the wrong color for the type of anti-icing fluid."

Additional forms of anti-icing and deicing are now in wide use, said Kelvin Williamson, corporate director, Basic Solutions North America. Chemicals include potassium acetate for anti-icing and sodium formate for deicing. "Potassium acetate is virtually odorless, contains a corrosion inhibitor and is 100 percent nontoxic," he said. "It is effective in very low temperatures." The chemical is also effective at cleaning rubber, grease, oil and fuel off runway surfaces. During snow clearing operations, these surface contaminants along with frozen contaminants can be removed at the same time, leaving an improved surface, he said.

Sodium formate is effective to minus 22 degrees C (minus 8 degrees F), fast-acting and environmentally sound, Williamson said. It is used to melt through packed snow and ice, breaking ice-to-pavement bonds and making mechanical removal easier.

Clint Tanner, Bombardier senior technical adviser, flight sciences, Core Engineering, discussed the recent history of takeoff accidents and incidents in winter operations involving CRJ200 and CL600 aircraft, in which, he said, "Generally, it has been found that there was a failure to follow the published operational procedures for the aircraft."

Speakers from left: Williamson, Wiszniowski and Leroux

Photos: Rick Darby

Among the analytical findings, he said, were that "in all cases, a premature wing stall occurred during the takeoff rotation. It is believed that the premature wing stall was caused by ice contamination along the wing leading edge."

Accidents involved failure to deice or anti-ice properly, he said. In every accident, the wing anti-icing system was not used. In-service experience with the two Bombardier models showed that "no 'winter operations' accident has *ever* occurred where the wing anti-ice system was selected 'ON,'" he said. Tanner said that a review of operators' documentation found that several operators had pilot checklists lacking a pre-takeoff check for wing anti-ice selection. Another causal factor was excessive rate of rotation, with the average maximum pitch rate greater than 6 degrees per second.

Airplane flight manuals (AFMs) for the CRJ200 and CL600 now call for tactile inspection of the wing leading edge and upper surface when the outside air temperature is lower than 5 degrees C (41 degrees F), or the wing fuel temperature is 0 degrees C (32 degrees F), or "the atmospheric conditions have been conducive to frost formation," he said. Such definite criteria are better than vague conditions such as "water on the wing" or "visible moisture." In another change to the AFMs, "wing anti-ice is required to be 'ON' for all takeoff operations when the outside air temperature is less than or equal to 5 degrees C, and visible moisture is present below 400 ft above ground level, or the runway is wet or contaminated, or there is any precipitation." The new procedure and a new definition of ground icing conditions supersede a former 1-mi (1.6-km) visibility criterion that was found to be ineffective in ensuring that wing anti-ice was used appropriately.

High-altitude ice crystals have recently been connected to engine power loss and aircraft damage. Since 1991, more than 100 such events have been recorded. Jeanne Mason, senior specialist engineer in engine icing and inclement weather with Boeing Commercial Airplanes, described an incident in which high-altitude ice crystals resulted in multiple engine flameouts in a 747 on descent into Manila, Philippines.

"'Icing conditions' has always referred to conditions where super-cooled liquid drops cling to airframe surfaces, typically below 22,000 ft," she said. "But high-altitude water is likely to be frozen ice particles — crystals — rather than super-cooled liquid drops." Crystals can form ice even on surfaces warmer than freezing temperature, such as compressor surfaces aft of the engine fan, she said. Ice shed from compressor surfaces can cause surges, flameouts or engine damage.

Convective, cumulonimbus clouds have a high concentration of ice crystals, Mason said. "Strong updrafts and heavy rain are conducive to water and lots of potential ice crystals," she said. "The key to identifying clouds that contain ice crystals is heavy rain below the freezing levels." Crystals accumulate in the "anvil" part of a cumulonimbus cloud and have poor reflectivity for aircraft weather radar. "Use the tilt feature of the radar to identify heavy rain below, a good indicator that ice crystals may exist above the rain," she said.

Bryon Mask, a retired Air Canada captain and ACPA director of flight safety, discussed the use of flight data analysis (FDA) in winter operations in a program "designed to enhance safety through the controlled, automated recording and analysis of flight data generated during routine line operations." The data are retained and used for safety, trend and operational analysis.

"It is imperative to store lots of data for best results," he said. "From our perspective, 15 months is the minimum for data mining, that is, asking complex questions of the database and receiving answers based on enough data. Air Canada has kept over 4 terabytes of data." A terabyte is 1,000 gigabytes.

As examples of how FDA can help reveal risk factors in winter operations, Mask cited studies to determine whether tail-mounted engines like those on the Challenger CL-65 were susceptible to icing, and another study to see if engine ice-clearing procedures for operating engines at idle in prolonged icing conditions on the ground were followed. In both cases, the danger to be avoided was engine fan blade damage.

Mask told an anecdote that summed up the importance of taking precautions to reduce the risks of winter operations:

"Back in the early 1970s, I was flying helicopters. We stopped at a small airport in Quebec for refueling. We set the chopper down beside a light twin, which had obviously been there for two or three days because it was covered with snow and ice.

"We saw a gentleman walk up to the aircraft, open the door and get out a broom. He went over to the left wing and took a little snow off it, then did the same on the right wing. He didn't even bother with the tail. He then started to get back in the pilot seat.

"We went over to him and asked, 'Excuse me, are you waiting for the deicing truck?' I'll always remember his words: 'There's no need for deicing. I'm not going very far.'"

A Conversation With Capt. Barry Wiszniowski, Air Canada Pilots Association

AeroSafety World: Why did you organize this conference?

Wiszniowski: For one thing, because the Air Canada Pilots Association was respected but not well known. We have 3,000 professional pilots with experience and expertise operating in the Canadian winter environment. This is one of our specialties, and we wanted to share it with the industry, including foreign carriers coming into Canada — because for many of them, operating in icing conditions is anything but a normal procedure, and some have never seen a major snow or ice event before. For us, winter operations are normal operating procedures.

ASW: Quite a few Canadian pilots are here as well. They must have felt they had something to learn, too.

Wiszniowski: It's like what one of your Americans, [former Secretary of Defense] Donald Rumsfeld, said: There are the known knowns, the known unknowns and the unknown unknowns. There are things we don't even know that we don't know.

ASW: What are some of the things that even pilots experienced in winter ops might not understand, or not fully understand?

Wiszniowski: [Deicing] fluid failures, deicing techniques, some of the technological advances that will make operations safer and things that we should avoid — the traps in deicing. So through the education process we had today, with the airport authorities, fluid and deicing equipment manufacturers, and so on, we can eliminate the known unknowns.

ASW: What if anything is still uncertain?

Wiszniowski: We don't know the characteristics of a fluid failure. As one of the presentations demonstrated, we don't know the effect of one wing being contaminated and what level of contamination is going to lead you into a serious event. From the airport side, we don't know the effect of an unstable approach or noncompliance with SOPs that is going to put you in harm's way.

ASW: What kind of noncompliance is especially risky in winter operations?

Wiszniowski: There's always the possibility of the normalization of deviance, where someone thinks, "I don't have to perform a stable approach all the time, because I've always gotten away with it." And now he's in a situation where he has a contaminated runway, the airframe has picked up ice on the flaps and he's above the approach speed.

ASW: So the margin for error is drastically reduced.

Wiszniowski: Yes. In another example of an unknown discussed here, we found that air traffic control (ATC) did not know that we do an engine run-up on the runway. We do that because it's part of our operational procedures — it's in the Embraer FOM [flight operations manual], it's in the Airbus FOM, that when you're in icing conditions, before you take off you have to do a run-up.

So the unknowns aren't only among the pilots. They're on the ATC side of the house and the airport side of the house. Through this conference, now we're getting together as a community.

ASW: Is this conference a one-off, or will there be others?

Wiszniowski: We are planning to hold another two years from now.

— RD

Bird Control

BY LINDA WERFELMAN

A Citation's collision with a flock of pelicans has prompted a call for more consistency in bird strike certification.

Bird strike certification requirements should be revised and made more consistent for transport category airplanes, and aircraft manufacturers should develop specific guidance to help pilots minimize damage in the event of a bird strike, the U.S. National Transportation Safety Board (NTSB) says.

The NTSB developed these safety recommendations and others, all addressed to the U.S. Federal Aviation Administration (FAA), as a result of its investigation of the March 4, 2008, crash of a Cessna Citation 500 that collided with a flock of large birds after takeoff from Wiley Post Airport in Oklahoma City.

All five people in the airplane were killed and the airplane was destroyed in the crash, which occurred about two minutes after takeoff for the flight to Mankato, Minnesota. The airplane was over the southeast corner of Lake Overholser, climbing through 1,800 ft above ground level, when it rolled left and spiraled, nose down, to the ground, witnesses said.

In its final report, the NTSB said that the probable cause of the accident was "airplane wing-structure damage sustained during impact with one or more large birds (American white pelicans), which resulted in a loss of control of the airplane."

The report said that American white pelicans typically weigh between 8 and 20 lb (4 and 9 kg), with wingspans from 96 to 114 in (2 to 3 m). The NTSB calculated that the accident airplane, which was traveling at 200 kt, would have generated kinetic energy of up to 35,416 ft-lb in a collision with just one pelican. However, the Cessna 500 wing structures are designed, in accordance with transport category airplane certification requirements of U.S. Federal Aviation Regulations (FARs) Part 25, to withstand a collision with a 4-lb bird while in cruise at 287 kt; according to NTSB calculations, such a strike would generate kinetic energy of 14,586 ft-lb — less than half the force generated by the accident airplane's collision with one pelican.

Although the 4-lb standard applies to airplane wings and other airframe structures, a stricter requirement applies to the empennage, which must be able to withstand the impact of an 8-lb bird. The empennage requirement was implemented in 1970, after a review of bird strike data — ordered in the aftermath of a 1962 bird strike accident — prompted the FAA to conclude that, although "most existing transport airplanes were inherently bird resistant, a few types … were not sufficiently resistant in the empennage area."

The differing standards have persisted, and the NTSB said it is "concerned that the current airframe bird strike certification standards, which are inconsistent in that different criteria apply to different structures on the same airplane, have evolved piecemeal … and do not uniformly address the risks to aircraft presented by current bird populations."

These bird populations have shifted in the past 30 years, and although the total bird population has declined, populations of large bird species — those weighing more than 8 lb — have increased significantly, the NTSB said.

"Therefore, the NTSB concludes that the current airframe certification standards for bird strikes are insufficient because they are not based on bird strike risks to aircraft derived from analysis of current bird strike and bird population data and trends and because they allow for lower levels of bird strike protection for some structures on the same airplane."

The safety board's recommendation to the FAA called for a revision of bird strike certification requirements for Part 25 transport category airplanes so that the "protection from in-flight impact with birds is consistent across all airframe structures."

'Operational Strategies'

The NTSB said that, although most efforts to prevent bird strikes rely on wildlife hazard management, proposals also should be studied to identify operational practices, such as a slower airspeed, to reduce the severity of damage in the event of a bird strike.

"Pilots face many safety of flight considerations for airspeed selection during airport departures and arrivals," the NTSB said. "These may include, but are not limited to, air traffic control clearances, maneuvering requirements and desired climb performance or descent rates."

U.S. National Transportation Safety Board

Accident investigators developed a simulation-based illustration of the Citation's descent and ground impact.

In most cases, pilots would not select an airspeed solely because of the presence of birds in the area; nevertheless, the NTSB said, "Knowledge of the range of target airspeeds within which the aircraft can operate below the bird strike energy defined by the certification standards could be useful in scenarios in which flying within the target airspeed range is feasible without compromising other safety of flight issues."

The NTSB also recommended that the FAA require general aviation airports that receive federal funds and are surrounded by woodlands, water or wetlands to arrange for wildlife hazard assessments to be conducted by a wildlife damage management biologist and to "establish a distance of 5 mi" between the edge of the airport operations area and any area that could attract wildlife and result in "hazardous wildlife movement into or across the approach or departure airspace."

Included among the other recommendations was a call for the FAA to require operators of airports that serve air carrier aircraft, as well as aircraft operators regulated under FARs Part 121 (air carriers and commercial operators), Part 135 (commuter and on-demand) and Part 91 Subpart K (fractional ownership), to report all wildlife strikes — as well as the species involved — to the FAA National Wildlife Strike Database.

The NTSB noted that in the past, the FAA has said that data and species information are "critical for biologists developing and implementing wildlife risk management programs at airports because a problem that cannot be measured or defined cannot be solved."

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Does LaGuardia Need

New York City plans to build a garbage transfer station less than half a mile from LaGuardia Airport.

BY STEVEN D. GARBER

Plans by the New York City Department of Sanitation to build a truck-to-barge transfer station handling nearly 2,700 tons of garbage a day, and up to 5,000 tons per day, close to New York's LaGuardia Airport (LGA), have prompted some to object. The facility at College Point would be around 2,200 ft (671 m) from the end a busy LGA runway. The Port Authority of New York and New Jersey, the airport operator, and the Department of Sanitation say that closed containers on barges and trucks, plus handling the transfer in an enclosed structure, would not attract birds. If this were true, you would think they would have done the studies that prove this, as required by the National Environmental Protection Act (NEPA), but they haven't.

There are more Canada geese, gulls and other large birds in the skies around cities and airports in North America than ever. Wherever birds and airplanes share the same airspace, it's only a matter of time before another airplane crashes, as was the case this past January when an aircraft that had departed from LGA was forced to ditch in the Hudson River.

There are many rules, laws and regulations regarding managing birds around airports, and some of these rules are taken seriously by airport management. Some rules, however, aren't.

Rule number one: Garbage attracts birds. Therefore it would seem safe to conclude that the Port Authority of New York and New Jersey knows that LGA should not be surrounded with garbage barges, garbage trucks and a garbage transfer station, but that is not the case.

LaGuardia's management knows better. I know this for sure because I used to be part of Port Authority's management. I've worked closely with Port Authority Airport Directors Al Graser, Warren Kroeppel and Lanny Rider. Why would they let College Point become Garbage Point?

New York City is much like many other cities in that its Sanitation Department has far more power than makes sense, unless you appreciate the inner workings of cities. What's so unusual here is that it's not just New York that has made the wrong choice. Here, we've seen every government agency on the wrong side of this issue.

More Birds?

Although most New Yorkers were saddened, few were surprised when, along with the New York City and New York State agencies, the U.S. Federal Aviation Administration (FAA) told the Sanitation Department it could build — right next to LGA — a marine transfer station, with all the garbage-related business that would involve, even though these activities are against FAA regulations and even though these activities fall squarely within the LGA runway protection zone.

If anyone should have been able to see this for what it is, it's New York Mayor Michael Bloomberg, a pilot who knows how important it is to protect America's busiest airspace and those of us who live around the airport. Bloomberg recently was in a jet that hit a bird. Shortly thereafter, he scheduled a tour with the FAA and the Port Authority of the new transfer facility he was supporting. Almost immediately after his tour, yet another LGA jet hit yet another goose.

Bird strikes at LaGuardia have been steadily increasing. The FAA has rules that call for reducing the risks, not increasing them, and yet, that's exactly what the FAA is doing by giving the green light on this. Instead of taking measures designed to minimize hazardous wildlife attractions on and around the airport, it seems all involved are doing the opposite of what is required to reduce or eliminate the number of gulls and geese and other dangerous species flying directly through sensitive areas that lie under or next to approach and departure airspace.

Luckily, the fear of negative media reports still has some impact on those involved. That's why I'm writing this. I want to remind them and everyone else around the world who might be contemplating building a bird attractant near an airport that, in the end, it can only lead to tragedy.

New York City has stepped up to this issue in the past. I've been involved in forcing other Sanitation Department operations to close over the past several decades, including three garbage dumps surrounding John F. Kennedy International Airport, where birds attracted by the garbage were constantly getting sucked into jet engines.

FAA, in Advisory Circular 150/5200-33B, issued in August 2007, says, "Information about the risks posed to aircraft by certain wildlife species has increased a great deal in recent years. Improved reporting, studies, documentation and statistics clearly show that aircraft collisions with birds and other wildlife are a serious economic and public safety problem." Notwithstanding this support for documentation, it is not clear the agency studied the issue. FAA insists, however, that studies were done and that the garbage barges and garbage trucks and garbage transfer station, for the first time in the history of this planet, will not attract birds.

Instead of fighting these plans tooth and nail, the Port Authority has quietly gone along. In the end, who's going to get sued when the next airplane crashes? It seems most of the government agencies are immune from such litigation. In the end, it's going to be the insurance companies that cover the airlines flying into and out of these airports that will have to pay. So you might think they would balk, and do something to stop the inevitable before it happens. Someone should.

Steven Garber holds an MBA and Ph.D. and he runs the environmental consulting firm, Worldwide Ecology, based in White Plains, New York, that specializes in environmental and legal issues in aviation, wind energy, development, landscaping and park management. The author can be reached at steve@worldwideecology.net.

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

小川航空

In a Fog

Witnesses saw the AS 350B news-gathering helicopter fly into dense fog off the coast of Japan before they heard the sounds of a crash.

BY LINDA WERFELMAN

Low-altitude flight through dense fog probably caused the crash of an Aerospatiale AS 350B television news helicopter off the coast of Japan on July 6, 2008, the Japan Transport Safety Board says. The two pilots were killed in the crash, and their two passengers were listed as missing; the helicopter was destroyed.

The safety board, in its final report on the crash, said that the pilot who is believed to have been at the controls at the time probably lost sight of the horizon and became disoriented in the moments before impact.

The morning of the accident, the helicopter left its base in Akita and flew north to Aomori Airport (Figure 1). The helicopter was refueled at Aomori, and took off at 1116 local time, carrying the two pilots, a television reporter and a cameraman. The crew's last contact with air traffic control was an 1118 call to the air traffic control tower at Aomori Airport in which they said they planned to leave the airport control zone.

The crew had filed a visual flight rules (VFR) flight plan, noting that visual meteorological conditions were reported along their planned route to Shiriyasaki Point. The helicopter carried enough fuel for 3 ½ hours, and they planned to spend about three hours in the air for aerial coverage of a Japan Maritime Self-Defense Forces ship that had reported a fire earlier in the day.

Air traffic control radar recorded the helicopter's flight path and altitude beginning at 1118 until 1144; the radar showed that the aircraft flew along the east coast of the Tsugaru Peninsula, north toward the ship.

The report quoted several witnesses, each of whom discussed the dense fog.

"The weather condition then was fog, and visibility was below 200 m [656 ft] and the sea was very calm," said one witness, who noted that, while he was in a seaside parking lot near a cliff in Gankakeiwa, he saw the helicopter flying at about 100 m (328 ft). "I didn't think the aircraft's flight was unusual," he said.

A second witness, who was fishing with a companion at a breakwater 500 m (1,641 ft) southwest of Cape Omasaki, said he saw the helicopter 700 to 800 m (2,297 to 2,625 ft) offshore, flying "among masses of fog … . It was visible for about 10 seconds. It disappeared into a fog, and I heard a boom right after that."

He used his cell phone at about 1145 to notify police of the crash, he said.

"The sea was dead calm then," the second witness added. "The visibility to the south was good. … The visibility to Bentenjima Island (to the north) appeared to be about 800 m."

Witnesses said that visibility varied, and in some directions, it was a low as 50 m (164 ft).

Forecasts had predicted dense fog until about noon with visibility below 500 m.

Search and rescue operations began about 1209, after the Tokyo Rescue Coordination Center was informed of the crash. The wreckage was found about 700 m southwest of the Omasaki–Bentenjima lighthouse and was recovered from a rocky seabed beneath about 13 m (43 ft) of water.

One pilot's body was recovered three days after the crash; the second was found nine days afterward, the day after search and rescue operations officially ended.

The pilot-in-command (PIC) of the accident helicopter had a commercial pilot certificate for rotorcraft and a current Class 1 medical certificate, and had accumulated 4,981 flight hours, including 942 hours in the helicopter type.

A second pilot, "whose assigned mission was to watch," also had a commercial pilot certificate for rotorcraft and a current Class 1 medical certificate; he had 2,608 flight hours, including 596 hours in the helicopter type. This pilot was referred to in the report as "Pilot A" — and apparently was flying the helicopter at the time of the crash, the report said.

Both pilots received basic instrument flight training on June 16, 2008, as part of PIC qualification renewal flight checks, the company said. "The contents of the training," the report said, "were to fly straight and level [and] to recover from unusual attitudes and the like, under hooded condition to simulate instrument meteorological conditions."

The helicopter was manufactured in 1988 and had a total time of 2,303 flight hours. The engine, a Turbomeca Arriel 1B, had total time in service of 2,674 hours; the last periodic maintenance check was conducted 80 flight hours before the accident. Investigators determined that the helicopter's weight and balance were within allowable limits when the crash occurred.

Television Station Contracts

The operator, Ogawa Air, maintained a base in Akita with three employees. The PIC was in charge. Although the helicopter could be operated with a single pilot, a second pilot often was included in the crew "for visual watch," the report said.

The company had contracts with three television stations to provide aircraft for aerial news-gathering operations.

Flight Route

Source: Japan Transport Safety Board

Figure 1

Daily duties at the Akita base called for one employee to visit the airport weather station to receive a weather briefing and to subsequently disseminate the information to other employees.

The day of the accident, around 0830, Pilot A received the briefing, which said that, although the morning weather conditions around Akita Airport included haze and poor visibility, improvement was expected, and "no foul weather was expected," the report said. The forecast for the Pacific coast called for areas of poor visibility and low ceilings, with improvement as the day progressed. Because no flights were planned, Pilot A did not request more detailed information.

The request was submitted around 0930 for aerial coverage of the ship fire and — after a check of weather conditions and the pilots' health — approved by the operator's head office, which also took control of flight management, the report said, adding that the head office was "unaware of the dense fog advisory issued for [the] Shimokita area" and that neither pilot checked with the airport weather station for an update on weather conditions.

The operator's "Standard for News/Photo Missions" specified that pilots should "change flight routes, … return to airports or … make precautionary landings" if they encountered unacceptable weather conditions during a flight. The precautions are contained in the company's "Handbook for Aerial TV Coverage," developed in 2004, after an accident in which a TV news helicopter struck power lines in Nagano prefecture in central Japan and crashed into the Kiso River.

The report quoted one company official as saying, "I had given safety-oriented directions to pilots to … never try to fly under unfavorable conditions. We do not care [about] losing one or two flight orders by quitting flights." The official added that he believed the policy "should have taken root among all company employees."

He also said that the television stations had never asked the company to fly in unfavorable conditions, and that in June 2008, the PIC ended a flight because of deteriorating weather and returned to the departure airport.

In addition, the report quoted an official of the television station as saying, "Due to the safety-oriented nature of flights, we don't force pilots to fly under difficult situations. The reporter and the cameraman who got on board the aircraft are not pushy types."

Fog Advisory

Investigators said that an analysis of the wreckage indicated that the helicopter had hit the water nose-first, slightly banked left and while traveling at a high speed, and that Pilot A probably had been flying the helicopter at the time.

"It is considered probable that [the pilots] had the general weather outlook in Tohoku area after receiving the weather briefing that morning," the report said. "It is considered possible that they checked the weather conditions of Akita and Aomori airports … before departure … .

Eurocopter AS 350B

The Eurocopter AS 350B is a light utility helicopter with a Turbomeca Arriel 1B turboshaft engine and a rotor of three fiberglass blades that rotate clockwise as viewed from above.

First produced by Aerospatiale in October 1977, the AS 350B has two standard bucket seats at the front of the cabin and two two-place bench seats aft.

The helicopter's maximum normal takeoff weight is 1,950 kg (4,300 lb) or 2,100 kg (4,630 lb) with a maximum sling load. Maximum rate of climb is 1,575 fpm. The AS 350B has a maximum cruise speed at sea level of 125 kt and a service ceiling of 15,000 ft. Hovering ceiling in ground effect is 8,200 ft; hovering ceiling out of ground effect is 5,900 ft. It has a range of 700 km (378 nm) with maximum fuel of 535 L (141 gal).

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

"Given the fact that neither [pilot] confirmed the updated weather information at the weather station on the Aomori Airport, it is considered probable that they resumed their flight without knowing the issuance [and continuation of the] fog advisory. Given the fact that the head office was unaware of the issued fog advisory over [the] Shimokita area, only recognizing the non-problematic weather conditions over [the] Akita and Aomori region, and with the PIC's aborted coverage flight one month before due to bad weather, it is considered probable that the head office expected that the same action would be taken and did not take measures to acquire new weather information."

Radar information indicated that the pilots flew north from Aomori, probably intending to locate the ship before it entered Mutsu Bay. Visibility along some parts of their flight path probably was less than 1,500 m (0.9 mi) — less than required for VFR flight for the area.

The report said it was possible that the pilots continued the flight because they could see the coastline and because they expected the weather to improve.

However, the fog near Bentenjima Island and to the east was likely to persist, the report said, because the sea surface was calm and there was no wind.

"Under this weather condition, it is considered probable that visual altitude judgment was difficult with the … horizon [obscured] by fog," the report said. As a result, it probably also was difficult for the pilots to determine the helicopter's attitude, the report said, adding that the PIC "should have abandoned proceeding further east beyond Cape Omasaki."

The pilots may have been attempting to fly out of fog at the time of the crash, the report said.

"It is considered probable that the aircraft was circling left to get out of the fog by turning to the opposite direction, turning to the direction of no expected obstacles and to the direction of easy lookout for … Pilot A," the report said. "Despite the maneuver, the aircraft probably flew into a dense fog and its surroundings became all white. It is considered possible that in the dense fog, … Pilot A lost the horizon as the attitude benchmark and … failed to shift to instrument flight quickly, fell into spatial disorientation, failed to maintain altitude and crashed into the sea at high speed."

The report said that at the time of the accident, the ship was cruising 7 km (4 nm) west of the crash site, and "it is considered highly probable that the aircraft was unable to spot it due to poor visibility."

This article is based on Japan Transport Safety Board Aircraft Accident Investigation Report AA2009–5, Ogawa Air Inc., Aerospatiale AS 350B (Rotorcraft), JA9755, Sea Surface off Cape Omasaki, Oma-Cho, Shimokita-Gun, Aomori Prefecture, at about 11:45 JST, July 6, 2008. Adopted June 12, 2009, by the Japan Transport Safety Board aircraft subcommittee.

Wreckage of the AS 350B news helicopter is hauled onto a ship off the coast of Japan, near Cape Omasaki.

Despite an 'economic tsunami' and environmental uncertainties, Europe's regional airlines commit to 2010 safety initiatives.

Cautious Optimism

BY WAYNE ROSENKRANS | FROM INTERLAKEN

Ambrose

Photos: Wayne Rosenkrans

Enthusiasm about advances in aircraft, engines, maintenance, training and safety technologies counterbalanced subdued talk during the General Assembly of the European Regions Airline Association (ERA) about surviving the current economic crisis and coping with environmentally driven costs. In the safety arena, attendees at the Oct. 7–9 event in Interlaken, Switzerland, caught up on initiatives related to fatigue risk management, aircraft deicing/anti-icing, universal occurrence reporting and expansion of just culture.

Priorities on ERA's agenda for 2010 include lobbying for the European Aviation Safety Agency (EASA) to appropriately translate the existing consensus on flight and duty time limitations into the EU OPS 1 regulatory framework, considering fatigue research and operating experience, said Mike Ambrose, ERA director general. "EASA's crew duty and rest time limitations will be a major 2010 portfolio for many ERA operators … and rationally based on safety rather than social needs or regulatory perception."

ERA supports the link to fatigue science "in a way that all of us can achieve the efficiency that should be achievable," added Antonis Simigdalas, ERA president and CEO of Olympic Air.

The current EU OPS 1 flight time limitations (FTL) impose "high level" parameters considered equal or superior to those applied for many years by national aviation authorities, Ambrose said. "No European Union [EU] state has a conspicuously poor safety record regarding crew fatigue; indeed, I cannot think of one accident involving an EU airline in which crew fatigue was a significant factor," he said. "Likewise, I expect the 'low level' parameters — for example, split duty and reduced rest — to be subject to the same level of national aviation authority scrutiny and enforcement that has always existed. All operators have always had an obligation to ensure that neither the application of regulations nor the application of local agreements and rostering patterns results in crew fatigue."

While the ERA Board addresses FTL, the ERA Air Safety Group will focus on mitigating risks of frozen residues from thickened fluids used for aircraft deicing and anti-icing affecting aircraft flight controls (*ASW,* 10/08, p. 27, and *ASW,* 11/08, p. 15); regulation of airport deicing/anti-icing service providers; full implementation by states of the European Commission's directive on occurrence reporting; and encouragement of the region's air navigation service providers (ANSPs) to adopt a charter for just culture with guidelines for no-penalty reporting procedures. The group also will advise operators on obtaining funding to acquire datalink and automatic dependent surveillance–broadcast equipment and work with Eurocontrol on identifying suitable airports for regional airlines to implement continuous descent approaches.

Ambrose and Simigdalas also described ongoing vigilance for EU legislative and judicial actions that could adversely affect operational risk. For example, member airlines protested a recent judicial interpretation requiring — without any known consultation with safety specialists — passenger compensation for flight cancellations for technical reasons, he said. "European Court of Justice deliberations and decisions regarding the application of Regulation 261/2004 on passenger compensation and assistance, although no doubt considered with the best of intentions, illustrate how important decisions undertaken by ill-informed decision makers can fail to provide EU citizens with the 'justice' to which they are entitled," Ambrose said.

"They could result in airlines having to pay compensation to passengers on flights cancelled for safety reasons such as equipment failure on the aircraft. The court has decided that such failures are not 'exceptional circumstances.' The result is that someone, somewhere, sooner or later, will accept an aircraft that might be 'legal' to fly but might have a cumulative set of allowable deficiencies that the aircraft commander would otherwise deem unacceptable were it not for the commercial pressures of compensation payments if the flight is cancelled."

Battling Criminalization

Aviation accident criminalization — the prosecution and punishment of aviation professionals with fines and imprisonment — continues to have a "corrosive tendency on safety" in Europe despite alarms raised in an October 2006 joint resolution by the Flight Safety Foundation, Royal Aeronautical Society, Académie Nationale de l'Air et de l'Espace and Civil Air Navigation Services Organisation (*ASW,* 1/07, p. 13), said Sean Gates, senior partner of Gates and Partners, London.

The practice has a "very chilling" effect on aviation professionals routinely disclosing safety-critical information and discourages some witnesses from cooperating in the safety investigations of crashes, he said. As a result, the careers and even retirements of CEOs, regulators, pilots, maintenance technicians, air traffic controllers and others have become more vulnerable to being destroyed unjustly when the public wants to identify and punish "guilty" parties, he added.

"You may discover that as a consequence of something you have done in your home country, you may be prosecuted in one of the other states of the European Union, in a foreign language with foreign criminal procedures," Gates said. "You've all got plans ready to accommodate years in a foreign country dealing with a set of criminal procedures against you and the possibility of five to 10 years in a foreign slammer [prison], is that right? And do you have a million euros [about $1.5 million] put by to cover your defense costs?"

Crashes in some countries still lead automatically to a criminal investigation targeting all parts of the aviation industry, with a high probability of prosecution. "The surprising thing to many people — certainly in the United Kingdom — is the power of some countries to issue arrest warrants and initiate extradition processes," Gates said. "We can no longer just examine the charges against our nationals as to whether they would stand up in a U.K. court. Today, they are automatically obliged to go to whichever European court summoned them."

Involvement of judicial authorities sometimes generates simultaneous investigations in multiple jurisdictions. "At one airline, the chief flying officer was subpoenaed to attend criminal procedures in two jurisdictions on the same day," Gates said. "He could only attend one, so the [foreign] court to which he said he couldn't go issued an arrest warrant to Scotland Yard, which had to execute the warrant. Fortunately, we were able to intervene. The idea that an airline executive could be arrested and taken to prison as a result of such conflicts is absurd."

Other trends are the targeting of chief executives and mid-level managers, and misuse of the official report produced by a national safety investigation authority, as has occurred in cases in Greece and Cyprus, he said. "Accident reports also are routinely used in France, Spain and Italy as part of the prosecution process," Gates noted. "All of these states are signatories to the Chicago Convention [the 1947 Convention on International Civil Aviation that created the International Civil Aviation Organization (ICAO)]. ICAO Annex 13, *Aircraft Accident and Incident Investigation,* sets down what accident reports should be used for and what they should not be used for. This is an international law, which all these countries have signed and all of them continue ignoring."

Some consequences have been subtler than the argument about impeding the flow of critical safety information. "It is more insidious than that," Gates said. "Talking to a number of witnesses in connection with an event, I also was told several times that there is a growing tendency when checking out [the crew as a

Photos: Wayne Rosenkrans

From top: Simigdalas, Gates and Stark.

causal factor not to] describe the actual circumstances that could give rise to a critical comment about them." The reason is that if the airline continued to employ a pilot who received such critical comments, and this becomes evidence in a subsequent criminal investigation, the record very easily could be used against the airline, he said.

He counsels clients to incorporate into their crisis management manuals contingency plans for criminal prosecutions in the home country or foreign countries as applicable, he said. "Stopping accident criminalization only can be addressed at ICAO, but that takes six or seven years. Meanwhile, we need sustained industry attention to this issue, and we need the public to understand it."

H1N1 Virus Threat

European regional airlines, like other airlines in the Northern Hemisphere, can take several actions to prepare for the current pandemic caused by the 2009 Type A (H1N1) strain of the influenza virus, according to Craig Stark, a physician and regional medical director of SOS International for Northern Europe and Russia. So far, this flu strain typically has caused mild illness — sometimes resulting in public complacency — but also caused severe respiratory illness and deaths during winter in the Southern Hemisphere.

"No one knows what this virus will do," Stark said. "In Australia, they have just finished their research, and their newly released reports[1] may give us a preview of what is to come. People over 65 seemed to be protected by natural immunity. Those severely affected were in a 15- to 40-year-old age group; 40 percent of those who died were healthy and under age 65. Australia also identified at-risk groups: pregnant women and patients with chronic medical conditions such as diabetes, asthma and heart problems."

The number of patients simultaneously requiring treatment in intensive care units (ICUs) strained health care resources in Australia. Some of the sickest patients survived and some died after undergoing seven to 15 days of extracorporeal membrane oxygenation, which is oxygen treatment of blood outside the body for patients with acute respiratory distress syndrome, he said.

H1N1 has a very high attack rate and very high morbidity. "That means it causes significant illness that may not kill your employees but might make them sick for seven to 10 days, and if you are not careful, you might have all your employees sick at the same time, which obviously could cripple your [operations]," he said. "If an infected person coughs or sneezes, particles of the virus become aerosolized in the air, and if these droplets land on a hard surface they can infect others for up to 48 hours." Infected people are infectious from one day before until about 14 days after their flu symptoms appear.

Airlines and other aviation organizations already should have a pandemic plan in place to mitigate potential disruptions and operational risks from temporary reductions of the normal contingent of employees. Plans ideally will spell out how to coordinate back-up resources, including assigning people to work from alternative locations, such as by telecommuting, and how to obtain mission-critical products if normal suppliers have closed temporarily. The master plan should be customized for flight operations and safety departments, airline hub offices, call centers, maintenance facilities, airport check-in/gates and categories of critical staff such as aircraft crewmembers who are prone to infection while on duty.

As soon as school closures begin during the pandemic's typical seven- to eight-week period in a local community, employers typically lose 15 percent of their workforce, Stark said. "Ideally, the company will identify in advance critical people who would not be able to come to work when that happens," he said. During the three-week peak local period of the pandemic, only 50 to 65 percent of personnel may be available to work.

Therefore, clear policies must be set for how to handle employees who call in sick and how to handle employees who report for duty with flu-like symptoms, he said. The policies may have to be applied for weeks to months because the global crisis can be expected to last from nine to 15 months.

Airline crewmembers who fly international trips especially should be aware of the importance of an H1N1 vaccination — which can safely prevent 70 to 90 percent of influenza-specific illness — and the possible lack of availability of anti-viral medications such as Tamiflu and Relenza or physicians who can prescribe them to crewmembers who are away from home.

Note

1. The Australia and New Zealand Extracorporeal Membrane Oxygenation (ANZ ECMO) Influenza Investigators. "Extracorporeal Membrane Oxygenation for 2009 Influenza A (H1N1) Acute Respiratory Distress Syndrome." *JAMA-EXPRESS*, the online Journal of the American Medical Association. Oct. 12, 2009. Of 68 patients receiving this treatment between June 1 and Aug. 31 in 15 intensive care units (ICUs), 48 survived until ICU discharge, 32 survived until hospital discharge and 14 died. They ranged in age from 26 to 43. Fifty-three had confirmed cases of 2009 H1N1 influenza and eight had Type A influenza not subtyped as H1N1. An additional 133 patients with Type A influenza during the same period only received mechanical ventilation in the same ICUs.

That VISION Thing

Electronic vision enhancement technology becomes widespread in corporate aviation products.

BY J.A. DONOGHUE | FROM ORLANDO, FL

Whether it be equipment providing a better way to see what is really out there or showing a highly detailed representation of what should be in front of the cockpit, there is no lack of options in the corporate aviation world, as judged from a visit here to the 62nd Annual Meeting and Convention of the National Business Aviation Association (NBAA).

However, that wasn't the first thing people here talked about, or any other piece of technology or hardware — economic matters ruled most discussions. For an industry that was flying so high just a year ago, the present state of affairs is sobering, to say the least.

Most manufacturers steered away from discussing the state of their order backlog, but Cessna Chairman, Chief Executive Officer and President Jack Pelton was quoted as saying that half of his company's 2008 order backlog of $16 billion disappeared in nine months. Agreeing with the predictions of

some of his peers, Pelton judged that 2010 would be the market low.

Gulfstream, which in the previous few weeks rolled out two airplanes — the G250 and the G650, begun in happier times — is "starting to see some positive times, signs of increased flight hours," said Joe Lombardo, company president, "especially in large-cabin airplanes."

Manufacturers' inventories of used aircraft ballooned as already-negotiated trade-ins came in but didn't go out. Dassault Falcon Jet President John Rosanvallon had the most vivid tale: "Before the start of the recession in 2008 we had almost no inventory — four aircraft. We had 110 in May 2009," although by mid-October that number had declined to 97, he said. "That inventory probably will go away in 18 months."

That timeframe was in synch with forecasts from others. The consensus seemed to be that the decline has stopped, but that recovery would be slow, indeed, especially in the next two years, in part due to the competition for new aircraft orders presented by the glut of used airplanes that were designated for trade-in during the hot market cycle of a year or two ago.

Honeywell issued a forecast that said business jet operations had stopped declining in the U.S. and Europe and showed a slight increase. A survey of existing operators showed that 40 percent expected to expand or replace their fleets in the next five years, but 85 percent of that group said the buys would be toward the end of the five-year period.

Forecast International, an independent analysis group, seemed most pessimistic, saying business jet deliveries will continue to decline until 2012. However, noting the lag between placing orders and taking deliveries, that estimation is closely in line with others. In fact, FI was more optimistic for a few years out, saying that deliveries will hit a new annual record of 1,400 aircraft in 2016. Last year Honeywell predicted that level of deliveries would be reached this year. Now, Honeywell hopes the world market will approach 1,300 annual deliveries by 2019. Bombardier's forecast was in line with this thinking, as well.

An interesting aspect of the current market is the absence of any purchase activity by fractional operators, several manufacturers said. One forecast said that fractional operators would no longer be an expanding element in the business jet market, but would remain active, ordering replacement aircraft.

© Garmin

One of a new family of touch screen–controlled integrated flight decks for light turbine aircraft, the Garmin G3000 SVT adds synthetic vision.

The spread of enhanced and synthetic vision devices throughout the corporate fleet, or at least the availability of such devices, was evidenced by the many announcements at the show.

Gulfstream, one of the earliest users of enhanced vision systems (EVS), said it recently delivered the 500th Gulfstream Enhanced Vision System, eight years after the system was first offered. The EVS II, the newest version of the system, using a nose-mounted infrared camera to provide a clearer picture of what lies ahead in dark and reduced-visibility situations, has been installed in 36 aircraft. It will be part of the standard avionics suite on the new G650.

Honeywell VP-Aftermarket Brian Sill said its Primus Epic line is being developed with an EVS merged with a synthetic vision system (SVS). Honeywell has been flight testing its SmartView system with more than 25 hours flight time at the time of the show.

SmartView is a heads-down display with the same information others receive in a heads-up display (HUD) system without the added cost of a HUD, Honeywell said.

Garmin introduced its new G3000 touch screen–controlled integrated flight deck for light turbine aircraft. The complete system includes

Jay Donoghue

Committee Sets Safety Targets

The Safety Committee of the National Business Aviation Association meeting in Orlando, Florida, U.S., had a task: Assemble a list of the sector's top safety concerns, "creating a strategic roadmap directing future committee work," said the group's chairman, Roger Baker, a safety consultant and former U.S. Federal Aviation Administration official.

This is the initial list the committee compiled, without any specific priorities or ranking implied.

Complacency was judged to be a major issue that required a good definition and strategies for correction. This seemed tied in many ways to a long committee discussion on leadership, and the need to raise the awareness of corporate operators about the importance of personally informed leaders who constantly seek to enhance their knowledge.

Safety Culture also has strong leadership themes, the committee said. The first part of this focus, also using the familiar "just culture" label, would include "what is it and how do I do it," likely using case studies. The role played by corporate succession planning, making sure that there are people in the pipeline trained to assume management positions, also was thought important.

Fatigue Management, Awareness and Education was on the minds of many, especially with the increased range of modern large-cabin business jets.

Training, especially in terms of what training vendors supply, and the operator's role in determining the adequacy and appropriateness of the training program, was thought to be of vital importance.

Data Collection and Analysis was judged essential, "how to get it and what to do with it," especially in developing a robust safety management system. Several committee members noted the value they had found in corporate flight operational quality assurance programs, also called flight data monitoring.

Runway Excursions, and how to avoid them, was said to be an important education and training point.

Safety Management System (SMS) development is important, closely tied to data collection and analysis. The committee believed there's a need to identify "what are we doing."

Maintenance, especially in terms of following procedures, and management awareness of maintenance activities when they are outsourced, was judged to be crucial.

Emergency Response Plans are important not only for continuity of operations in a safe manner, but also to ensure that corrections are put into place after incidents and accidents.

Ground Operations might be overlooked in terms of safety procedures that have a heavy focus on the flight component.

The committee also discussed issuing what originally were called Very Light Jet (VLJ) Training Guidelines, developed by committee members and based on more than four years of actual VLJ training. It was noted that what was once thought to be an imminent tidal wave of VLJ operations had turned out not to be so large and the label "VLJ" was being dropped by many in the industry.

The original goal of the program, which, members said, already was being adopted by major industry players, was to devise training for single-pilot, advanced automated cockpits. Noting this, it was suggested by committee members that the scope of the applicability of the program be expanded to include aircraft above 10,000 lb (4,536 kg) maximum gross takeoff weight, going up to the 12,500 lb (5,443 kg) level, and also to include turboprops. In the end, the name adopted was "Light Business Aircraft Training Guidelines."

— JD

Synthetic Vision Technology that displays three-dimensional images of terrain, obstacles, pathways and traffic.

Forward Vision Systems said it had obtained a supplemental type certificate (STC) to install its EVS-100 and EVS-600 enhanced vision systems on Cessna 208/208B Caravans. The company said that that STC brings the number of aircraft makes and models that have approved EVS installations available to 162.

Bombardier said that its Global Vision cockpit now in testing in a Global Express XRS, which uses the Rockwell Collins Pro Line Fusion avionics, includes an SVS. Pro Line Fusion also offers EVS capability.

The first STC for an SVS on a transport-category aircraft from Cobham Avionics has been approved for use on Cessna 550s, the company said. The firm recently received an STC for its SVS on Bell 412 helicopters.

NBAA reported 1,075 exhibitors at the 2009 show, some 91 percent of the total for 2008. The number of attendees took a bigger hit, with 22,920 at the show's final day, 75 percent of last year's total. Ed Bolen, NBAA president and CEO, said, "This was an opportunity to come together all in one place, and underscore the importance of business aviation to citizens, companies and communities across the country, and articulate a vision for our future." This recurring theme, the practical utility of business aviation, was repeated constantly by the exhibitors.

Hearing the Call

U.S. air carriers are handing the FAA written promises to institute recommended safety programs.

BY LINDA WERFELMAN

Ninety-three percent of U.S. air carriers have responded to the U.S. Federal Aviation Administration (FAA) "Call to Action on Airline Safety and Pilot Training" by submitting written promises to implement specific safety practices, including the establishment of two safety-information-gathering programs, the FAA says.

The information-gathering programs are flight operational quality assurance (FOQA) — sometimes known as flight data monitoring — and the aviation safety action program (ASAP) — a voluntary, self-disclosure reporting program. The airlines also agreed to develop data analysis "to ensure effective use of this information." In addition, the FAA called on air carriers to ask pilot job applicants to voluntarily disclose certain FAA records, including "notices of disapproval for evaluation events," and to "adhere to the highest professional standards."

"We take these commitments very seriously and believe they are a big step toward making future commercial air travel even safer than it is today," said FAA Administrator Randy Babbitt.

In early October, the FAA singled out the 30 airlines[1] that had not complied with the agency's request for a written commitment, making public a list of their names.

"The operators … who have not responded need to understand the American public will ultimately judge their reluctance to adopt proven safety practices," Babbitt said. "The fact that carriers haven't responded or are too small to have certain programs in place will be taken into consideration when performing FAA surveillance activities. Our goal is to ensure that all carriers are operating at the highest levels of safety."

He noted, however, that several of the named carriers already were using FOQA and ASAP and that some "may simply be too small or have too limited operations for FOQA programs to be practical."

Around the same time, Babbitt told a congressional subcommittee that the call to action in June was followed by a letter to all air carrier operators and their unions, seeking to "solidify oral commitments" to honor the call to action — in particular, commitments in several key areas, including FOQA, ASAP and voluntary pilot disclosure of FAA records.

In addition, Babbitt asked labor organizations for their commitment in the following areas:

- To "establish and support professional standards and ethics committees to develop peer audit and review procedures, and to elevate ethics and professional standards";
- To "establish and publish a code of ethics that includes expectations for professional behavior, standards of conduct for professional appearance and overall fitness to fly"; and,
- To "support periodic safety risk management meetings between FAA and mainline and regional carriers to promote the most effective practices, including periodic analysis of FOQA and ASAP data with an emphasis on identifying enhancements to the training program."

Babbitt said that the FAA's June call to action had yielded information that the agency already has begun to use in industrywide safety improvement efforts.

Among the first actions taken by the FAA as a result of the call to action was the establishment of an aviation rulemaking committee to develop recommendations for new rules on flight time limitations, duty period limits and rest requirements for pilots in operations covered by U.S. Federal Aviation Regulations Part 121, "air carriers and commercial operators," and Part 135, "commuter and on-demand operations." The rulemaking process, which is aimed at developing a "science-based approach to fatigue management," is continuing.

In addition to the call to action, another ongoing process, dealing with all aspects of FAA regulations, is the agency's effort to revise procedures used to ensure air carrier compliance with airworthiness directives (see "Procedural Overhaul").

Another element of the call to action involved what the FAA calls a focused inspection initiative, which requires principal operations inspectors for Part 121 operators to "conduct a focused program review of air carrier flight crewmember training, qualification and management practices."

These reviews, which have been completed, called for FAA inspectors to meet

Procedural Overhaul

The U.S. Federal Aviation Administration (FAA), in response to recommendations from an FAA-industry review team, is modifying the procedures used in ensuring that air carriers comply with airworthiness directives (ADs).

The FAA said that the changes are intended to improve "service information and instructions from aerospace manufacturers, air carrier management of planning and prototyping how ADs are implemented, [and] FAA coordination with the air carriers through the planning and prototyping process."

The review team was appointed by then-Acting Administrator Robert A. Sturgell in mid-2008, in the aftermath of two events involving airline compliance with ADs issued by the FAA. The team was asked to review compliance issues related to one of those events, as well as the general process for developing ADs.

The specific event singled out for review involved the cancellation, over a four-day period in April 2008, of about 3,000 flights by American Airlines while the airline conducted aircraft wiring inspections on McDonnell Douglas MD-80s in accordance with AD 2006-15-15.[1]

"From this review, it became clear that while the events that created such massive disruptions were an anomaly, there were areas where system improvements could be made to mitigate such major disruptions in the future," said the final report by the AD Compliance Review Team.[2]

The team's general review concluded, "The AD processes within the FAA and within the manufacturing and air carrier industry have worked well over the years. However, during this review, the team uncovered areas where improvements can be made."

The FAA received related recommendations in September 2008 from an Independent Review Team that reviewed the FAA's safety culture and safety management (*ASW*, 11/08, p. 10).

The FAA has established an aviation rulemaking committee (ARC) to review AD-related recommendations from both panels. The FAA said that the agency is drafting proposals to be considered by the ARC, which is expected to develop an implementation plan; all actions in the plan are expected to be completed by 2011.

—LW

Notes

1. The other event involved the operation by Southwest Airlines of 46 airplanes that had not been inspected for fuselage fatigue cracks in accordance with an AD issued in 2004; the event resulted in a $7.5 million civil penalty against the airline in March 2008. At the time, the FAA said that the 46 airplanes had been operated on 59,791 flights during parts of 2006 and 2007 without having had the required inspections. Southwest said that the missed inspections were "one of many routine and redundant inspections" that involved "an extremely small area in one of the many overlapping inspections" that were conducted to detect early indications of fatigue cracking.

2. AD Compliance Review Team. *Airworthiness Directives: Process Review Technical Report*. July 8, 2009.

with officials of each air carrier to evaluate the carrier's ability to "identify, track and manage low-time flight crewmembers and those who have failed evaluation events or demonstrated a repetitive need for additional training," and to determine whether carriers have adopted FAA recommendations for remedial training for pilots with "persistent performance deficiencies."

About two-thirds of the carriers with traditional systems of pilot training and checking used systems that enabled them to identify low-time crewmembers and those with persistent performance problems, Babbitt said. Carriers without such systems will be subject to intensified oversight to ensure that their training and qualification programs comply with regulatory requirements, he said.

Babbitt said the FAA would provide carriers with guidance material on how to conduct a comprehensive training program review, including information on the role of a review within an operator's corporate safety structure and safety management system. The current goal is to complete the guidance material by the end of the year.

Also by the end of the year, the FAA expects to issue a final report summarizing its findings and recommending additional action items, Babbitt said, adding that the report will include measures to assess progress.

Note

1. In late October, a revised list named 22 operators that had not complied with the FAA request.

FLIGHT SAFETY
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STEP INTO OUR WEB

You'll be glad to be caught

Flight Safety Foundation (FSF) has launched its newly upgraded Web site.

This redesign creates a more interactive forum for the aviation safety community, a place you can depend on to stay informed on developing safety issues and Foundation initiatives that support its mission of pursuing continuous improvement of global aviation safety.

Follow our blog, and get updates on FSF events and comment on issues that are important to the industry and to you.

Follow us on Twitter, Facebook and LinkedIn — join these social networking groups and expand your aviation safety circle.

Follow *AeroSafety World* magazine by subscribing on line for your *free* subscription to the digital issue.

Follow us around the globe — click on the interactive world map that documents current safety issues and the locations of FSF affiliate offices.

Follow the industry news — stay current on aviation safety news by visiting the Latest Safety News section of the site, or check out what interests other people as noted under the Currently Popular tab.

Follow Flight Safety Foundation initiatives such as ALAR, C-FOQA, OGHFA and others, as the Foundation continues to research safety interventions, provides education and promotes safety awareness through its tool kits, seminars and educational documents.

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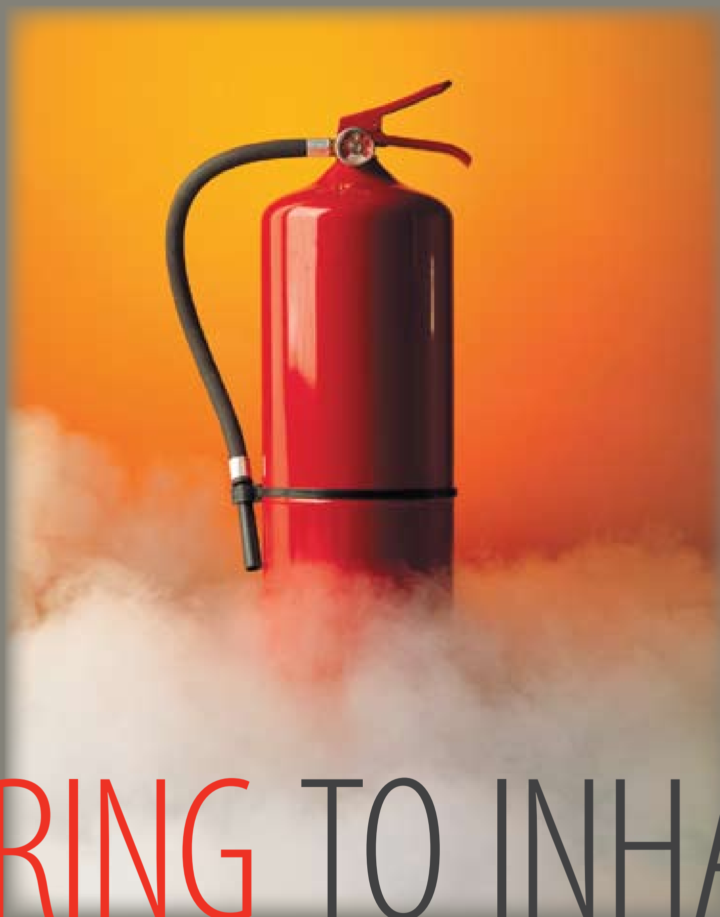

DARING TO INHALE

Research clarifies factors that mitigate risks to aircraft occupants when using hand-held fire extinguishers.

BY WAYNE ROSENKRANS

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Aircraft crewmembers in the United States were reminded in 2004 they should initiate aggressive firefighting without delay because halon extinguishing agents at recommended use concentrations are "relatively nontoxic" compared with exposure to combustion products of fires, and a new study by the Federal Aviation Administration (FAA) reiterates that advice.[1] Concerns of pilots and flight attendants about the toxicity[2] of halon vapors when discharging hand-held fire extinguishers inside aircraft were addressed at that time by the FAA in Advisory Circular (AC) 120-80, *In-Flight Fires,* and by a subsequent companion video and related educational material. The study's findings, however, have led to more conservative guidance about safe-use concentrations of Halon 1211, the predominant clean streaming agent in FAA-required hand-held extinguishers, the FAA said.

Several other halocarbon agents also were examined: Halon 1301, the clean flooding agent used primarily in other aircraft applications; a blend of these two halons; and three halon-equivalent agents — hydrochlorofluorocarbon (HCFC) blend B (Halotron I), and the hydrofluorocarbons (HFCs) 227ea and 236fa. The study included animal testing and mathematical modeling of the human health effects of inhaling the agents at their maximum recommended concentration levels, which depend on aircraft-compartment volume,[3] rates of air exchange in compartments, cabin pressure altitude and aircraft maximum certificated altitude, the study's final report said.

The FAA's updated guidance was introduced first in draft AC 20-42D, *Hand Fire Extinguishers for Use in Aircraft.* This draft AC, issued Oct. 13 for public comment until Nov. 27, is scheduled to replace the 25-year-old AC 20-42C of the same title.

Draft AC 20-42D covers other aspects of safe use of extinguishing agents, including fire-fighting effectiveness and selection, and the location and mounting of extinguishers. It also establishes these equivalent agents as approved replacements for Halon 1211 in the context of international environmental initiatives to phase out all uses of halons (*ASW,* 9/09, p. 29) and discourages the use of any other extinguishing agents in aircraft.

The guidance prevents high concentrations of the tested halocarbons that, if inhaled for less than five minutes, could induce cardiac arrhythmia — that is, abnormal electrical activity in the heart — and if inhaled longer than five minutes, could induce anesthetic effects, the report said. "This report recommends limits on the amount of [these agents] that can be used to fight fires in ventilated and unventilated aircraft compartments without adverse health effects due to inhalation of the agents themselves or low-oxygen concentration caused by agent displacement," the report said. "The technical basis for the prescribed safe-use limits of halocarbon extinguishing agents in aircraft is a simplified kinetic model that describes the halocarbon concentration history in the blood of humans exposed to gaseous halocarbon environments."

"Halon 1211 [guidance] is based on the *no observed adverse effect level* and *lowest observable adverse effect level* concentrations, as maximum safe human concentrations cannot be determined using equivalent methodologies to the other agents," the report said. "Maximum safe human concentrations are generally between [these] concentrations. … The minimum safe volume[4] must be calculated for the agent weight in a particular extinguisher."

Agent-specific discharge amounts for ranges of compartment volumes and operating conditions have been listed in the report's graphs and tables as a safe agent weight to compartment volume (W/V) ratio in pounds per cubic feet. The researchers determined that each known risk of agent inhalation can be mitigated by the updated guidance.

"The minimum safe volume is obtained by dividing the total agent weight by the maximum safe-use agent W/V for the appropriate altitude and aircraft ventilation," the report said. "The minimum safe volume for all extinguishers in a compartment is based on the weight of the agent in all of the bottles in an aircraft compartment."

The typical Underwriters Laboratories–rated 5B:C aircraft fire extinguisher — the capacity and type suitable for hand-held use on flammable liquids and gases and energized electrical equipment — meets FAA standards by combinations of agent weight, nozzle design, pressurization and other factors. The report's graphs and tables show the maximum safe W/V ratios for pressurized aircraft and for unpressurized aircraft, including ventilated and unventilated types equipped to operate up to altitudes of 12,500, 14,000, 18,000 and 25,000 ft. Halocarbon agents are heavier than air, and in pressurized airplanes, can be removed by selecting the air recirculation "OFF" so that the agent passes through floor-level exhaust grilles.

An unpressurized aircraft requires immediate action to mitigate adverse effects based on the study's analysis of minimizing occupant exposure to low-oxygen, partial-pressure environments that can occur when halocarbon agents are discharged in small, unpressurized compartments.

"With exposure times beyond five to 10 minutes at the minimum forecast alveolar [lung] oxygen pressure, some occupants could be incapacitated," the report said. "Thus, guidance on minimizing exposure by using aircraft ventilation and rapid descent is important not only for minimizing exposure to the halocarbon agents but also for minimizing hypoxic hazards in small compartments. … Immediate descent at the maximum safe rate to the lowest practicable altitude or 8,000 ft is recommended for all unpressurized aircraft to minimize exposure to halocarbon gases and reduce hypoxia resulting from the agent displacing oxygen from the air in the compartment. Occupants in unpressurized aircraft equipped to fly above 12,500 ft should immediately don oxygen masks or nasal cannula to prevent hypoxia."

Notes

1. Speitel, Louise C.; Lyon, Richard E. *Guidelines for Safe Use of Gaseous Halocarbon Extinguishing Agents in Aircraft.* FAA Office of Research and Technology Development. Final Report no. DOT/FAA/AR-08/3. August 2009.
2. *Toxicity* in the latest FAA research means an arterial blood concentration at which cardiac sensitization — the onset of electrical abnormalities in the heart when adrenalin is present — began based on canine exposure data, using beagle dogs, which could be applied to humans without data adjustments.
3. *Aircraft compartment* means an enclosed space such as a flight deck, cabin or crew rest facility.
4. *Minimum safe volume* means the smallest volume of space into which a hand-held fire extinguisher can be discharged without posing a toxicity hazard.

BY ROBERT BARON

Speaking of Errors

A survey of regional airline employees reveals attitudes toward error.

Today there appears to be a paradigmatic shift in organizations' handling of errors, with the understanding that human error is both universal and inevitable.[1] Organizations are beginning to accept the fact that errors can and will happen and that more productive mitigation strategies are required.

Attitudes about errors can, in themselves, be a line of defense in error-provoking situations and environments. In fact, in one of the better-known error models known as the Human Factors Analysis and Classification System (HFACS), *attitudes* are explicitly referenced. The taxonomy states that "adverse mental states of operators may be due to personality traits and pernicious attitudes such as overconfidence, complacency and misplaced motivation."[2] These types of attitudes can clearly influence, and actually exacerbate, error-provoking behavior. However, numerous other error-related attitudinal constructs have, to date, been grossly ignored. These include employee attitudes toward errors themselves.

Questionnaire Reveals Attitudes

The study described here investigated error attitudes of employees at a regional airline using the Error Orientation Questionnaire (EOQ).[3] What the EOQ labels *orientation* has been used interchangeably with *attitude* in this study. Attitude was defined as "the way an individual feels about something or someone, which in turn affects an individual's responses and actions."

The EOQ is a 37-item, non-industry-specific survey questionnaire with demonstrated validity and reliability. The EOQ uses eight scales to measure attitudes toward, and coping with, errors at work. The eight-factor model includes six scales — error competence, learning from errors, error risk taking, error strain, error anticipation and covering up errors — and two additional scales, measuring error communication and thinking about errors.

Error competence is defined as "active knowledge for immediate recovery from errors and reduction in error consequences." **Learning from errors** is defined as "the ability to prevent errors in the long term by learning from them, planning and changing work processes." **Error risk taking** is defined as "the result of an achievement-oriented attitude which requires flexibility and taking responsibility." **Error strain** is defined as "a generalized fear of committing errors and by negative emotional reactions." **Error anticipation** is defined as "a general expectancy that errors will happen, because one has a realistic view that even in one's field of expertise, errors will occur."

Covering up errors is mainly "the strategy of a non-self-assured person and may also be an adaptation to error-sensitive conditions at work." A definition of **error communication** was not provided for the EOQ. For this study, it was defined as "the ability to communicate one's errors to the proper channel or to rely on co-workers to rectify any errors that occur." Nor was a definition of **thinking about errors** provided. For this study, thinking about errors was defined as "the reactive thought process that occurs after one commits an error in order to prevent the error from happening again."

Distribution of the EOQ was coordinated and conducted through the airline's management, and participation was voluntary. The EOQ was distributed via e-mail to approximately 400 employees.

Safety-Sensitive Positions

A total of 65 EOQs were returned for a response rate of 16 percent. Although not an impressive response rate, for descriptive purposes this sample was adequate. The respondents consisted of 47 males, or 72 percent, and 18 females, 28 percent. Age ranged from a categorical low of 18–22 years with a categorical high of 63+ years, with 18–22 the largest age category, providing 22 percent of responses.

Years of experience in aviation ranged from a categorical low of 1–5 years to a categorical high of 31+ years, with 1–5 years the largest experience category, providing 42 percent of responses.

Reported employment departments included, in descending order of participation in the survey, ramp operations, flight crew, other, flight operations, maintenance, dispatch and safety (Figure 1). Forty-seven, or 72 percent, indicated they were in non-management positions and the rest indicated they were in management positions. The majority of participants, 97 percent, indicated they worked in a safety-sensitive position.

The scales were organized by theme (Tables 1–6, pp. 50–52). Many questions within a scale were similar to one another. This was to test for consistency, an indicator of validity for the scales.

Orientation Toward Goals

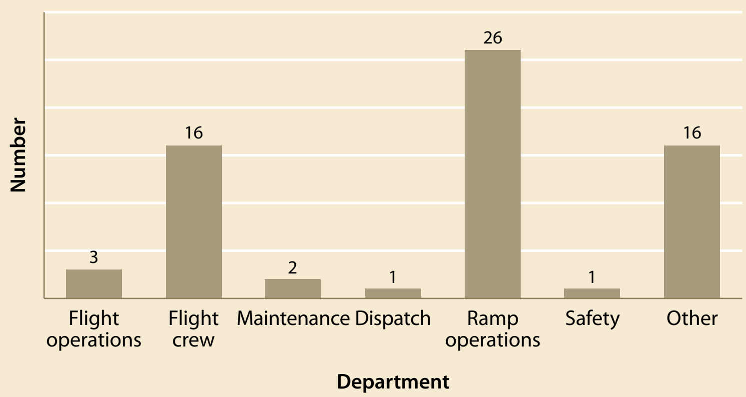
The mean scores overall did not show any major variation between the non-management and management groups. However, some content items had noticeable differences between the means or standard deviations. For instance, in the Error Competence scale (Table 1), item 19, *I don't let go of the goal, although I may make mistakes,* showed a moderate difference in means between non-management and management. This indicates that those employees in non-management positions have a stronger orientation toward completing a goal, knowing that mistakes may happen.

In the Risk Taking scale (Table 3), Item 13, *If one wants to achieve at work, one has to risk making mistakes,* showed a moderate difference in means between non-management and management. This indicates that those employees in management positions have a stronger orientation toward work achievement at the risk of making mistakes. Also, there was less variation, or standard deviation, in the management group.

A qualitative component was also included in this study, consisting of participants' perceptions of why they committed an error on the job, as well as why they believed someone they knew committed an error. These questions were added to the EOQ. The errors were categorized based on their subjective root causes. Some errors were difficult to assign to a specific category, in which case the category that most closely fit was chosen. Twelve root-cause categories emerged (Figure 2, p. 52). The qualitative portion of the study uncovered additional information that was useful in supporting the results of the EOQ. The top three categories combined — pressure, situation awareness and complacency — accounted for well over 50 percent of perceived root causes of errors.

Pressure is exerted by the daily demands of tight flight schedules and affects all personnel including pilots, maintenance technicians, dispatchers and, in fact, anyone directly or indirectly involved with the completion of a flight. Among other things, pressure can lead to shortcutting procedures, irrational decision making and loss of focus. While pressure is not something that can be readily eliminated in the aviation

Regional Airline Survey Respondents, by Department



Note: The responses included 65 returned surveys of about 400 distributed to study error attitudes.

Source: Robert Baron

Figure 1

Error Competence

Item No.	Description	Non-Mgmt (N=47) M	Non-Mgmt (N=47) SD	Mgmt (N=18) M	Mgmt (N=18) SD
8	When I have made a mistake, I know immediately how to rectify it.	3.46	(0.776)	3.55	(0.704)
15	When I do something wrong at work, I correct it immediately.	4.36	(0.605)	4.16	(0.707)
16	If it is at all possible to correct a mistake, then I usually know how to go about it.	3.80	(0.741)	4.11	(0.832)
19	I don't let go of the goal, although I may make mistakes.	4.00	(1.000)	3.38	(0.916)

Agree 1: Not at all, 2: A bit, 3: Neither a bit nor a lot, 4: A lot, 5: Completely

M = mean; Mgmt = management; N = number; SD = standard deviation

Note: The responses included 65 returned surveys of about 400 distributed to study error attitudes.

Source: Robert Baron

Table 1

environment, it can be mitigated. Countermeasures include an awareness of the effects of pressure as well as the ability to understand when and where a line needs to be drawn between "everyday pressure" and the type of pressure that can lead to consequential errors. Situation awareness (SA) is knowing where you have been, where you are currently and where you are projected to be in the future. Mostly related to cockpit operations, SA can also be applied to maintenance and other activities. A common word, *attention,* was used in many of the SA qualitative reports. Countermeasures for inadequate SA include creating an awareness of the reasons why SA may be compromised at a given time. For instance, high-workload situations, ineffective workload management, lack of delegation and complacency may all lead to a loss of SA. In multicrew flight operations, it is critically important that one pilot monitor the other pilot, or in cases where the autoflight system is engaged, monitor the autopilot. Maintaining good SA is required for the entire duration of a flight, but it is critically important during the approach phase, especially in areas of mountainous terrain.

Complacency is a feeling of contentment and self-satisfaction that tends to put employees in an "autopilot mode." People may feel that because they have done the job a hundred times previously with no problems, there will be no problems this time. Repetitive tasks may be met with less conscious attention and awareness by the employee. This has become a major issue in maintenance-related accidents, where complacency has been cited as a contributing factor in airframe or powerplant inspections.

Countermeasures for complacency include increasing awareness of complacency's potential consequences; understanding that just because a task or

Learning from Errors

Item No.	Description	Non-Mgmt (N=47) M	Non-Mgmt (N=47) SD	Mgmt (N=18) M	Mgmt (N=18) SD
4	Mistakes assist me to improve my work.	3.97	(1.073)	4.00	(0.970)
14	Mistakes provide useful information for me to carry out my work.	3.25	(1.259)	3.50	(0.857)
17	My mistakes help me to improve my work.	3.87	(0.991)	4.05	(0.872)
29	My mistakes have helped me to improve my work.	3.72	(1.036)	4.05	(0.937)

Agree 1: Not at all, 2: A bit, 3: Neither a bit nor a lot, 4: A lot, 5: Completely

M = mean; Mgmt = management; N = number; SD = standard deviation

Note: The responses included 65 returned surveys of about 400 distributed to study error attitudes.

Source: Robert Baron

Table 2

Risk Taking

Item No.	Description	Non-Mgmt (N=47) M	Non-Mgmt (N=47) SD	Mgmt (N=18) M	Mgmt (N=18) SD
13	If one wants to achieve at work, one has to risk making mistakes.	2.74	(1.241)	3.33	(0.840)
26	It is better to take the risk of making mistakes than to "sit on one's behind."	3.27	(1.346)	2.88	(1.022)
27	To get on with my work, I gladly put up with things that can go wrong.	3.02	(1.343)	2.66	(0.970)
31	I'd prefer to err, than to do nothing at all.	2.80	(1.469)	2.72	(1.178)

Agree 1: Not at all, 2: A bit, 3: Neither a bit nor a lot, 4: A lot, 5: Completely

M = mean; Mgmt = management; N = number; SD = standard deviation

Note: The responses included 65 returned surveys of about 400 distributed to study error attitudes.

Source: Robert Baron

Table 3

Error Strain

Item No.	Description	Non-Mgmt (N=47) M	Non-Mgmt (N=47) SD	Mgmt (N=18) M	Mgmt (N=18) SD
6	I find it stressful when I err.	3.55	(1.119)	3.88	(0.963)
25	I am often afraid of making mistakes.	2.61	(1.207)	3.11	(1.131)
32	I feel embarrassed when I make an error.	3.10	(1.303)	2.94	(0.998)
36	If I make a mistake at work, I "lose my cool" and become angry.	1.39	(0.613)	1.33	(0.766)
37	While working I am concerned that I could do something wrong.	2.93	(1.143)	2.33	(1.028)

Agree 1: Not at all, 2: A bit, 3: Neither a bit nor a lot, 4: A lot, 5: Completely

M = mean; Mgmt = management; N = number; SD = standard deviation

Note: The responses included 65 returned surveys of about 400 distributed to study error attitudes.

Source: Robert Baron

Table 4

Error Anticipation

Item No.	Description	Non-Mgmt (N=47) M	Non-Mgmt (N=47) SD	Mgmt (N=18) M	Mgmt (N=18) SD
20	In carrying out my task, the likelihood of errors is high.	2.14	(0.955)	2.61	(1.195)
24	Whenever I start some piece of work, I am aware that mistakes occur.	3.02	(1.259)	3.11	(1.231)
28	Most of the time I am not astonished about my mistakes because I expected them.	2.04	(1.284)	2.50	(0.923)
30	I anticipate mistakes happening in my work.	2.74	(1.169)	2.94	(1.055)
35	I expect that something will go wrong from time to time	3.13	(1.258)	3.16	(1.294)

Agree 1: Not at all, 2: A bit, 3: Neither a bit nor a lot, 4: A lot, 5: Completely

M = mean; Mgmt = management; N = number; SD = standard deviation

Note: The responses included 65 returned surveys of about 400 distributed to study error attitudes.

Source: Robert Baron

Table 5

Covering up Errors

Item No.	Description	Non-Mgmt (N=47) M	Non-Mgmt (N=47) SD	Mgmt (N=18) M	Mgmt (N=18) SD
11	Why mention a mistake when it isn't obvious?	2.19	(1.244)	2.50	(1.098)
21	It is disadvantageous to make one's mistakes public.	2.19	(1.191)	2.22	(0.942)
22	I do not find it useful to discuss my mistakes.	1.91	(1.039)	1.83	(0.923)
23	It can be useful to cover up mistakes.	1.57	(0.800)	1.66	(0.907)
33	I rather keep my mistakes to myself.	2.02	(1.021)	2.00	(0.970)
34	Employees who admit to their errors make a big mistake.	1.41	(0.717)	1.33	(0.766)

Agree 1: Not at all, 2: A bit, 3: Neither a bit nor a lot, 4: A lot, 5: Completely

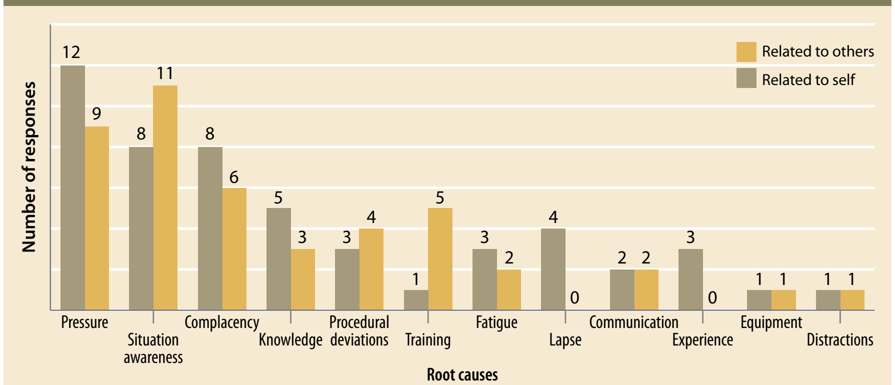
M = mean; Mgmt = management; N = number; SD = standard deviation

Note: The responses included 65 returned surveys of about 400 distributed to study error attitudes.

Source: Robert Baron

Table 6

Root Causes of Errors



Note: The responses included 65 returned surveys of about 400 distributed to study error attitudes.

Source: Robert Baron

Figure 2

inspection has been completed successfully a hundred times before, it does not guarantee that the outcome will be successful this time; not letting down your guard; assuming that something may have been missed; and always double-checking your own work, especially if an additional set of eyes is *not* required for a particular task (such as completing a task and signing it off yourself).

Additional Research

Understanding the psychology of errors is critically important to the successful implementation of an error-reporting system. This study showed, at least on a self-reporting level, that there were differences between non-management and management in terms of error attitudes. It would be highly desirable to conduct additional research in this area. Building a rich database will allow meta-analyses to be conducted. Hypotheses can then be posited and tested for statistical significance.

Robert Baron, Ph.D., is the president and chief consultant of The Aviation Consulting Group. As a consultant, he has assisted a multitude of aviation organizations in the development of their human factors, safety management system, and crew resource management training programs. Baron is also an adjunct professor at Embry-Riddle and Everglades Universities and teaches courses on aviation safety and human factors subjects.

Notes

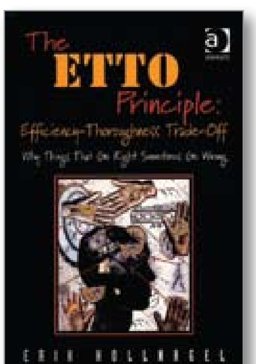
1. Reason, J.; Hobbs, A. *Managing Maintenance Error: A Practical Guide*. Aldershot, England: Ashgate, 2003.

2. Shappell, S.; Wiegmann, D. *The Human Factors Analysis and Classification System (HFACS)*. DOT/FAA/AM-00/7. Washington, D.C.: U.S. Federal Aviation Administration, 2000.

3. Rybowiak, V.; Garst, H.; Frese, M.; Batinic, B. "Error Orientation Questionnaire (EOQ): Reliability, Validity, and Different Language Equivalence." *Journal of Organizational Behavior* Volume 20 (1999), 527–547.

The Good, the Bad and the Tradeoff

Compromise between productivity and accuracy cannot be avoided.



BOOKS

Push and Pull

The ETTO Principle: Efficiency–Thoroughness Trade-Off

Hollnagel, Erik. Farnham, Surrey, England and Burlington, Vermont, U.S.: Ashgate, 2009. 162 pp. Figures, tables, references, index.

The ETTO (efficiency–thoroughness tradeoff) principle can be stated most simply, Hollnagel says, as follows: "In their daily activities, at work or at leisure, people routinely make a choice between being [efficient] and being thorough, since it rarely is possible to be both at the same time. If demands for productivity or performance are high, thoroughness is reduced until the productivity goals are met. If demands for safety are high, efficiency is reduced until the safety goals are met."

A bird in the wild looking for dinner can illustrate the ETTO principle, Hollnagel says. It must go "head-down" to find food, but "head-up" to detect predators. Neither requirement can be eliminated. "The partly unpredictable environment of wild birds therefore requires them to find a balance or a strategy that increases their chances of survival on both counts," he says.

When people assume that there is little or no risk, efficiency takes over and thoroughness is a distant second. "As long as the assumption is right and there is no risk, it is safe," says Hollnagel. "But as soon as there is a risk, it is not. And human — and organizational — memory is unfortunately rather short."

Another way to look at the principle is to distinguish between information "pull" and information "push." In the former, "the user or operator decides when to get information, and will therefore also usually have the time and resources (and readiness) to make use of it," Hollnagel says. "In information push, the information is forced upon the operator who may not be ready to deal with it."

One form of information push happens when ongoing activities are interrupted by a new event. "If this happens often, the typical response is to be efficient rather than to be thorough, since this reduces the likelihood of losing control," he says.

There are dozens of unofficial work rules based on efficiency. Among those Hollnagel cites are these:

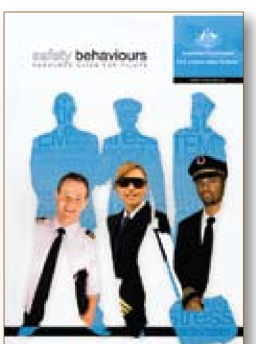
- "'It is good enough for now, or for 'government work'' — meaning that it passes someone's minimal requirements;
- "'It will be checked later by someone else' — so we can skip this test now and save some time; [and,]
- "'We must get this done before someone else beats us to it or before time runs out' — therefore, we cannot afford to follow the procedures, rules and regulations in every detail."

The ETTO principle often takes the form of a relationship between how fast something can be done and how precisely it can be done. This applies to individuals and organizations.

"When asked to perform a task as well as possible, people will apply various strategies that may optimize speed, optimize accuracy or combine the two," Hollnagel says. "For a concrete example, think of a radar operator trying to identify an approaching object, which could be friend or foe. An incorrect identification might be fatal, but so might waiting too long in order to be sure."

At the organizational level, "It is not unusual that the pressure to plan and implement a change — often with the primary purpose to cut costs — forces decisions to be made on an insufficient basis," he adds.

Although safety professionals are inclined to focus on the value of thoroughness, that cannot be an end in itself. For example, Hollnagel says, "Thoroughness requires that all, or as much as possible, of the available information is used, processed or taken into account. This demand is reasonable, as long as the amount of information is limited. But in our day and age, that is not the case. We are all constantly inundated with data, and frequently find ourselves in a situation that best can be characterized as information input overload. … There is more information available than can be made use of in the time available."



In practice, says Hollnagel, using the ETTO, individuals respond with tactics such as omission, or temporary non-processing of information; reduced precision, or trading accuracy for time, which leads to a "more shallow" use of the input; queuing, or delaying response during high workload, hoping for a lull later on; and filtering, or neglecting to process certain information categories, prioritizing data types.

The book describes many kinds of tradeoffs, some leading to bad outcomes, but most capable of being viewed as sensible. "Making such tradeoffs is not only normal for humans and organizations, it is actually necessary," Hollnagel says. "The best illustration of that is when people stop making them, as when they work strictly according to the written procedures and follow safety or other regulations to the letter. 'Work-to-rule' invariably leads to a slowdown and a loss of efficiency and is therefore often used as a minimal form of a labor strike."

— Rick Darby

ELECTRONIC MEDIA

Portable Instruction

Safety Behaviours: Human Factors for Pilots

Australian Government, Civil Aviation Safety Authority (CASA). CASA Aviation Safety Promotion. First edition. 2009. To request information about obtaining kits, e-mail <humanfactors@casa.gov.au> or visit <www.casa.gov.au>.

"Safety Behaviours: Human Factors [HF] for Pilots," a training package for "fixed-wing pilots from low-capacity air transport and charter operations, flying training schools and private operators" was developed by CASA. The target audience is general aviation and low-capacity public transport sectors, CASA says, because they tend to lack the resources to implement safety management systems, HF training, flight operational quality assurance and other currently recommended safety programs.

The kit is designed to enhance awareness of single-pilot HF issues and threat and error management (TEM). According to CASA, "On March 1, 2008, the Day Visual Flight Rules Syllabuses (Aeroplanes) Issue 4 and (Helicopters) Issue 3 became effective. These documents contained new flight standards for single-pilot HF and TEM. From July 1, 2009, HF and TEM are being assessed on flight test exams for the General Flying Progress Test and private and commercial pilot licenses. Additionally, TEM will be examined in all HF aeronautical knowledge examinations for these licenses from July 1, 2009. Consequently, instructors will be required to teach HF and TEM skills, and approved testing officers and flight operations inspectors will need to assess the standards on license and rating flight tests."

CASA summarizes the importance of HF to safe aviation operations as follows:

- "Human performance issues continue to dominate aviation accident statistics;
- "The effective management of error remains one of the greatest challenges to the further reduction of accidents and improving aviation safety;
- "Effective technical [factors] and HF are required for safe and efficient flight operations; [and,]
- "The continuing threat of low-capacity air transport accidents, the need for improved efficiency and the importance of having fit-for-duty flight crew highlight the crucial role of effective HF."

The safety behaviors kit is designed for group-facilitated or self-paced, individualized training. Kit contents include a pilot's workbook, resource guide, facilitator's guide, DVD, CD-ROM and guidance material. CASA recommends that individuals work with a mentor or tutor, perhaps a senior pilot, rather than training alone, thus enabling discussion of case studies and exercises. Classes with a facilitator provide even greater value, says CASA. The elements of the learning program encourage a systematic pattern of studying a chapter in the resource guide, then watching the corresponding dramatization on the DVD and following up with related exercises in the pilot's workbook.

The "Resource Guide for Pilots" study topics are fatigue, stress, alcohol and other drugs, communication, teamwork, leadership, situational awareness, decision making, TEM and airmanship. Each chapter of the resource guide is a self-contained module focusing on one of the topics and contains explanatory text, figures, tables, photographs, references, a list of related resources and a summary of key points.

The DVD includes a 30-minute dramatic re-enactment based on the lives of two young pilots working for a low-capacity regional airline. One pilot, single with an active social life, and the other, with a family, face challenges of work-life balance, fatigue and sleep deprivation, alcohol and medication abuse, stress and other life issues. Re-enactments demonstrate personal and workplace events to illustrate preparation and communication, personal responsibility and self-discipline, crew resource management, mentoring from senior staff and HF skills. Upon completing the first part of the DVD, pilots are encouraged to complete corresponding exercises in the accompanying workbook. In the second part of the DVD, HF and industry experts analyze problems exposed in the drama and discuss solutions.

The "Workbook for Pilots" contains case studies to teach and reinforce a practical understanding of various HF issues. Chapter topics match those in the resource guide and correlate with the DVD. Each chapter contains suggested discussion, practical activities and written exercises.

The kit includes a facilitator's guide with recommended group-facilitated and self-paced learning strategies and a reprint of CASA-issued Civil Aviation Advisory Publication (CAAP) 5.59-1(0), "Teaching and Assessing Single-Pilot Human Factors and Threat and Error Management." The CAAP is a guidance document for instructors and is also available free at <www.auf.asn.au/safety/CAAP_5_59_1.pdf>.

The final item in the kit is a CD containing full-text versions of all books in the kit. These electronic duplicates may be read online, downloaded or printed as needed.

"While we cannot eliminate human error, a thorough understanding of human factors principles can lead to the development of appropriate policies, strategies and practical tools to mitigate its adverse impact on aviation safety," CASA says.

— Patricia Setze

'Human performance issues continue to dominate aviation accident statistics.'

WEB SITES

Focusing on Commercial Aviation Safety

United Kingdom Flight Safety Committee, <www.ukfsc.co.uk>

"The United Kingdom Flight Safety Committee [UKFSC] is an unincorporated association of professionals dedicated to the improvement of commercial aviation safety," the Web site says. "Members meet regularly to exchange safety information and to examine ways to improve safety and to avoid incidents and accidents."

The committee makes some of its publications and resources available to nonmembers — safety alerts, notices and briefings; risk assessment and management, and safety management system materials from the U.K. Civil Aviation Authority and other organizations; and examples of fatigue and safety attitude surveys. These documents, articles, presentations, workshop handouts and other materials are free and may be read online or printed. Likewise, past issues (2000–2007) of UKFSC's official magazine, *FOCUS on Commercial Aviation Safety*, are free online.

Videos, CDs and books are available to members only, but publishers and authors are identified, making it easy for nonmembers to locate their own sources. The Web site includes information about UKFSC events, courses, committee activities and history.

The UKFSC has transitioned to a new Web site, but the old site may still be accessed through a connecting link from the new site or directly at <www.ukfsc.co.uk/oldsite>.

— *Patricia Setze*

Looking Through the Portal

Aircraft System Safety, <www.aircraftsystemsafety.com/Home/tabid/36/Default.aspx>

The opening page says, "The aim of this website is to provide a 'first stop' portal for anyone interested in safety assessments and safety cases." As a portal, the site identifies and links to information and resources that focus on the development and operation of large aircraft systems.

The site contains a glossary of aviation terms; a bibliography of aviation system safety books, papers and magazines; links to safety-related Web sites; industry news articles; and information on safety services offered by the Web site authors. Readers are invited to contribute to the bibliography.

There is a lengthy list of "safety assessment tools and techniques" that are used by various industries, including aviation and transportation. Software, diagrams, graphics, analyses, methodologies, and other tools and techniques are briefly described. The site says, "Each of these tools has its own advantages and disadvantages and the extent to which these can be used during various phases of the product life cycle, and the degree to which they can be applied to safety assessments, vary."

— *Patricia Setze*

Spoilers Spoil Go-Around

Tail strike follows bounced landing.

BY MARK LACAGNINA

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

JETS

Expanded Training Recommended

Boeing 727-200. Minor damage. No injuries.

The flight crew was conducting a cargo flight from Moncton, New Brunswick, Canada, to Hamilton, Ontario, the night of July 22, 2008. The first officer was the pilot flying. He had 2,900 flight hours, including 75 hours as a first officer and 1,100 hours as a second officer in 727s. The captain, whose 9,500 flight hours included about 7,500 hours in type, was the pilot monitoring. The second officer had 1,600 flight hours, including 600 hours in type.

"This was the first time this crew had operated together, and it was the fourth flight of their pairing," said the report by the Transportation Safety Board of Canada (TSB).

The weather at Hamilton Airport was influenced by thunderstorms. The most recent meteorological report, issued at 2200 local time, included winds from 270 degrees at 10 kt, gusting to 16 kt, 1 1/2 mi (2,400 m) visibility in heavy rain, scattered clouds at 1,200 ft and a 3,200-ft overcast. Temperature and dew point both were 17° C (63° F).

Nearing Hamilton, the crew briefed for an approach to Runway 30, which had an available landing distance of 9,600 ft (2,926 m). "During the descent, air traffic control (ATC) advised that the winds were now favoring Runway 06 and that [the crew] could now expect an approach to Runway 06," the report said. "The crewmembers navigated around a thunderstorm and, although they had the airport in sight, prepared for a nonprecision approach to Runway 06, which has an [available landing distance] of 6,000 ft [1,829 m]."

While being vectored for a visual approach, the crew was told that a pilot who had landed a Cessna Caravan on Runway 06 at 2209 reported that flight conditions were smooth during the approach, with no wind shear, and that braking action was fair.

Shortly after the crew established the 727 on downwind, the airport traffic controller told them that winds were from 050 degrees at 10 kt and that the runway was wet and might be contaminated with standing water. "Because the first officer had little flying experience on this aircraft type, the crewmembers assessed the option of switching flying duties because the landing would now be on the shorter runway," the report said. "They concluded that it was acceptable for the first officer to fly the approach and landing.

"They flew a stabilized approach, using guidance from the precision approach path indicator (PAPI). Due to the limited FDR [flight data recorder] parameters, it could not be determined why, after a stabilized approach, the aircraft touched down at a high rate of descent [about 350 fpm]."

The report also noted that the 30 minutes of information recorded by the cockpit voice recorder during the accident flight had been overwritten because of a delay by maintenance personnel in removing power from the system after the accident.

Among the 11 parameters recorded by the FDR was vertical acceleration. The flight data showed that vertical acceleration was 1.9 g on the first touchdown, which occurred about 1,200 ft (366 m) from the approach threshold. The 727 bounced about 8 ft (2 m) and touched down again with a vertical acceleration of 2.3 g.

"Following company procedures, after the second touchdown the first officer deployed the spoilers using the speed brake lever," the report said. "As the first officer was reaching for the thrust reverser handles, the captain took control of the aircraft and initiated a go-around." The aircraft was 2,500 ft (762 m) from the end of the runway.

The drag produced by the spoilers prevented the aircraft from becoming airborne.

The takeoff configuration warning horn sounded because the spoilers remained deployed as go-around thrust was applied and the flaps were retracted from 30 degrees to either 25 degrees or 15 degrees.

The captain rotated at about 115 kt. However, the drag produced by the spoilers prevented the aircraft from becoming airborne, and the tail skid struck the runway. About 300 ft (91 m) from the departure end, the captain moved the thrust levers full forward. "Shortly thereafter, the main wheels came off the ground and the landing gear was retracted," the report said. "At the same time, the captain noticed that the spoilers were deployed and immediately stowed them."

As the aircraft became airborne, the no. 2 engine tail pipe and thrust reverser actuator fairing struck the ground off the end of the runway, leaving a 12-ft (4-m) scar on the turf. The crew subsequently landed the 727 without further incident on Runway 12.

Investigators determined that after the second bounce, the crew could have either brought the aircraft to a stop on the runway or flown away safely *if* the spoilers had been retracted at the initiation of the go-around.

The operator's training program required flight crews to practice several different procedures in a flight simulator, but none required spoiler retraction at the initiation of a go-around (*ASW*, 9/09, p. 11). Although bounced landing recovery procedures were described in Boeing's *Maneuvers Manual*, they were not included on the operator's training syllabus. "Canadian operators are not required to train their crews in the recovery of bounced landings," the report noted.

Citing three other recent accidents in which Canadian-registered aircraft were substantially damaged during bounced landings, the TSB recommended that the Canadian Department of Transport "require air carriers to incorporate bounced landing recovery techniques in their flight manuals and to teach these techniques during initial and recurrent training."

Wheel Brakes Locked on Touchdown

Airbus A320-321. Substantial damage. No injuries.

The A320 was en route with 133 passengers and seven crewmembers from Jakarta, Java, Indonesia, to Medan, North Sumatra, the morning of June 1, 2008. During final approach to Runway 05 at Polonia Airport in visual meteorological conditions (VMC), the flight crew saw an unsafe indication for the left main landing gear. The pilot-in-command (PIC) initiated a go-around, climbed to 5,000 ft and entered a holding pattern.

The crew held for 45 minutes and recycled the landing gear several times. The unsafe gear indication persisted. "The PIC then instructed the copilot to do the landing gear extension manually, which he did several times without any change to the landing gear indication," said the report by the Indonesian National Transportation Safety Committee.

The crew then consulted the quick reference handbook (QRH) procedures for landing with an abnormal gear configuration. One of the procedures was to ensure that brake pressure does not exceed 1,000 psi.

Airport emergency services were standing by when the A320 was landed on Runway 05 according to the QRH procedures — with the exception that brake pressure was 4,032 psi, "significantly higher than the QRH-specified maximum brake pressure," the report said.

The main landing gear was down and locked on touchdown, but three wheels failed to rotate, and their tires burst. The aircraft was stopped on the 2,900-m (9,515-ft) runway after rolling about 1,200 m (3,937 ft). "The aircraft could not be taxied from the runway to the apron, nor could it be towed to the apron due to damage to the wheels," the report said. The passengers and crew disembarked normally using the forward left door and airstairs. The runway was closed for seven hours while the aircraft was examined and the damaged wheels were replaced.

The examination revealed that the left main landing gear down-lock cable was broken and had caused an erroneous gear-unsafe indication. The cable was shorter than normal. Investigators determined that the cable might have been shortened during previous maintenance involving replacement of the proximity switch.

Investigators also determined that a hydraulic lock had jammed the brakes and prevented the three wheels from rotating on touchdown. The hydraulic lock "was the result of an incorrect manual landing gear extension procedure used by the pilots," the report said. Contrary to guidance in the aircraft flight manual, the copilot had stowed the emergency landing gear extension handle after manually cranking down the gear. According to the report, this caused the return line to the hydraulic fluid reservoir to remain closed, trapping the excessive hydraulic pressure that had built in the landing gear and brake lines during the crew's repeated efforts to extend the gear.

Slide Inflation Causes Control Problem

McDonnell Douglas MD-81. Minor damage. No injuries.

The MD-81 had been chartered to transport 45 passengers, including "a political candidate, his staff, news reporters and U.S. Secret Service personnel," from Chicago Midway International Airport to Charlotte, North Carolina, the morning of July 7, 2008, said the report by the U.S. National Transportation Safety Board (NTSB). Media reports identified the political candidate as Barack Obama.

During initial climb, an uncommanded increase in the airplane's nose-up pitch attitude occurred. The pitch attitude "exceeded normal limits before the captain was able to regain control," the report said. "Although the flight crew was able to regain airplane control, a significant restriction in pitch control still remained."

The crew diverted the flight to Lambert–St. Louis International Airport and landed the airplane without further incident. The report noted that "normal pitch control pressures returned" during the descent.

Examination of the MD-81 revealed that an emergency evacuation slide had inflated inside the tail cone during lift-off at Chicago. "The pitch control restriction was caused by the inflated slide and a subsequently damaged walkway railing that impinged on a set of elevator cables in the tail cone," the report said. "The investigation further revealed that the slide cover had not been secured to the floor fittings on the walkway before the flight.

"It could not be determined why the slide's cover was not secured. In normal circumstances, the cover is secured by the mechanic who installs it and should remain secured until it is removed from the airplane."

FDR data indicated that inertial loads during rotation were of sufficient magnitude and duration to allow the unsecured slide cover to open and initiate slide inflation. "Post-incident testing showed that the slide pack could not have rotated enough to activate its inflation cylinder if the slide container had been properly secured," the report said. "Further, a properly secured slide cover would have contained the slide if the inflation cylinder had improperly discharged."

A service check of the slide had been performed about a month before the incident occurred. "That check was a general visual examination … which included inspection of the forward tie-down straps that secure the slide cover to the floor fittings," the report said. "There would be no reason for the mechanic to touch the straps during this inspection."

After the service check, the MD-81 had made three flights with presidential candidates aboard. "Security sweeps" by U.S. Secret Service personnel had been performed before each

The pitch attitude exceeded normal limits before the captain was able to regain control.

flight. A post-incident investigation by the Secret Service concluded that the sweeps had not "interfered with or altered the aircraft's hardware or systems related to the tail cone evacuation slide," the report said.

Two previous inadvertent inflations of tail cone evacuation slides in MD-80-series airplanes had been reported. "The causes of each of these inflations could not be definitively determined," the report said. "No actions were taken."

Odor Traced to Hot Generator Control

Boeing 737-600. Minor damage. No injuries.

The 737 was en route from Stockholm, Sweden, to Oslo, Norway, on Oct. 24, 2008, when the warning light for the left engine-driven generator illuminated. "The system was checked while the aircraft was on the ground by a flight technician, and no fault or abnormality was found in the generator system," said the report by the Swedish Accident Investigation Board. "The aircraft was then cleared for the return flight to Stockholm [with 97 passengers and six crewmembers]."

Shortly after reaching cruise altitude, Flight Level 330 (approximately 33,000 ft), the flight crew detected the odor of burned electronics. "At about the same time, the cabin staff reported that there was a smell of burning in the passenger cabin," the report said. "Soon thereafter, the master warning lamp lit, and simultaneously the left generator warning lamp lit."

After transferring control to the first officer, the captain conducted the emergency checklist.

The crew began an expedited descent toward Stockholm/Arlanda Airport. However, when the odor became stronger, the crew donned their oxygen masks, declared an emergency and diverted to Stockholm/Västerås Airport, "which they assessed as the most suitable alternative," the report said.

After transferring control to the first officer, the captain conducted the emergency checklist. "After a rapid descent, a normal approach and landing were performed," the report said. The flight crew stopped the aircraft on the runway and ordered an emergency evacuation. Despite problems opening the doors on the right side of the cabin and inflating the slides, the evacuation was rapid and without injury.

A technical investigation revealed that the left generator control unit (GCU) had overheated. The GCU was replaced, but the replacement unit also overheated during the subsequent ferry flight to Stockholm/Arlanda Airport.

The report said that after previous, similar faults had been found in 737-series aircraft, Boeing had issued service bulletins recommending repositioning of some GCU connector pins "to reduce the risk of an electrical flash-over." After the incident, the operator modified all the 737s in its fleet according to the service bulletins.

Hot Landing Rejected Too Late

Cessna Citation 500. Destroyed. Two fatalities, one minor injury.

The pilot was conducting a personal flight with one passenger from Wichita Falls, Texas, U.S., to Conway, Arkansas, on June 30, 2007. There was convective activity along the route, but VMC prevailed at the destination. The pilot was cleared by ATC to conduct a visual approach to the uncontrolled airport.

An employee of a fixed-base operator (FBO) responded to the pilot's radio call for an airport advisory. "He told the pilot that the winds were out of the west between 5 and 10 kt, surface visibility was 10 mi [16 km] and that the runway was wet from a recent rain shower," said the NTSB report.

The airplane was an early model Citation that had been modified with wing extensions and certified for single-pilot operation. The pilot, 72, had 5,575 flight hours and held a type rating; his time in type was not determined during the investigation.

The Citation was not equipped with thrust reversers or anti-skid brakes but did have a wheel-skid warning system. The runway was 4,875 ft (1,486 m) long. Assuming proper operation of the airplane, investigators calculated a landing distance of 4,789 ft (1,460 m) on a runway contaminated by standing water. However, recorded ATC radar data indicated that when the jet was about 1/4 mi (2/5 km) from the threshold of Runway 26, airspeed was 120 kt, or 16 kt above the appropriate landing reference speed (VREF), and the descent rate was 1,150 fpm.

The passenger later told investigators that the runway was "soaked and shiny with water" and that the airplane landed hard and "fish-tailed."

The FBO employee did not see where the Citation touched down but said that it "did not slow enough to stop" on the runway and that the pilot "added power at the last second." Another witness said that the airplane was "traveling at a high rate of speed" at midfield and that the pilot initiated the go-around with about 1,220 ft (372 m) of runway remaining.

The Citation overran the runway and struck a jet-blast deflector and the airport perimeter fence. It then crossed a road and struck a "residential structure," the report said. The pilot and a person inside the residential structure were killed; the passenger sustained minor injuries.

The probable causes of the accident were "the pilot's failure to fly a stabilized approach and his delayed decision to abort the landing," the report said. "Contributing to the accident was the standing water on the runway."

TURBOPROPS

Steep Turn, Stall on Short Final

Beech King Air A100F. Destroyed. Two fatalities.

Instrument meteorological conditions (IMC) prevailed for the positioning flight from Val-d'Or to Chibougamau, both in Quebec, Canada, the morning of Oct. 25, 2007. The TSB report said that the pilots had limited experience in instrument flight rules operations.

The PIC had flown in the West Indies before being hired by the Canadian charter operator a month before the accident. He had 1,800 flight hours, including 123 hours in type. Almost all of the copilot's flight experience had been in VMC before he joined the company four months before the accident. He had 1,022 flight hours, including 72 hours in type. "They had worked together as flight crewmembers three times since they were hired," the report said.

Chibougamau's Chapais Airport had a partially obscured sky, an overcast at 700 ft, 2 mi (3,200 m) visibility in fog and winds from 260 degrees at 6 kt. Nearing the airport from the southwest, the pilots prepared to conduct the NDB/DME (nondirectional beacon/distance measuring equipment) approach to Runway 05.

During descent, however, the PIC began programming the global positioning system (GPS) receiver for the area navigation approach to Runway 05. "Neither of the pilots was authorized or trained to use GPS as a primary source of navigation for an instrument approach," the report said, noting that the PIC spent nine minutes programming the GPS receiver but abandoned the effort about 15 nm (28 km) from the runway.

The pilots did not adhere to standard operating procedures. They did not activate the radio-controlled airport lights or announce the aircraft's position, and they were late in configuring the King Air for the approach. When the runway came in sight, the aircraft was not in position for a safe landing, and the crew conducted a missed approach.

During the second approach, the King Air crossed the final approach fix with a groundspeed of 150 kt. Shortly thereafter, the landing gear was extended and the flaps were lowered to the approach position. The aircraft was 500 ft above ground level (AGL) when the PIC saw the runway threshold about 0.7 nm (1.3 km) to the right. "The copilot transferred the controls to the PIC, and the flaps were lowered completely," the report said. "A right turn was made to direct the aircraft toward the runway, followed by a steep left turn to line up with the runway centerline."

The report said that the King Air's wings-level stall speed was 71 kt, but the aircraft stalled at 100 kt, VREF, because of the increased load factor induced by the steep left turn. The stall occurred at about 100 ft AGL. Bank angle was 55 degrees and pitch attitude was 20 degrees nose-down when the aircraft struck the runway at a high rate of descent.

Control Loss Occurs in Night IMC

Cessna 208B. Destroyed. 10 fatalities.

After a weekend of skydiving in Star, Idaho, U.S., the pilot and nine parachutists were returning to their home base, Shelton, Washington, the night of Oct. 7, 2007. The pilot initially flew the unpressurized airplane at 12,500 ft but then climbed to 14,500 ft and maintained that altitude for more than one hour.

The pilot did not use supplemental oxygen. "He was instrument-rated but had logged a total of two hours of actual instrument flight time," the NTSB report said. "Company policy was to fly under visual flight rules [VFR] only, and they had not flight-checked the pilot for instrument flight."

ATC radar data showed that the airplane made a series of 360-degree turns while climbing and descending. "The recorded radar data indicated that the pilot was likely maneuvering to go around, above or below rain showers or clouds while attempting to maintain VFR," the report said. "The airplane likely entered clouds during the last three minutes of flight, and possibly icing and turbulence."

The Caravan stalled, and its descent rate reached nearly 8,000 fpm before it struck mountainous terrain near Naches, Washington.

The report said that the probable cause of the accident was "the pilot's failure to maintain an adequate airspeed … while maneuvering" and that contributing factors included "the pilot's impaired physiological state due to hypoxia, the pilot's inadequate preflight weather evaluation and his attempted flight into areas of known adverse weather."

Hydraulic Leak Disables Gear

Hawker Beechcraft 1900D. Substantial damage. No injuries.

En route on a scheduled flight with 15 passengers from Timaru, New Zealand, the morning of June 18, 2007, the flight crew was unable to extend the landing gear while conducting an instrument landing system approach to Wellington, where IMC prevailed.

The crew performed a missed approach. Further attempts to lower the landing gear using the normal and manual extension systems were unsuccessful. "The captain reported that, as he operated the [manual] pump handle, he felt no resistance or pressure that would normally be expected," said the report by the New Zealand Transport Accident Investigation Commission.

The crew diverted the flight to Woodbourne, which was clear of cloud, and, "having exhausted all possible options to lower the landing gear and aware of the amount of fuel remaining, prepared the aircraft for a wheels-up landing," the report said. "On first contact with the runway, the first officer started to shut down the engines while the captain kept the aircraft straight. The aircraft took nearly 15 seconds to come to a halt, after which the crew completed securing the aircraft and the passengers started to vacate the aircraft using all four exits. … None of the occupants required assistance to vacate the aircraft, and there were no injuries."

Examination of the 1900 revealed a fatigue crack in the hydraulic actuator for the right main landing gear. "[This] allowed hydraulic fluid to escape, which prevented the crew from lowering the gear by either the normal or emergency systems," the report said. The hydraulic actuator failure occurred after about 11,900 landing gear cycles. An unrelated failure of the hydraulic fluid low-level sensor also had occurred.

PISTON AIRPLANES

Broken Exhaust Pipe Causes Fire

Piper Chieftain. Substantial damage. No injuries.

The Chieftain was at 1,000 ft AGL, departing for a cargo flight from Portland, Oregon, U.S., in VMC the morning of Oct. 14, 2008, when left engine manifold pressure decreased about 6 in and the engine began to surge. "The left cylinder head temperature was reading zero degrees, but all other gauges were normal," the NTSB report said.

The pilot told investigators that she believed the turbocharger had failed. "No smoke or flames were noticed as the pilot returned to the airport for landing without declaring an emergency or shutting down the engine," the report said. "During taxi to the ramp, the engine lost power."

Examination of the engine revealed that the exhaust pipe that extends from the right cylinder head had fractured because of fatigue cracking of the flange beneath the clamp that attaches the pipe to the turbocharger waste gate. The fatigue cracking was induced by failure of the slip joints within the exhaust pipe system, the report said, noting that there also was "evidence of a fire in the accessory section and a burned-through section of the skin."

Misplaced Selector Blocks Fuel Flow

Beech H18. Destroyed. One serious injury.

The right engine lost power at about 100 ft AGL during departure from Fort Lauderdale (Florida, U.S.) Executive Airport for a cargo flight the afternoon of Sept. 21, 2007. "Performance calculations indicate that … the airplane would most likely not have been able to continue the departure on one operating engine," the NTSB report said.

The pilot declared an emergency, announcing that he could not maintain altitude, and looked for a place to land. Airspeed decreased below VMC, the minimum control speed with the critical engine inoperative, and the airplane rapidly rolled right and entered an uncontrolled descent.

The landing gear was retracted, the throttles and mixture controls were full forward, and the propeller on the right engine was feathered when the airplane struck the ground. The pilot sustained serious injuries.

Investigators determined that the engine had failed because of fuel starvation. The fuel selector had been positioned between the auxiliary tank and fuel cut-off detents, and no fuel was found downstream of the fuel selector.

The report also said that the cargo had been misloaded. Gross weight was near maximum, and the center of gravity (CG) was 1 to 6 in (3 to 15 cm) aft of the aft limit, "which would have created instability in the handling characteristics of the airplane, especially after a loss of engine power," the report said. "In addition, the aft-of-limit CG would have increased the airspeed needed to prevent the airplane from entering a VMC roll."

HELICOPTERS

Rag Entangles Tail Rotor Drive Shaft

Agusta Westland A109E. Substantial damage. One serious injury.

Approaching the destination, Dunshaughlin, Ireland, at 800 ft during a ferry flight on March 28, 2008, the pilot heard a loud bang before the helicopter pitched nose-up and yawed right. The pilot told ATC, "I seem to have a bit of a problem here." He then declared an emergency and said that he had to make an emergency landing.

"The helicopter landed heavily on soft ground and rolled over onto its left side," said the report by the Irish Air Accident Investigation Unit.

During the initial examination of the wreckage, "some cleaning-cloth material was found entangled on the long tail rotor drive shaft, between the first and second bearing," the report said. "It was also found that the drive shaft had completely severed just forward of the second bearing, thus cutting off the vital drive to the tail rotor gearbox."

Investigators were unable to "absolutely determine when and by whom the cloth was left in the area of the tail rotor drive shaft," the report said.

Low Visibility Cited in Gulf Crash

Bell 206L1. Destroyed. One fatality, one serious injury, two minor injuries.

The LongRanger was nearing a platform in the Gulf of Mexico the afternoon of Dec. 29, 2007, when weather conditions deteriorated below the operator's minimums of a 500-ft ceiling and 3 mi (5 km) visibility. The pilot lost control as he maneuvered to slow the helicopter. All four occupants survived the impact, but one subsequently suffered hypothermia and drowned, the NTSB report said.

The report said that the probable causes of the accident were "the pilot's decision to continue … in weather conditions below the company's minimums and his failure to maintain aircraft control during the approach."

Contributing factors were the absence of a passenger briefing on life raft deployment, the pilot's failure to deploy life rafts and a company radio operator's inaccurate report that the helicopter had landed — an error that delayed the start of rescue efforts, the report said.

Preliminary Reports, August 2009

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 1	Nairobi, Kenya	Cessna U206	destroyed	2 fatal, 2 minor
The pilot and front-seat passenger were killed when the 206 struck a power line and a building during an aerial photography flight.				
Aug. 1	West Point, Virginia, U.S.	Beech King Air B90	substantial	1 fatal, 6 none
A skydiving instructor was standing near the open cabin door when his reserve parachute deployed and pulled him out of the King Air, where he was struck by the horizontal stabilizer.				
Aug. 2	Oksibil, Indonesia	de Havilland DHC-6	destroyed	15 fatal
The Twin Otter was on a scheduled passenger flight from Jayapura to Oksibil when it struck a mountain at 9,300 ft about 42 km (23 km) from the destination.				
Aug. 4	Nahanni Butte, Northwest Territories, Canada	Robinson R44	destroyed	2 fatal, 1 serious
During an attempted ridge landing, the helicopter rolled down a steep slope, killing both passengers.				
Aug. 4	Koh Samui, Thailand	ATR 72-212A	destroyed	1 fatal, 4 serious, 68 NA
The captain was killed when the aircraft veered off the runway and struck the airport traffic control tower.				
Aug. 5	Paris, France	Airbus A320-211	minor	NA
Six people reportedly were injured when an engine caught fire while the A320 was being pushed back from a gate at Paris Orly Airport.				
Aug. 8	Hoboken, New Jersey, U.S.	Eurocopter AS 350BA, Piper PA-32R	destroyed	9 fatal
Six people aboard the air tour helicopter and three people aboard the single-engine airplane were killed when the aircraft collided 1,100 ft over the Hudson River.				
Aug. 11	Kokoda, Papua New Guinea	de Havilland DHC-6	destroyed	13 fatal
The Twin Otter struck a mountain at 5,500 ft during a go-around in adverse weather conditions.				
Aug. 12	Eden Prairie, Minnesota, U.S.	Beech E18S	destroyed	2 fatal
Witnesses said that the Twin Beech was flying erratically while circling the airport at about 500 ft shortly after takeoff. The airplane then rolled left and descended to the ground.				
Aug. 13	Minidoka, Idaho, U.S.	Beech A60 Duke	substantial	2 minor
The airplane flipped over during a forced landing after losing power from both engines.				
Aug. 14	Lytton, British Columbia, Canada	Bell 212	destroyed	1 fatal
The helicopter crashed into a river while fighting a forest fire.				
Aug. 14	Évora, Portugal	Beech 99	destroyed	2 fatal
The airplane lost power from one engine during a skydiving flight and then struck a building during a go-around at the Évora airport.				
Aug. 16	Taiping, Malaysia	Avcen Jetpod	destroyed	1 fatal
The prototype twin-engine jet crashed shortly after takeoff for its first test flight.				
Aug. 16	Caracas, Venezuela	Britten-Norman BN-2A	substantial	10 NA
The Islander was ditched offshore during approach to the Caracas airport. No fatalities were reported.				
Aug. 17	North Captiva Island, Florida, U.S.	Eurocopter EC 145	substantial	3 none
Dark night visual meteorological conditions (VMC) prevailed when the emergency medical services (EMS) helicopter struck the water while approaching a landing site to pick up a patient.				
Aug. 21	Teterboro, New Jersey, U.S.	Beech 58 Baron	destroyed	2 serious
Night VMC prevailed when the Baron overshot the runway while landing and crashed into a vacant warehouse.				
Aug. 22	Hamburg, Germany	Cessna T206H	substantial	2 fatal, 1 none
Both passengers were killed when the float-equipped airplane flipped over while landing on the Elbe river.				
Aug. 22	Cortina d'Ampezzo, Italy	Agusta A109S	destroyed	4 fatal
The helicopter struck power lines during an EMS flight in adverse weather conditions.				
Aug. 26	La Tortuga, Venezuela	Cessna 208B	destroyed	2 minor, 11 none
The Caravan was ditched after the engine lost power during a scheduled passenger flight.				
Aug. 26	Nganga Lingolo, Congo	Antonov An-12	destroyed	6 fatal
Night VMC prevailed when the cargo airplane crashed in a cemetery during approach to Brazzaville.				

NA = not available

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

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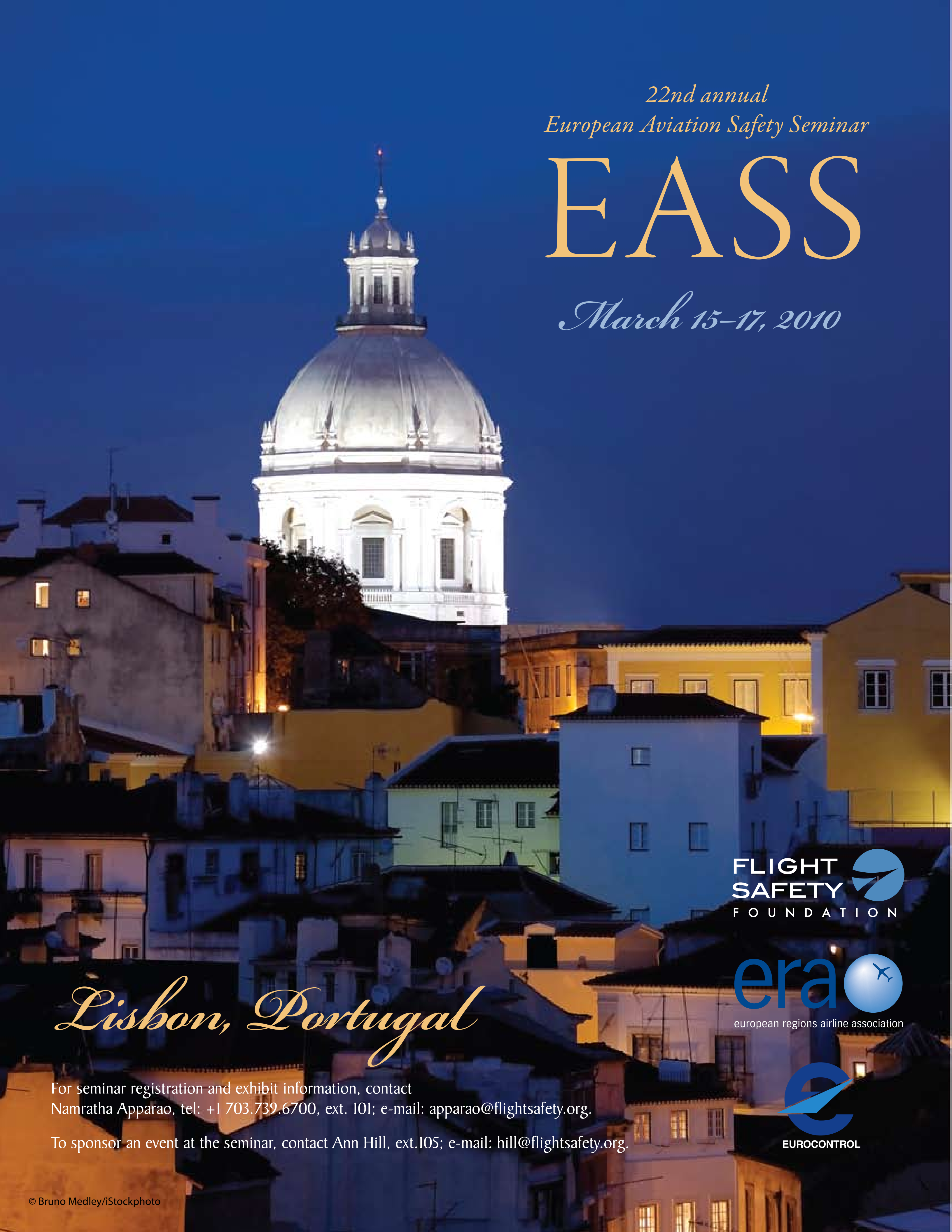
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