AeroSafety WORLD

AFRICAN SAFETY
A foundation for political will

TROUBLE WITH ENGLISH
When the course is not enough

INTEGRATING UAS TRAFFIC
Unmanned aircraft and the system

APRON IMPROVEMENTS
Analysis leads to lower risk

ON SHORT FINAL
MESSAGE TRIGGERS ACCIDENT CHAIN

THE JOURNAL OF FLIGHT SAFETY FOUNDATION

JULY 2008

APPROPRIATE Management

I have been in a few international meetings lately where there seemed to be an emerging sense of confusion, and even despair, over the widespread implementation of safety management systems (SMS). I worry that we might be trying to make SMS all things to all people.

SMSs are most powerful when used by an accountable safety executive who has the ability to allocate resources to mitigate risk. That is why the International Civil Aviation Organization chose to target the front-line safety managers in airlines, airports and air navigation service providers (ANSP) with its initial SMS requirement.

Those operational executives manage hundreds of variables that can affect safety, and it was obvious an SMS would help them by providing the data and the processes needed to manage risk. Many organizations felt a bit left out by that decision. They asked, "How can you talk about safety if you do not address flight schools, repair organizations and manufacturers?" Clearly these suppliers play a vital role in aviation safety. If they don't deliver a quality product the results can be catastrophic. In this case, quality is so important that it deserves to be managed by systems designed to ensure quality, not an SMS designed to manage risk. There is a difference.

Let's look at a simple example: Bad fuel can take down an airplane. If an airline's SMS sees reports of contamination, that risk will be flagged, and an array of mitigations will be considered. The airline might put in place testing procedures, change suppliers, or even avoid taking on fuel at a location. The airline uses the *SMS* to manage *risk*. The fuel supplier's job in this case is different. When they detect a problem with the quality of their product, they will engage their processes to determine how to correct it. They will use *quality systems* to correct *defects* and meet specifications.

I used a fuel example, but it doesn't take much imagination to apply the same principles to a maintenance and repair organization, an engine manufacturer or a radar supplier. In these cases, it is important to ask ourselves whether we are trying to achieve a quality target or mitigate safety risks.

There also is a practical regulatory limit to how far into the supply chain we should push SMS. Airlines, ANSPs and airports are certified by a single state with a single state safety system and a single SMS standard. On the other hand, if you go to an engine repair station or a major manufacturer, you will often find more than a dozen certificates on the wall, each issued by a different state, and each of these states ultimately will produce SMS standards that will be a little bit different. Meeting requirements for multiple SMSs will produce a lot more paper but probably not a lot more safety. While an SMS might be appropriate to reduce the risk of workplace hazards, the proper tool to enhance aviation system safety would seem to be a quality management system.

Many of my friends and colleagues may disagree with some of the points I have made, and I must admit that there is room for debate. But let's agree that the problem of where and when to implement SMS deserves thoughtful debate. If we try to make SMS all things to all people it will fail, threatening one of the most effective tools we have ever held.

William R. Voss
President and CEO
Flight Safety Foundation

AeroSafetyWORLD

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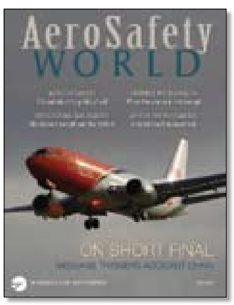

About the Cover
A disrupted approach nearly ended in disaster.
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AeroSafetyWORLD

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Serving Aviation Safety Interests for More Than 60 Years

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

Member**Guide**

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OUR NEW Mark

This issue of *AeroSafety World* starts the magazine's third year, and my, how the time has flown. We've been gratified by the industry's acceptance of the magazine and appreciate your input; we'll strive to maintain a high standard.

Aviation safety is high drama, no pun intended. General news media — print and electronic — have capitalized on this drama, knowing that while aviation stories with unvarnished facts captivate readers, the fascination becomes even more pronounced if a pinch of fear-mongering is thrown in.

I think it has been in response to the "shock/horror" headlines of the general media that aviation safety publications have favored a rather dry storytelling style.

But aviation's participants know its drama up close and personally, especially the flight crews. The system is safe, to be certain, but when an airplane is making an approach to a short and slick runway on a stormy night with low clouds, poor visibility and a gusting crosswind, no one is bored.

While there is no way a magazine can capture the many facets of aviation's inherent excitement, we hoped to make *ASW* an interesting and easily read publication that reflects some of aviation's visual drama. We do not intend for our stories to be the final word on any subject — although some come close — but we do hope to present thorough overviews of our chosen topics that will suffice many, while others hopefully will be inspired to further investigation.

With the magazine a successful update of the seven Flight Safety Foundation publications that preceded it, the Foundation considered another legacy. The globe-and-wings logo that for many years has represented the Foundation in several versions lately has seemed increasingly dated. It also is visually complex, difficult to use in designs and not very Internet-friendly. We decided to develop a replacement.

After a design process that evolved over a number of months, a new logo has been settled on that reflects, we hope, the movement and vitality that symbolizes both the industry and the Foundation's activism. You can see our new logo and mark on this magazine's cover, and on the page facing this one.

An early version of this mark escaped the design lab and sneaked into a presentation package that, when shown, caused a number of people to ask what it means. I'll try to explain.

The design effort sought to develop an image that would first invoke the soaring spirit of flight, capturing the rising, advancing nature of aviation in its many forms, and the speed that is inherent in its utility.

But in addition, the mark had to be visually fairly simple, with no moving parts, so to speak, to ease its incorporation into other designs and uses. Also, frankly, we wanted a mark-and-name combination that would help differentiate the Foundation from the well-known training company, FlightSafety International, a good friend of the Foundation.

We hope the new logo is accepted as quickly and warmly as *AeroSafety World* has been welcomed by the industry and rapidly becomes part of the Foundation's visual personality.

J.A. Donoghue

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

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FSF, Eurocontrol and ERA
21st annual European Aviation Safety Seminar

Hilton Cyprus Hotel, Nicosia, Cyprus

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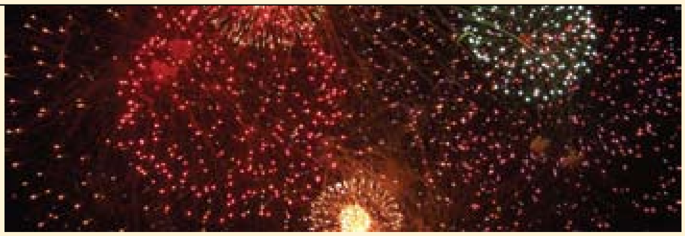
FSF and NBAA
54th annual Corporate Aviation Safety Seminar

Hilton Walt Disney World, Orlando, Florida



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JULY 7–10 ➤ Wildlife Management Techniques Course. American Association of Airport Executives. Minneapolis. Stacey Renfroe, <stacey.renfroe@aaae.org>, <www.aaae.org/products/meeting_details.html?Record_id=646>, +1 703.824.0500.

JULY 8–10 ➤ Wildlife Hazard Management Workshop. Embry-Riddle Aeronautical University. Denver. <training@erau.edu>, <www.erau.edu/ec/soctapd/wildlife-management.html>, 866.574.9125, +1 386.226.7694.

JULY 14–20 ➤ Farnborough International Airshow. Farnborough International. <enquiries@farnborough.com>, <www.farnborough.com/intro.aspx>, +44 (0)1252 532800.

AUG. 11–14 ➤ 2008 Air Safety and Security Week. Air Line Pilots Association, International. Washington, D.C. <crewroom.alpa.org/SAFETY/Default.aspx?tabid=2427>, +1 703.689.2270.

AUG. 14–16 ➤ Latin American Business Aviation Conference and Exhibition (LABACE) 2008. National Business Aviation Association and ABAG–Brazilian Association of General Aviation. São Paulo, Brazil. <www.labace.com.br/ing/statics.php>.

AUG. 17–19 ➤ ALA Aeronautical Convention and Exhibition. Latin American Aeronautical Association. Miami. <ala@ala.aero>, <www.ala-internet.com>, +1 817.284.0431.

AUG. 18–21 ➤ 10th Bird Strike Committee USA/Canada Meeting. American Association of Airport Executives and Bird Strike Committee USA/Canada. Orlando, Florida, U.S. Christy Hicks, <christy.hicks@aaae.org>, <www.aaae.org/products/meeting_details.html?Record_id=566>.

AUG. 19–21 ➤ Wichita Aviation Technology Congress & Exhibition. SAE International. Wichita, Kansas, U.S. <CustomerService@asae.org>, <www.sae.org/events/watc>, 877.606.7323, +1 724.776.4970.

SEPT. 4 ➤ De/Anti-Icing Seminar. National Air Transportation Association. Boise, Idaho, U.S. <www.nata.aero/events/event_detail.jsp?EVENT_ID=1661>.

SEPT. 8–11 ➤ ISASI 39th Annual Seminar: Investigation: The Art and the Science. International Society of Air Safety Investigators. Halifax, Nova Scotia, Canada. <www.isasi.org/asasi2008.html>.

SEPT. 10–11 ➤ Crisis Preparedness Conference and Aeropolitical Conference for Legal Issues Facing the Aviation Industry. Latin American Air Transport Association (ALTA). Miami. Valerie Garcia, <vgarcia@alta.aero>, <www.alta.aero/crisispreparedness>, <www.alta.aero/aviationlaw>, +1 786.522.7824.

SEPT. 10–11 ➤ 8th Annual CIS, Central and Eastern European Airline Engineering and Maintenance Conference. Aviation Industry Group. Prague, Czech Republic. Lucy Ashton, <lucya@aviation-industry.com>, <www.aviationindustrygroup.com/index.cfm?pg=306&archive=false&offset=1>, +44 (0)207 931 7072.

SEPT. 15–18 ➤ Flight Simulator Engineering and Maintenance Conference. ARINC. Salt Lake City. Sam Buckwalter, <sbuckwal@arinc.com>, <www.aviation-ia.com/fsemc>, +1 410.266.2008.

SEPT. 16 ➤ De/Anti-Icing Seminar. National Air Transportation Association. Cleveland. <www.nata.aero/events/event_detail.jsp?EVENT_ID=1701>.

SEPT. 16–17 ➤ Asia Pacific Aviation Training Symposium (APATS): Training for Safety in a Commercial World. Halldale Media. Bangkok, Thailand. Chris Long, <chrislong@halldale.com>, <http://www.halldale.com/APATS.aspx>, +44 (0)1252 532000.

SEPT. 16–19 ➤ 34th European Rotorcraft Forum. Council of European Aerospace Societies and the Royal Aeronautical Society. Liverpool, England. <raes@raes.org.uk>, <www.aerosociety.com/cmspage.asp?cmsitemid=ConferenceAndEvents_ERF34>, +44 (0)20 7670 4300.

OCT. 4–5 ➤ Flight Operations Manual Workshop: Employing the International Standard for Business Aircraft Operations. National Business Aviation Association. Orlando, Florida, U.S. Sarah Dicke, <sdicke@nbaa.org>, <web.nbaa.org/public/cs>, +1 202.783.9000.

OCT. 6–8 ➤ 61st Annual Meeting and Convention. National Business Aviation Association. Orlando, Florida, U.S. Donna Raphael, <draphael@nbaa.org>, <web.nbaa.org/public/cs/amc/2008>, +1 202.783.9000.

OCT. 7–9 ➤ Aircraft Accident Investigation Course. University of North Dakota Aerospace Foundation and Air Line Pilots Association, International. Grand Forks, North Dakota, U.S. Frank Argenziano, <argenzia@aero.und.edu>, +1 701.777.7895.

OCT. 9 ➤ Maintenance Manual Workshop. National Business Aviation Association. Orlando, Florida, U.S. Donna Raphael, <draphael@nbaa.org>, <web.nbaa.org/public/cs>, +1 202.783.9000.

OCT. 15–18 ➤ 25th International Meeting of Aerospace Medicine. Mexican Association of Aviation Medicine and the Iberoamerican Association of Aerospace Medicine. Zacatecas, Mexico. Luis A. Amezcua Gonzales, M.D. <lamezcua@att.net.mx>, <www.amma.org.mx>, +52-55 55.23.82.17.

OCT. 20–22 ➤ Air Medical Transport Conference. Association of Air Medical Services. Minneapolis. <www.aams.org/AM/Template.cfm?Section=Education_and_Meetings>, +1 703.836.8732.

OCT. 21 ➤ Accident Prevention via Human Factors Training. National Air Transportation Association. San Diego. <www.nata.aero/events/event_detail.jsp?EVENT_ID=1582>.

OCT. 27–30 ➤ International Air Safety Seminar (IASS). Flight Safety Foundation, International Federation of Airworthiness and International Air Transport Association. Honolulu. Namratha Apparao, <apparao@flightsafety.org>, +1 703.739.6700, ext. 101.

OCT. 27–29 ➤ 46th Annual Symposium. SAFE Association. Reno, Nevada, U.S. Jeani Benton, <safe@peak.org>, <www.safeassociation.com>, +1 541.895.3012.

NOV. 2–5 ➤ ATCA 53rd Annual Conference and Exposition. Air Traffic Control Association. Washington, D.C. Claire Rusk, <claire.rusk@atca.org>, <www.atca.org/event_items.asp?month=10&year=2008&comm=0>, +1 703.299.2430.

NOV. 11–12 ➤ European Aviation Training Symposium (EATS): Exploring and Promoting European Best Practice in Aviation Training and Education. Halldale Media. Vienna, Austria. Chris Lehman, <chris@halldale.com>, <http://www.halldale.com/EATS.aspx>, +44 (0)1252 532000.

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

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

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

Safety News

Debonding Problems

Some hot, humid operating environments may be contributing to the degradation of adhesive bond joints in Robinson Helicopter rotor blades, and new testing methods are required to ensure the detection of separation at bond joints, the U.S. National Transportation Safety Board (NTSB) says.

The NTSB said that examination of rotor blades from helicopters involved in several recent accidents indicates that "debonding (separation) of the rotor blade skin … led to fracture of the rotor blade."

In each instance, the debonding occurred before the rotor blade achieved its retirement life of 2,200 operating hours or 12 years, the NTSB said, adding that it was concerned that "certification testing and inspection methods currently used by manufacturers may not be adequate to ensure the durability of the rotor blade, particularly in severe environments."

Typically, the inspection of adhesive joints on Robinson main rotor blades involves the tap test method in which the surface of an adhesive joint is tapped with a small hammer or a coin while the person conducting the inspection listens for changes in pitch that indicate defects.

The accidents included the Oct. 11, 2006, in-flight breakup of an R44 over the Dominican Republic in which four people were killed; the Dec. 5, 2006, in-flight breakup of an R44 off the coast of the Fiji Islands in which the pilot was killed; and a March 15, 2007, incident of severe vibration in an R22 in Australia that ended without injury to the crew. In another accident — a March 4, 2006, in-flight breakup of an R22 along the New Zealand coast that killed two people — the rotor blade "showed bond joint fracture features consistent with a degraded bond," the NTSB said.

"Adhesive bond joints are likely to degrade with time when subjected to harsh environments, such as the high humidity and high temperatures typically found at or near the sea, and … tap


Australian Transport Safety Bureau

testing of the main rotor blades is not adequate for consistently detecting debond at the skin-to-spar and skin-to-tip cap bond areas," the NTSB said. "Consequently, separation at bond joints could remain undetected and lead to in-flight separation of the main rotor blade skin and possible loss of control."

The NTSB recommendations to the U.S. Federal Aviation Administration (FAA) included calls for the FAA to revise advisory circulars to "include long-term durability testing of adhesive bond joints for helicopter blades"; amend an airworthiness directive to require that main rotor blades be inspected "for cracks in the paint layer at the skin-to-spar bond line" and that any blades with such cracks be removed from service; require Robinson to develop a nondestructive testing technique to detect bonding defects and require this technique to be used in inspections of all Robinson main rotor blades; and determine if sufficient tests and inspections of adhesive bonds are in place for blades manufactured by other companies.

Turn on the Lights

Despite the widely held belief that aircraft external lights could be effective in preventing runway incursions, uniform procedures do not exist worldwide governing the use of external lights while on the ground, the International Federation of Air Line Pilots' Associations (IFALPA) says.

Working together, IFALPA, Eurocontrol and the U.S. Federal Aviation Administration have developed guidelines intended to improve the visibility of aircraft within the maneuvering area of an airport. The guidelines — which discuss lighting procedures to be used before starting an aircraft, during taxi out, while crossing a runway, while entering a runway for takeoff and during taxi in — are not intended to replace proper communications.

IFALPA said that, regardless of the guidelines, the aircraft captain is "responsible for ensuring [that] operating limitations


© Adam Jastrzębowski/Fotolia.com

and established operating procedures are observed. The captain always has the final authority to use the aircraft lights as deemed necessary for the safe execution of flight, including ground movement operations."

Emergency Procedures

Manufacturers of aircraft with engine turbochargers should be required to amend the emergency procedures sections of pilot operating handbooks and airplane flight manuals to include information on turbocharger failure, the U.S. National Transportation Safety Board (NTSB) says.

In a safety recommendation to the U.S. Federal Aviation Administration, the NTSB said that it was especially concerned about including procedures that would minimize the hazards of in-flight fires and/or engine power loss.

The NTSB cited a fatal May 24, 2004, accident in which a Cessna T206H, operated by the U.S. Drug Enforcement Agency, crashed after the pilot reported losing engine power in cruise flight 1,150 ft above ground level. The pilot, the only person in the airplane, was killed in the crash, and the airplane was destroyed.

During its investigation, the NTSB found that the turbocharger had failed and the turbine wheel had seized. The in-flight emergency procedures included in the pilot operating handbook "lacked information to assess the difference between an engine [failure] and a turbocharger failure and did not provide any clear guidance or instructions on how to handle a turbocharger failure once a pilot identified the problem," the NTSB said.

The NTSB said the probable causes of the accident were "the seized turbocharger, the altitude/clearance not maintained/obtained during approach to a forced landing on an agricultural field and the unsuitable landing area encountered by the pilot." The NTSB cited "inadequate emergency procedures by the manufacturer" as a contributing factor.

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Belgian accident investigators are searching for the cause of the May 25 crash of this Kalitta 747-200 during takeoff from Brussels for a flight to Bahrain. Witnesses reported hearing a loud bang just before the airplane ran off the runway and broke apart. None of the four people in the cargo airplane was injured.

Human Factors Standards

New requirements call for Australian pilots to be trained and assessed in "the practical application of human factors" for every flight.

The Civil Aviation Safety Authority (CASA) says the new human factors standards, which were introduced into pilot training for all licenses being issued beginning March 1, will be subject to formal skills assessment beginning July 1, 2009.

"The move recognizes the need for skills such as human performance and lookout, situation awareness, decision making, workload management and communications to be delivered through structured training," CASA said.

Flight training organizations are being required to implement training methods that "ensure pilots meet the human factors standards," CASA said.

757 Clip Inspections Urged

© Boeing

Operators of Boeing 757s should be required to conduct a one-time visual inspection of support beam clips on a portion of the upper wing to ensure that the clips are not cracked and that they are properly oriented, the U.S. National Transportation Safety Board (NTSB) says.

The NTSB cited a March 22 incident in which the left upper wing fixed trailing edge panel on a US Airways 757 separated at 27,000 ft while the airplane was en route from Orlando, Florida, U.S., to Philadelphia. The panel struck several airplane windows; the outer pane of one window cracked as a result. None of the 180 people in the airplane was injured in the incident.

A subsequent examination of the wing found fatigue cracks in three support clips; the maintenance technician who removed the clips said that they had been oriented incorrectly and that no spacers had been installed, as required by a 1988 Boeing service bulletin and a subsequent airworthiness directive from the U.S. Federal Aviation Administration (FAA).

After the incident, inspections of 18 other US Airways 757s revealed that a total of 11 clips on seven airplanes were cracked; of the 11, nine clips on five airplanes were oriented incorrectly. US Airways records did not indicate whether spacers had been installed.

The NTSB, noting that Boeing considers spacers critical in extending the fatigue life of the support clips, said that the cracked clips could have resulted from incorrect clip orientation, the age of the clips, the absence of spacers or a combination of these three issues.

The NTSB said it is "concerned that there may be other [757s] with cracked and/or improperly oriented clips or lack of spacers, which could lead to support clip failure and a wing fixed trailing edge panel separation. A wing fixed trailing edge panel that separates from the aircraft in flight could impact the tail of the airplane, resulting in the potential loss of controlled flight, or could damage the windows or fuselage, resulting in possible rapid depressurization of the aircraft."

The NTSB recommended that the FAA require operators to conduct a one-time visual inspection of the clips and replace those that are cracked and reinstall those that are oriented improperly or that lack spacers. Other recommendations called for the FAA to require operators to report any cracked clips discovered in their inspections, as well as the part number and orientation of the clips and whether spacers were present, and to require Boeing to issue more explicit instructions for the correct orientation of the clips and spacers.

Unmanned Aircraft Join the Crowd

© BAE Systems

Eurocontrol says it has begun a program to safely integrate unmanned aircraft systems (UAS) into the pan-European air traffic management (ATM) network.

The current separation of UAS from manned aircraft has limited their use in "a wide range of activities that are particularly well suited to their unique mix of capabilities such as flexibility, agility, long endurance and low cost," Eurocontrol said.

The agency said that to accomplish its goal, a strong partnership is needed with industry, operators and all airspace users.

"The challenge of UAS integration is global," said Jean-Robert Cazarré, Eurocontrol's director of civil-military coordination.

The Eurocontrol program will focus first on the integration of UAS into the ATM network in the short to medium term, within the framework of the existing ATM environment. The second phase of the program will address how UAS will be handled after 2020 under Single European Sky ATM Research (SESAR), which is intended to change the way air traffic is managed throughout Europe. Primary concerns are "the requirement for an effective sense-and-avoid system, and the need to ensure adequate radio spectrum for the additional avionics associated with UAS flight," Eurocontrol said.

In Other News …

The U.S. Federal Aviation Administration (FAA) has ordered pilots and air traffic controllers to stop taking Chantix, an **anti-smoking medicine** that researchers say is associated with an increased risk of seizures, loss of consciousness, heart attacks, vision problems and psychiatric instabilities. … The FAA is proposing to rewrite a 1960 regulation that allows aircraft to take off with **"polished frost"** on their flight surfaces. Decades of research have convinced the FAA and others that any amount of a contaminant — including smoothly polished frost — on critical surfaces "could be detrimental to the flight characteristics of an aircraft," the FAA says.

Compiled and edited by Linda Werfelman.

BY MARK LACAGNINA

A relayed company message distracted the crew during an autoland approach.

U.K. Air Accidents Investigation Branch

The Boeing 737-300 freighter was about 500 ft above ground level (AGL) during a Category IIIA approach to England's Nottingham East Midlands Airport when the flight crew was told by air traffic control (ATC) that the airline had instructed that they were "not to land here." The commander, the pilot flying, inadvertently pressed the autopilot-disengage button instead of the radio-transmit button on his control yoke to seek clarification of the message. The 737 deviated above the glideslope and left of course before sinking rapidly.

Confusion briefly reigned on the flight deck before the commander initiated a go-around, although too late to avoid ground contact. The right main landing gear separated when the 737 touched down in a grassy area between the runway and a parallel taxiway. However, the aircraft became airborne again, and the crew was able to fly it to Birmingham Airport and conduct a successful emergency landing.

In its final report on the accident, the U.K. Air Accidents Investigation Branch (AAIB) said that a causal factor was the airport tower controller's inappropriate transmission of a company radio message when the crew was engaged in a late stage of an autoland approach. The crew's delayed decision to go around also was a causal factor; the approach should have been rejected immediately after the autopilots disengaged, the report said.

The accident occurred the morning of June 15, 2006, during a scheduled cargo flight from Liège, Belgium, to London Stansted Airport. The aircraft was operated under the call sign Quality 325N by TNT Airways, a Belgian company that provided cargo services internationally with a mixed fleet. The 737 was manufactured in 1987 and converted to a freighter in 2004; it had accumulated 45,832 airframe hours and 34,088 cycles.

The aircraft was scheduled to depart from Liège at 0234 coordinated universal time (0134 London time). Both pilots were Belgian nationals. The commander, 42, had 8,325 flight hours, including 4,100 hours in type and 4,000 hours as a flight engineer. "The commander had been promoted within the company, having previously been a copilot," the report said. "He completed his command qualification on 9 February 2006." The copilot, 35, had 1,674 flight hours, including 1,377 hours in type.

"The performance of both pilots may have been adversely affected by tiredness, as a result of the combined effects of their overnight periods on duty and the low point in their circadian rhythm," the report said.

The commander had been on duty since 1815 the previous day. His duty period began in Istanbul, Turkey, after a rest period of more than 12 hours. "He later reported that he was not able to sleep well before commencing duty and was affected by tiredness at the time of the accident flight [after 10 hours 25 minutes of flying]," the report said. The copilot had a rest period of nearly 17 hours before his duty period began in Vienna, Austria, at 1925 the previous day. He had flown 9 hours 15 minutes when the accident occurred.

Unforecast Fog

The weather forecast for Stansted called for 8 to 10 km (5 to 6 mi) visibility, scattered clouds at 1,500 ft and light winds, with a 30 percent probability of a temporary reduction of visibility to 4,500 m (about 2 3/4 mi) and a broken ceiling at 700 ft. The report said that "good weather" was forecast for the two alternate airports, East Midlands and Liverpool.

"The fuel required for the flight, according to the flight plan, was 5,514 kg [12,156 lb]," the report said. "The actual cargo load was such that extra fuel capacity was available, so the crew decided on a fuel load of 7,500 kg [16,535 lb]."

Ground Track

UTC = coordinated universal time

Source: Adapted from U.K. Air Accidents Investigation Branch report by Susan Reed

Figure 1

The 737 departed from Liège at 0312. Nearing London at 0344, the copilot established radio communication with Essex Radar and advised the controller that they had received Stansted automatic terminal information system (ATIS) information Quebec, which said that visibility at the airport was 6 km (3 3/4 mi). "However, Essex Radar advised the crew that ATIS information Romeo was now in force, giving a visibility of 4,900 m [about 3 mi] in mist," the report said. "Additionally, the controller informed the crew that there were reports of fog approaching Stansted Airport and that the touchdown RVR [runway visual range] was showing 1,000 m [3,000 ft]."

The instrument landing system (ILS) at Stansted was not in service because of extensive runway maintenance in progress. A temporary surveillance radar approach procedure had been commissioned with a minimum descent height of 930 ft and a minimum RVR of 2,000 m (6,500 ft).

Believing that the visibility at Stansted would improve as the sun continued to rise, the crew requested and received clearance from ATC to hold (Figure 1). While flying a holding pattern northwest of the airport, however, the crew received several updates indicating that visibility was steadily decreasing. At 0401, they were advised that RVR was between 650 and 350 m (2,100 and 1,200 ft).

Where to Go?

The commander had sent a message to the company, via the aircraft communications addressing and reporting system, asking which alternate airport was preferred if they had to divert from Stansted. "[He] had not received a reply, so he contacted the handling organization at Stansted and requested that they call the company operations at Liège to ask for the information," the report said.

Meanwhile, the crew recalculated their fuel endurance and told Essex Radar at 0403 that they could hold for 35 minutes. They also requested information on current weather conditions at East Midlands and Liverpool. They were told that East Midlands had a visibility of 2,000 m in haze, scattered clouds at 200 ft and

The fuse pins in the right main landing gear failed, as designed, on contact, preventing structural damage to the wing.


U.K. Air Accidents Investigation Branch

a broken ceiling at 300 ft; Liverpool's visibility was greater than 10 km (6 mi), with a few clouds at 300 ft.

The crew also received a reply from the company that East Midlands was the preferred alternate. At the time, Runway 09 was in use at the airport. At 0419, the crew asked Essex Radar if Runway 27 would be available at East Midlands for a CAT IIIA approach. The controller replied that the airport was changing landing operations to Runway 27 because of the deteriorating weather conditions; RVR was 400 m (1,300 ft) in the runway touchdown zone, 650 m at midfield and 900 m (2,900 ft) in the end zone.

"The pilots agreed that they would attempt an approach to EMA [East Midlands], in accordance with the company preference, as sufficient fuel would remain to continue to Liverpool Airport should the approach have to be abandoned," the report said.

The scrapes in the center of the grassy area were made by the right main gear, engine nacelle and flap track.

U.K. Air Accidents Investigation Branch

High Workload

The crew requested and received clearance to leave the holding pattern and fly to EMA. Their workload was very high during the 15-minute flight. "During the transit, the commander carried out an approach briefing, which included the possibility that a CAT IIIA approach might be required," the report said.

The copilot had difficulty finding the printed approach charts for EMA. He initially searched for them under the heading "East Midlands" and eventually found them under the correct heading, "Nottingham East Midlands."[1] The extra time required to locate the charts placed additional pressure on the crew, the report said.

The crew established radio communication with East Midlands Approach at 0430. The approach controller told the crew that they would be vectored for the ILS approach to Runway 27 and that touchdown zone RVR was 350 m. The flight crew was authorized to conduct CAT IIIA approaches in the 737 with a minimum RVR of 200 m (700 ft).

The aircraft was at 2,000 ft at 0437 when the copilot told the approach controller that they were established on the ILS localizer. The controller cleared the crew to conduct the approach and to establish radio communication with East Midlands Tower.

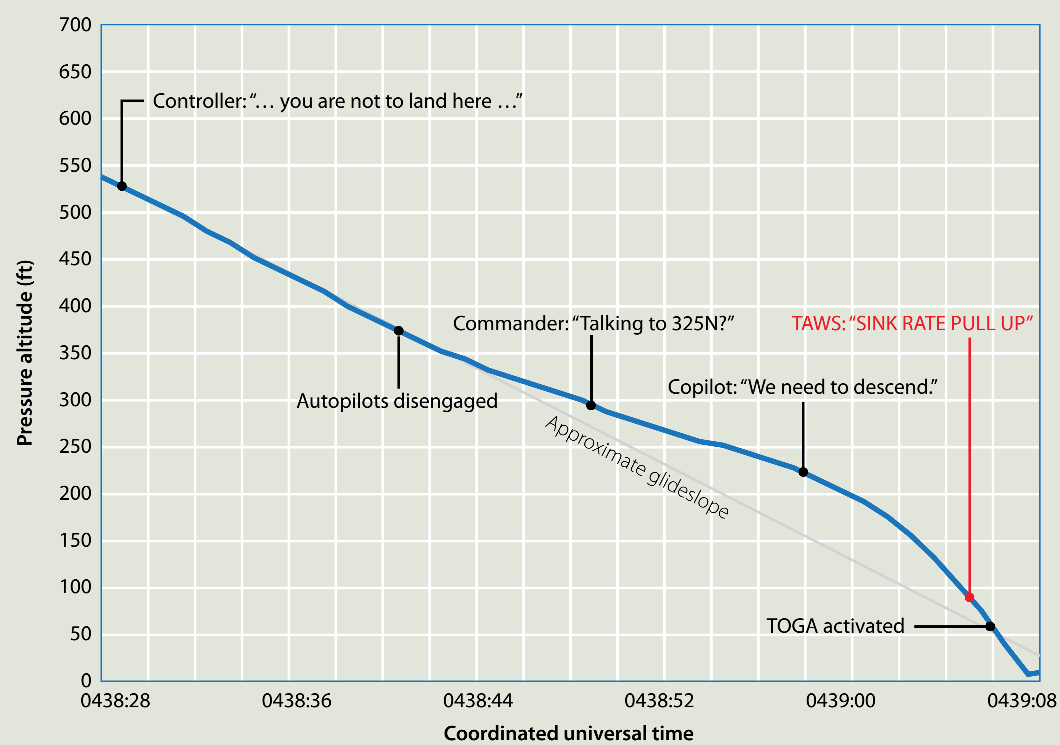
The tower controller cleared the crew to land and advised that the surface winds were from the southeast at 2 kt and that touchdown zone RVR was 350 m. "Approximately one minute later, the copilot asked for and was again given confirmation that they were clear to land," the report said. "Around this time, the crew had completed their landing checks for a CAT IIIA landing, with the landing gear extended and flap 40 set."

'You Are Not to Land Here'

About 0438, the tower controller received a telephone call from a company representative. "He was informed that the company would like the aircraft to divert to Liverpool Airport rather than land at EMA," the report said. "With the aircraft on final approach, the controller immediately took the decision to advise the crew of their company's request and give them the opportunity to go around. … The most prudent action would have been for the [controller] to have taken no action and allowed the aircraft to land."

The U.K. Civil Aviation Authority's *Manual of Air Traffic Services* (*MATS*) allows controllers to relay company messages pertinent to the flight but requires the radio transmission to be prefixed with "Company advise/request … ."[2]

Flight Path at East Midlands



TAWS = terrain awareness and warning system; TOGA = takeoff/go-around (mode)

Source: Adapted from U.K. Air Accidents Investigation Branch report by Susan Reed

Figure 2

Figure 2 shows the aircraft's flight path. It was within 2 nm (4 km) of the runway when the tower controller radioed, "Three two five November, I've been instructed that you are not to land here from your operation … operational authority. At your discretion, you may go around."

Both pilots heard the transmission, which had included only part of their call sign — "Quality" was omitted. The copilot, whose command of English was limited, did not realize that the transmission was meant for them and did not understand the message; thus, he did not reply to the controller. "With no response from the copilot, the commander was not sure whether the ATC message was for his aircraft and, if so, what it meant," the report said. "He attempted to respond to ATC himself, but he inadvertently pressed the autopilot disconnect button as he started to speak, so that both autopilots disconnected."

According to the airline's standard operating procedures (SOPs), a missed approach should have been initiated immediately after the autopilots disengaged. However, the commander attempted to re-engage the autopilots while responding to the controller's transmission, and the copilot failed to call for a go-around. "Had he done so, it is very likely that the commander would have overcome his own distractions and carried out a go-around in good time," the report said.

About 10 seconds elapsed before the commander asked the controller, "Talking to three two five November?" The controller replied, "Three two five November, clear to land." The commander acknowledged the clearance.

A CAT IIIA approach requires both autopilots to be operating in the approach mode. The system had defaulted to the control wheel steering mode when the autopilots were disengaged; in this mode, only one autopilot can be engaged.

The commander attempted to re-engage the autopilots while responding to the controller's transmission, and the copilot failed to call for a go-around.

Nevertheless, the commander made several attempts to re-engage both autopilots.

"The copilot observed that the aircraft was going above the glideslope and pointed this out to the commander by saying 'one dot high,'" the report said. "With no response, he said in French, 'We need to descend.'"

'Green' Fills the Windscreen

The 737 was at about 87 ft AGL and descending at 1,500 fpm when the terrain awareness and warning system generated a "sink rate, pull up" warning. "The commander looked up and saw 'green' filling the front windscreen," the report said. "He disconnected the autopilot, selected the takeoff/go-around (TOGA) mode and made an aft control wheel input. Almost immediately, the aircraft hit the ground; this was followed by a short period of extreme confusion."

Neither pilot could recall precisely what happened after ground contact. The copilot told investigators that he thought the commander was not reacting, so he called "go around" several times. The commander heard the calls, applied power "and, in his own words, 'recovered his senses,'" the report said. The copilot assisted in applying full power and rotating the aircraft to a climb attitude.

The impact occurred at 0439. After breaking off at its fuse pin attachment points, the right main gear struck the inboard flap assembly and the rear fuselage, and came close to striking the horizontal stabilizer. The bottom of the right engine nacelle and right wing tip also were damaged.

"The pilots were aware that the aircraft had suffered some damage, as the landing gear unsafe warning horn was sounding and one landing gear red light indication was showing," the report said. "As the 'split flaps' indication was also showing, they decided not to attempt to change the aircraft's configuration."

The tower controller had heard the sound of the 737's engines and radioed, "Quality three two five November, I hear you have gone 'round, and was that because of the reasons I gave you or because of the weather?"

The copilot told the controller that the aircraft had "touched the ground" and requested clearance to divert to Liverpool. "The controller responded with an explanation of the message that he had passed to the crew prior to landing, and he completed this transmission with the instruction … to climb to 4,000 ft," the report said.

'We Have Big Problems'

At 0443, the commander declared an emergency. "We have big problems," he said. "We have to maintain three thousand feet. We have one unsafe gear, and we have flap problems. … We are of a low fuel status, three thousand kilos, and we need an airfield where we have CAVOK [ceiling and visibility OK for visual flight operations]."

The approach controller, who also was the ATC watch supervisor, was monitoring the 737 crew's radio transmissions and told the tower

Boeing 737-300

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The 737 was designed to use many components and assemblies from the 727. Deliveries of the first production model, the 737-200, with Pratt & Whitney JT8D engines, began in 1967. The larger 737-300 was introduced in 1984 with CFM International CFM56 engines rated at 20,000 lb (9,072 kg) thrust.

The 737-300 can carry 128 to 149 passengers and 1,068 cubic ft (30 cubic m) of cargo. Maximum standard takeoff weight is 124,500 lb (56,473 kg). Maximum landing weight is 114,000 lb (51,710 kg). Maximum operating speed is Mach 0.82. Cruising speed is Mach 0.75.

Production of the 737-300 ceased in 2000 after 1,113 were built.

Source: *Jane's All the World's Aircraft* controller to transfer the flight to his frequency. The approach controller told the crew to maintain 3,000 ft and fly a heading of 230 degrees for radar vectors to Runway 15 at Birmingham Airport, which had CAVOK weather conditions.

At 0445, the approach controller told the crew that they had "thirty track miles to go to Birmingham" and asked what problems they had. In addition to the gear unsafe and split flaps warnings, there were indications that Hydraulic System A — one of two main hydraulic systems in the 737 — had failed and that the aft cargo door was not secure. Hydraulic System A is the sole source of power for the outboard spoilers, ground spoilers and nosegear steering system.

Not aware that the right main gear had separated, the crew conducted the manual and emergency gear-extension procedures listed in the quick reference handbook (QRH). The commander, who was hand-flying the 737, then decided not to conduct any other QRH procedures and to concentrate on landing the aircraft as soon as possible. "He was experiencing some control difficulties, in particular in maintaining the aircraft's wings level," the report said.

Dry Ice and Pyrotechnics

When the crew established radio communication with Birmingham Approach, they were told that the Runway 15 glideslope was not available because of routine maintenance. The commander told the controller that they required a full ILS and said that they would conduct the ILS approach to Runway 33.

"During the next three minutes, the controller continued to provide radar headings and also established from the crew the aircraft's fuel endurance and the number of persons on board," the report said. "The copilot checked the NOTOC [notice to captain relating to hazardous cargo] and passed information to ATC that part of the aircraft's cargo was dry ice and pyrotechnics. The crew reiterated that they needed to be on the ground as soon as possible."

At 0451, the controller said that the pilot of a police helicopter airborne over the city of Birmingham had offered to check the landing gear. The 737 crew accepted the offer and were told to fly a heading of 170 degrees to rendezvous with the helicopter. The 737 was at 2,500 ft when it flew by the helicopter. The controller told the crew that the helicopter pilot had reported that the nosegear and left main landing gear were extended but the right main gear appeared to be "up."

The report said that although the extra information about the gear was beneficial to the pilots, placing a damaged aircraft directly over the populated area of the city was "undesirable."

'Gentle Touchdown'

The flight crew prepared for a landing on Runway 33, which is 2,605 m (8,547 ft) long. The copilot conducted the "Partial or Gear-Up Landing" checklist, and the commander made a final attempt to manually lower the right main gear.

Surface winds were from 100 degrees at less than 5 kt when the aircraft touched down slightly to the left of the runway centerline at 0501. The landing was video-recorded by the police helicopter. "This showed a well-executed emergency landing, with a gentle touchdown and good control of the aircraft during the rollout," the report said.

The 737 came to a stop about 305 m (1,000 ft) from the end of the runway. "The aircraft was supported by its right engine nacelle, both left main wheels and the right nosewheel; the left nosewheel was just clear of the runway surface," the report said.

Aircraft rescue and fire fighting personnel arrived within 15 seconds, spread foam under the right engine as a precaution against fire and assisted the crew in evacuating the aircraft through the left forward entry door. None of the nearly 2,000 kg (4,409 lb) of fuel remaining in the aircraft leaked, and there was no fire. The report noted that there had been no substantial movement of the cargo.

Sticking to SOPs

The AAIB made only one recommendation based on the findings of the investigation: It called on the Belgian Civil Aviation Authority to require TNT Airways to review its SOPs to ensure that they include clear guidance on when go-arounds should be conducted.

"Although the circumstances of this event could easily have led to a catastrophic accident, there are few safety recommendations that can be made," the report said. "This is because actions by individuals which contributed to the accident were either inappropriate or were not in compliance with existing procedures. Noncompliance with procedures, whether inadvertent or deliberate, can be difficult to prevent and can only be addressed by effective training and maintaining a culture of adherence to SOPs within an organization."

This article is based on AAIB report no. 5/2008: "Report on the Accident to Boeing 737-300, Registration OO-TND, at Nottingham East Midlands Airport on 15 June 2006."

Notes

1. The airport's name was changed from "East Midlands" to "Nottingham East Midlands" in early 2004. In December 2006, the name was changed to "East Midlands Airport — Nottingham, Leicester and Derby."
2. The manual was revised after the accident to prohibit transmission of company messages that might distract pilots during a critical period of flight.

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Institutional changes and better national government understanding of the issues are preconditions for progress.

Putting Safety First

High accident rates are the most visible consequence of sub-Saharan Africa's struggling aviation safety system. It has been said that an underlying cause of the distressing accident rate in this part of the world is lack of political will at the highest levels of government for taking proactive steps on behalf of aviation safety. However, in most cases it may not be that simple.

Often, the key political officials are not the authorities responsible for safety in aviation. Other government branches play a critical role in enabling much-needed legislative changes and empowering the civil aviation department. Institutional problems, lack of communication, difficulty in understanding the international regulatory regime and the economic consequences of not meeting its standards, and outdated regulatory frameworks must be overcome before determination at the top of the political establishment can be effective.

Some consequences of the current situation in Africa can be seen in the International Civil Aviation Organization (ICAO) audits of states' government civil aviation departments or independent civil aviation authorities (CAAs). Audit results were formerly confidential but became public March 1, 2008. Another consequence has been the blacklisting of some African airlines by the European Union.[1]

Various African states are working towards improving their safety oversight systems on the basis of the findings of ICAO audits. However, many African civil aviation departments, those lacking the autonomy of CAAs, need the international aviation community to work with them in creating an enabling environment. That support will help African aviation professionals get

Photos: © AviAssist Foundation

in AFRICA

BY TOM KOK

U.S. National Aeronautics and Space Administration

the essential political backing from their governments and legislative bodies. Such a campaign to provide the preconditions for political will must focus on a number of issues.

Creating Political Momentum

Quite a few African countries have an established safety oversight system based on an outdated legal framework. The laws and regulations sometimes date back to the 1950s or 1960s. They were developed for a completely different era of the aviation industry. Such legal instruments may, for example, be geared to looking at purely technical solutions to safety issues. At best, they may take account of human factors. But hardly any are sufficiently current to tackle the issue of organizational weaknesses, as today's safety management systems do.

Civil aviation departments may face political reluctance when they try to realize fundamental changes toward the modern legal codes needed for adequate safety oversight. They may meet similar political reluctance when trying to restructure the system in the direction of independent CAAs. The civil aviation department may have to persuade its parent ministry, the cabinet and parliament that regulatory independence or regionalization is a critical step to more effective supervision and aviation safety improvements.

Quite a number of East and Southern African states have members of parliament who represent a district constituency. In such electoral systems, not only in Africa but throughout the world, some members of parliament are influenced by whether they can see political gain in supporting a particular legislative or administrative change to aviation safety oversight legislation. Moreover, members of parliament belonging to the political opposition may sometimes be reluctant to support changes favored by the ruling party.

Regular changes of a minister or secretary of transport will often mean new aviation policies and new managers of the civil aviation department. That, in turn, may result in having to start over again in familiarizing the new officials with aviation safety issues and the need to push for changes in laws and regulations or for regulatory independence from politics.

Members of parliament, however, usually remain in office for their full term. They are a more constant force in government. It would certainly help aviation departments to have explanatory documentation written for a non-aviation audience to sensitize new members of parliament and ministers about the roles and international responsibilities of the aviation regulators. Such documentation should also explain the relevance of aviation safety to possible blacklisting and subsequent consequences for tourism and trade. That may also help win the support of key political players.

Many African civil aviation departments … need the international aviation community to work with them in creating an enabling environment.

Civil Service Realities

Resistance to restructuring of aviation departments may come from many professional corners. A typical middle management civil servant in many African states may earn no more than US$500 per month, while there are opportunities for aviation inspectors to earn considerably more by moving to a commercial aviation job. In such a situation, it is difficult for a government to justify why a particular class of civil servants or experts, namely those in aviation, should earn significantly more than others.

More and more, the international aviation community considers the regionalization of safety oversight to be the best way to solve deficiencies in safety supervision. However, regional cooperation brings up issues of national independence and pride in Africa, just as it does elsewhere in the world, so the road to regionalization is not easy. An added complication in the case of African countries with a district electoral system is that decisions about these solutions may be put to members of parliament who may have no direct political interest in approving them.

Data-driven safety management has not yet influenced aircraft operations in Africa on a large scale.

While regional cooperation is a very constructive path, it should not lead to delaying the building of national capabilities. This is particularly true since lengthy development times are usually involved with such regional solutions. Capability build-up at a national level can very well be gradually integrated into the regional entity in due time.

Another temporary solution could be salary top-ups — a supplemental income — for key safety oversight experts. Salary top-ups are a contentious issue but may provide a bridge to more structural solutions such as regional oversight organizations. In fact, even the ICAO Cooperative Development of Operational Safety and Continuing Airworthiness Program (COSCAP) projects rely indirectly on salary top-ups.

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Salary top-ups are used in other economic sectors, such as health care. They help keep professionals with international qualifications available for critical civil service positions. In some cases, top-ups are supported by the international community. Examples from other sectors seem to indicate that the costs involved in salary top-ups could be borne fairly easily by the international community.

Sharing Experiences of Regulatory Independence

A wave of political and financial independence for government departments throughout Africa in the early 1990s has brought mixed experiences. In the case of financial independence, the civil aviation authority is allowed to keep part or all of its income from air traffic control and landing charges. Political independence means that the organization can operate outside the political mainstream. It then no longer has to devote precious resources to routinely addressing purely political issues.

In some countries, the aviation industry may be too small to generate sufficient revenues for a financially independent CAA. In those cases, regionalization of safety oversight may be a solution.

The African region can be helped by assistance in the form of tools to build an economic case for an independent civil aviation authority. Parliaments in Africa may want to know what are the credible sources of income for an authority. The amount of revenue that is generated by a particular level of industry activity is quite often difficult to quantify, however.

A number of documents[2] describe the tasks of a civil aviation authority, but they provide no logical explanation of the *raison d'être* for a civil aviation authority and its critical function in aviation safety based on state responsibilities. The international aviation safety community should consider organizing a program that enables countries in the region to learn from countries that already have established a CAA.

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The AviAssist Foundation is preparing to contribute to such a program through a workshop on regulatory independence.

Raising Public Awareness

Often the news media do not report, or incorrectly report, the international safety oversight responsibilities that have to be met by aviation authorities and are of little educational assistance. Each year, for example, numerous articles are written in which the responsibilities and powers of ICAO are misinterpreted. The media often do not understand the international expertise that is required to provide adequate safety oversight. Such experts can easily seek greener pastures in a growing industry in Africa or in other regions of the world, such as the Middle East.

Some news stories may be based on little or no research, encouraging unjustified public resistance to establishing financially and politically independent authorities and higher salary structures based on international standards.

Specific attention is often paid to the deficiencies in air navigation services in some countries, as well as the inconsistency between deficiencies and the charges for these services. The most notorious subject is radar coverage. Since it is one of the most visible pieces of infrastructure, the media eagerly pick up the issue, followed by calls for better navigation facilities and VHF radio communication coverage in controlled areas.

A number of countries, including Tanzania, have taken the important step of organizing aviation familiarization workshops for the media. That will help gain public appreciation of the international regulatory requirements through informed reporting. In turn, this public appreciation may help build parliamentary goodwill for well-organized and well-funded civil aviation authorities.

Data and Analysis

Very little information is available on the extent to which African aviation departments and authorities harvest comprehensive safety data other than accident statistics.

Safety data management and analysis have helped identify safety trends around the globe. They can be highly efficient in predicting where action is best taken to prevent incidents and accidents. However, data-driven safety management has not yet influenced aircraft operations in Africa on a large scale. Working toward a common collection of safety data will allow the detection of meaningful safety trends and eventually prevent incidents from developing into accidents. In most African countries, the practice will require a change in legislation to give aviation safety professionals sufficient confidence in the proper use of the data they provide. The legislators have

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to be educated about nonpunitive data collection to be able to strike a delicate balance between protection of aviation professionals in the interest of safety and criminalization of accident investigations if there is a case to answer.

However, such data can also assist in building a rationale for devoting adequate resources to a CAA. Figures and graphs make it easier to explain safety needs to key political players who have little aviation background. They may make clear to people outside the industry the added value of a competent CAA. In that manner, such data may help build a case for a restructured civil aviation authority or a transition to a regional safety oversight organization.

Nonspecialist Language

Communication is a critical component of safety management. Safety management also focuses on looking at the interfaces between organizations and processes in the aviation industry. However, the aviation community has to do a much better job in making its world understandable for aviation outsiders who nonetheless play a critical role in improving aviation safety. The interaction between the technical specialists of the aviation community and the government is not always well organized, and mutual understanding should be improved.

Governments may not always find it easy to determine what constitutes safety and lack of safety. Also, its officials may not be aware of the increasing international pressure to improve aviation safety. This is due to lack of plain-language documentation on such issues. The international element so important in aviation does not come into play nearly as much in other government sectors such as health or domestic commerce, where little if any international regulation is a factor.

Explanatory documentation also must make the link between aviation safety and related national economic interests such as tourism. African tourism boards usually try to attract U.S. and European tourists to their countries, some of the most affluent holiday spenders. However, to establish flight connections between an African country and tourists' home regions, aviation authorities outside Africa have to be convinced that the country meets its safety oversight obligations under ICAO standards. Governments may not be aware of that requirement.

Role of ICAO

A related challenge for the international aviation community is to produce publications that make all this more or less self-evident. Plain-language leaflets will have to describe why a regional oversight organization or an independent civil aviation authority can better take care of safety oversight then a politicized government department.

ICAO itself is being restructured into an organization that will focus on implementation of its standards. The African region can benefit from such standards-implementation assistance.

The ICAO Africa Comprehensive Implementation Plan (ACIP) offers good prospects for a coordinated approach. Important work is being done in cooperation with the Industry Safety Strategy Group on implementing the *Global Aviation Safety Roadmap*. The implementation of ACIP will provide a thorough test of whether ICAO can effectively execute its new implementation role.

The AviAssist Foundation and Flight Safety Foundation will focus on solutions and campaign for wide political appreciation of aviation safety in Africa. It is time to start sharing solutions instead of merely holding meetings on challenges. The AviAssist Foundation is proud to act at the forefront of African aviation safety and be part of the solutions.

Tom Kok is director of the AviAssist Foundation.

Notes

1. ICAO has audited or is planning a comprehensive safety audit of the civil aviation departments or CAAs of 20 African countries. The European Union has blacklisted all airlines from the Democratic Republic of Congo, Equatorial Guinea, Liberia, Sierra Leone and Swaziland, and one airline each from Angola, Rwanda and Sudan.
2. For example, *ICAO Safety Management Manual*, DOC 9859, Chapter 3.

The AviAssist Foundation

The AviAssist Foundation is the regional affiliate of Flight Safety Foundation for East and Southern Africa. As an independent nonprofit organization, the AviAssist Foundation relies on contributions of stakeholders to identify threats to safety, analyse the problems and work on practical solutions to them.

"Some countries and companies have done a brilliant job in improving their systems and can't wait to tell their stories," says AviAssist's director, Tom Kok. "The current system hides those heroes. The AviAssist Foundation will support others in their efforts to replicate such success stories."

AviAssist has a representative in Zambia. The AviAssist Foundation can be contacted at <info@aviassist.org> and has a Web site at <www.aviassist.org>.

— Rick Darby

Вы говорите по-английски?*

*Do You Speak English?

Susan Reed

Russian pilots and air traffic controllers are being challenged by new requirements to demonstrate proficiency in aviation English.

BY SERGEY MELNICHENKO

As the leader of a team of language and aviation specialists in Russia that developed a tool for English proficiency evaluation,[1] I know that non-English speakers in the aviation community are focused on getting English language proficiency endorsements. Because of differences in cultural, social and educational factors, methods of achieving this goal may vary from country to country, but in the rush to win the endorsement, the basics of aviation English must not be forgotten.

English language proficiency is a requirement of the International Civil Aviation Organization (ICAO), which initially established a March 5, 2008, deadline for airplane and helicopter pilots, air traffic controllers and aeronautical station operators to demonstrate their proficiency.

In recognition of the difficulties that many contracting states were having in meeting the March deadline, the ICAO Assembly has urged states to allow pilots and controllers to continue their work as usual, even without proficiency in English, as long as the state governments are proceeding according to a revised schedule for completion of language proficiency training. That new schedule calls for completion of the language proficiency requirement by March 2011.

Logical Chain

The logical chain of acquiring language proficiency begins with personnel selection and is influenced by the motivation, time, investment and commitment of everyone involved.

Our pilots are aging, and at least in this respect, Russia is like many other countries. Thirty or more years ago, when candidates' health, skills and knowledge were checked to certify their ability to fly aircraft, nobody tested their English. Today, in the final years of their professional careers, they are being challenged to demonstrate an ability to speak and understand English — a development they never expected.

Some of them remember a time 30 years ago when even an interest in learning a foreign language was closely scrutinized. Several generations of pupils graduated from school after a six-year course in English with precise knowledge of the answer to only one question: "What's your name?"

As is true of any new activity, language learning requires practice.

Observation of pilots and controllers engaged in today's language training process leads to the conclusion that about 20 percent of them, regardless of age, will never exceed Level 3 proficiency — defined by ICAO as "pre-operational," or inadequate in some situations. ICAO's requirements call for pilots, controllers and aeronautical station operators to demonstrate at least Level 4 "operational" proficiency (Table 1).[2]

Vulnerable Process

The training process is vulnerable in a number of areas — teachers, students, programs, training materials, motivation, course authenticity and content relevance, among others. Training in aviation English also is hindered because there is almost no opportunity for on-the-job practice of the language that would be used in urgencies and emergencies. Unfortunately, many aviation students of English may think that, because the probability of an incident or accident is low, there is little reason to pay so much attention to learning English.

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There are various forms of language learning — individually or within a group, in a non-English-speaking native country or an English-speaking country, in a classroom or online — but there is no magic wand, and nobody will wake up tomorrow to realize he or she is able now to speak and understand English. ICAO cautions aviation personnel to "understand that learning a language is more a function of time, effort and opportunity."[3]

A pilot's (or controller's) age or a shortage of training time often is cited as a reason for having not reached Level 4 proficiency. However, linguists have proved that age is not a factor in language learning, except as an influence on pronunciation. In addition, five years — the time since ICAO introduced its English language proficiency requirements — has been long enough for my alma mater, Moscow State Linguistic University, to train thousands of interpreters, teachers and translators, who attend evening classes while they work five days a week. There is no doubt their employers expect much more from them than Level 4 proficiency.

Nevertheless, time was lost because, during the first two or three years after ICAO's adoption of the requirement, many people did not believe that language requirements would become a reality. The three-year "transition period" before the proficiency requirements take effect in 2011 will hardly change this attitude, as even now, the same disbelief is being expressed in Internet discussion groups.

Time and Money

Airline managers are reluctant to spend money for English language proficiency training as it is costly, lengthy and there is no guarantee — if it is conducted by a reliable school with objective standards — that all students will reach Level 4 proficiency. Airlines in remote areas are in the worst position because some cities do not have training centers or language schools, and the airline management must allocate additional funds for travel, accommodations and other expenses associated with attending classes.

Some airline CEOs and pilots assume that paying for a course in aviation English will automatically mean that the entire class of students will achieve Level 4 proficiency.

Both pilots and management also hate spending much time on training, but as is true of any new activity, language learning requires practice. Some experience gained in language teaching indicates that to progress from Level 2 "elementary" proficiency to Level 3 proficiency requires about 50 percent more training time than a course that enables the student to move

International Civil Aviation Organization Language Proficiency Rating Scale

	Pronunciation[1]	Structure[2]	Vocabulary	Fluency	Comprehension	Interactions
Level 6 Expert	Pronunciation, stress, rhythm and intonation, though possibly influenced by the first language or regional variation, almost never interfere with ease of understanding.	Both basic and complex grammatical structures and sentence patterns are consistently well controlled.	Vocabulary range and accuracy are sufficient to communicate effectively on a wide variety of familiar and unfamiliar topics. Vocabulary is idiomatic, nuanced and sensitive to register.	Able to speak at length with natural, effortless flow. Varies speech flow for stylistic effect — for example, to emphasize a point. Uses appropriate discourse markers and connectors spontaneously.	Comprehension is consistently accurate in nearly all contexts and includes comprehension of linguistic and cultural subtleties.	Interacts with ease in nearly all situations. Is sensitive to verbal and nonverbal cues and responds to them appropriately.
Level 5 Extended	Pronunciation, stress, rhythm and intonation, though influenced by the first language or regional variation, rarely interfere with ease of understanding.	Basic grammatical structures and sentence patterns are consistently well controlled. Complex structures are attempted but with errors which sometimes interfere with meaning.	Vocabulary range and accuracy are sufficient to communicate effectively on common, concrete and work-related topics. Paraphrases consistently and successfully. Vocabulary is sometimes idiomatic.	Able to speak at length with relative ease on familiar topics but may not vary speech flow as a stylistic device. Can make use of appropriate discourse markers or connectors.	Comprehension is accurate on common, concrete and work-related topics and mostly accurate when the speaker is confronted with a linguistic situational complication or unexpected turn of events. Is able to comprehend a range speech varieties (dialect and/accent) or registers.	Responses are immediate, appropriate and informative. Manages the speaker-listener relationship effectively.
Level 4 Operational	Pronunciation, stress, rhythm and intonation are influenced by the first language or regional variation and frequently interfere with ease of understanding.	Basic grammatical structures and sentence patterns are used creatively and are usually well controlled. Errors may occur, particularly in unusual or unexpected circumstances, but rarely interfere with meaning.	Vocabulary range and accuracy are usually sufficient to communicate effectively on common, concrete and work-related topics. Can often paraphrase successfully when lacking vocabulary in unusual or unexpected circumstances.	Produces stretches of language at an appropriate tempo. There may be occasional loss of fluency on transition from rehearsed or formulaic speech to spontaneous interaction, but this does not prevent effective communication. Can make limited use of discourse markers or connectors. Fillers are not distracting.	Comprehension is mostly accurate on common, concrete and work-related topics when the accent or variety used is sufficiently intelligible for an international community of users. When the speaker is confronted with a linguistic or situational complication or an unexpected turn of events, comprehension may be slower or require clarification strategies.	Responses are usually immediate, appropriate and informative. Initiates and maintains exchanges even when dealing with an unexpected turn of events. Deals adequately with apparent misunderstandings by checking, confirming or clarifying.
Level 3 Preoperational	Pronunciation, stress, rhythm and intonation are influenced by the first language or regional variation and frequently interfere with ease of understanding.	Basic grammatical structures and sentence patterns associated with predictable situations are not always well controlled. Errors frequently interfere with meaning.	Vocabulary range and accuracy are often sufficient to communicate on common, concrete or work-related topics, but range is limited and the word choice often is inappropriate. Is often unable to paraphrase successfully when lacking vocabulary.	Produces stretches of language, but phrasing and pausing are often inappropriate. Hesitations or slowness in language processing may prevent effective communication. Fillers are sometimes distracting.	Comprehension is often accurate on common, concrete and work-related topics when the accent or variety used is sufficiently intelligible for an international community of users. May fail to understand a linguistic or situational complication or an unexpected turn of events.	Responses are sometimes immediate, appropriate and informative. Can initiate and maintain exchanges with reasonable ease on familiar topics and in predictable situations. Generally inadequate when dealing with an unexpected turn of events.
Level 2 Elementary	Pronunciation, stress, rhythm and intonation are heavily influenced by the first language or regional variation and usually interfere with ease of understanding.	Shows only limited control of a few simple memorized grammatical structures and sentence patterns.	Limited vocabulary range consisting only of isolated words and memorized phrases.	Can produce very short, isolated, memorized utterances with frequent pausing and a distracting use of fillers to search for expressions and articulate less-familiar words.	Comprehension is limited to isolated, memorized phrases when they are carefully and slowly articulated.	Response time is slow and often inappropriate. Interaction is limited to simple routine exchanges.
Level 1 Pre-elementary	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.	Performs at a level below Elementary level.	Performs at a level below the Elementary level.	Performs at a level below the Elementary level.

1. Assumes a dialect and/or accent intelligible to the aeronautical community.
2. Relevant grammatical structures and sentence patterns are determined by language functions appropriate to the task.

Source: International Civil Aviation Organization. *Manual on the Implementation of the ICAO Language Proficiency Requirements*, Document 9835. 2004.

Table 1

Sergey Melnichenko

from Level 1 "pre-elementary" proficiency to Level 2 proficiency. The progression of additional time is almost the same if we compare the training time required to enable someone with Level 3 abilities to progress to Level 4.

Robert Chatham of the ICAO Proficiency Requirements in Common English (PRICE) Study Group says that any measurable improvement requires several hundred hours of training. However, there is no guarantee that a pilot will achieve Level 4 proficiency in a 200-hour training program. Progress in learning a language depends on many factors, including the learner's starting point.

Absent Syllabus

The absence of a modern syllabus to satisfy ICAO requirements has been recognized by teachers, students and industry managers. Attempts to develop reliable programs have failed, probably because of some teachers' incomplete knowledge of the topic and the absence of subject-matter experts among course developers.

Measurable improvement requires several hundred hours of training.

The decision to send some aviation personnel, mostly controllers, for training in English-speaking countries was welcomed as a panacea. Has it helped? No, for several reasons, among them that, although groups of language students were sent to English-speaking countries for classes, the students spent much of their time together, using their native language.

In addition, the training period depended not on the time needed to achieve Level 4 proficiency but rather on the time available for the stay — typically four weeks but sometimes eight weeks. Although English was taught, the aviation context was missing because teachers often were unaware of the way controllers and pilots use the language. Instead, their students were drilled in such activities as discussing an airline business class menu. Four months after the course, sometimes sooner, the students regressed to the same level of English proficiency that they had before the trip.

Russian pilots who have passed new type-rating courses abroad — even in non-English-speaking countries — make more progress with language proficiency even if they are not simultaneously enrolled in English language courses. This may mean that the results of language training abroad depend primarily on whether subject-matter experts play leading roles in English language course development and the authenticity of a course's aviation content.

Varying Professionalism

As may be the case everywhere, the professionalism of aviation English teachers in Russia varies. Larger airlines capable of running their own training centers usually have well-trained teachers who frequently attend workshops on language issues and are capable of developing interesting and helpful training materials.

In other institutions, often state-owned enterprises, teachers still do not have computers or Internet access. At most, they receive a relatively short refresher course once every five years in another state-owned training institution with similar problems.

While training in English five years ago was limited to radiotelephony (RTF) learning, today some courses neglect RTF to focus instead on achieving a particular proficiency level. Courses range from a surprisingly low 60 hours to 220 hours per level. This disparity indicates that English has not been taught in accordance with English for Specific Purposes (ESP)[4] principles and — in comparison with impressive achievements in English for medicine, business, travel, metallurgy and other fields — the academic research in ESP aviation English is simply missing in Russia.

Fortunately, quite a few new teachers have joined aviation English training in recent years. They are hardworking and industrious, with an aptitude for developing new training materials and a zest for teaching.

However, because of a lack of serious research, the few books on aviation English that have been published in Russia are weak, and their authors obviously neglected to determine what actually needed to be taught. These books reflect their authors' anticipation of what radiotelephony *could* be, not what it *shall* be, according to ICAO standards discussed in Annex 10, *Aeronautical Telecommunications*, and Document 4444, *Procedures for Air Navigation Services: Rules of the Air and Air Traffic Services*.

Computer-based training is widely used by major airlines but is rare in other aviation settings. Without computers or an Internet connection, teachers are unaware of the wealth of Web resources that can be used for training. But probably the greatest shortcoming is the absence of ICAO documents. Some managers do not want to invest in what they mistakenly believe is not an ICAO standard but a recommended practice — a common attitude among medium-level aviation chiefs.

A 2001 Eurocontrol research project determined that only 20 percent of radio communications correspond to standard ICAO phraseology, although controllers and pilots involved in the research said they almost always complied with the standard. This finding makes clear that ICAO documents regarding standard phraseology should be more thoroughly studied during the training process. Each classroom should have a reminder of the ICAO prescription that "in all situations for which standard radiotelephony phraseology is specified, it shall be used."[5]

For its part, ICAO should be more attentive to the content of some documents. It is difficult to explain to meticulous students why "verify" — a word excluded several years ago from "Standard Words and Phrases" in Annex 10 — is still used in Document 9432, *Manual on Radiotelephony*. The same problem applies to some other words, and this violates the "one word–one meaning" principle.

Proficiency Maintenance

Attaining Level 4 proficiency is not the final goal for aviation personnel. Those who have Level 4 proficiency must work to retain it or to achieve a higher proficiency level. Language skills deteriorate without practice, and adequate practice may be difficult to obtain. On-the-job practice may well be limited to ICAO standard phraseology, although in accordance with ICAO language requirements, pilots and controllers should be able to demonstrate their ability to adequately interact in urgencies and emergencies.

Nevertheless, daily exposure to the English language is limited because English-language television programs are available only via satellite, English-language movies are dubbed into Russian, and there is a scarcity of English-speaking foreigners with whom to practice the language. Thus the ICAO recommendation of a three-year period between refresher courses for Level 4 proficiency may need to be shortened.

The aviation community in Russia is fully aware of ICAO language requirements; the country has four approved tests of English proficiency, more than 500 aviation English teachers and about 60 raters. In 2007, the civil aviation authority in Russia adopted federal regulations specifying the minimum English proficiency of flight crews, as well as their *ab initio* and refresher language training.

More airlines have recognized that ICAO's English language proficiency requirement has become a standard, and they are training crews for compliance. Russia also has begun inviting well-known foreign aviation English specialists to train its teachers.

Though noncompliant with the initial 2008 deadline, Russia has received the message and acknowledged it. Time will show whether the message was taken seriously.

Sergey Melnichenko is deputy director of the CompLang Aviation Training Center in Moscow.

Notes

1. The tool is TELLCAP, the Test of English Language Level for Controllers and Pilots, which is aimed at ensuring the valid evaluation of aviation personnel in line with ICAO's English language proficiency requirements.
2. ICAO's language proficiency rating scale describes six levels of language proficiency, ranging from Level 1 "pre-elementary" to Level 6 "expert." Minimum requirements are for aviation personnel to demonstrate at least Level 4 proficiency. Criteria for achieving Level 4 proficiency include, among other qualities, a sufficient vocabulary and comprehension to communicate effectively on "common, concrete and work-related topics," along with an ability to initiate and maintain verbal exchanges "even when dealing with an unexpected turn of events."
3. ICAO. *Manual on the Implementation of the ICAO Language Proficiency Requirements*, Document 9835. 2004.
4. ESP programs are English courses designed for workers in specific industries, including aviation; their goal is to provide the workers with language skills required for particular aspects of their jobs.
5. ICAO. Annex 10, *Aeronautical Telecommunications,* Volume II, Paragraph 5.1.1.1.

CRM on Demand

BY MARK LACAGNINA

Air taxi aircraft operators in the United States might be required to implement crew resource management (CRM) training for their pilots, according to rule-making action announced recently by the Federal Aviation Administration (FAA). The announcement responds to years of prodding by the U.S. National Transportation Safety Board (NTSB), which has highlighted the lack of such training as a factor in several accidents.

CRM training provides pilots with "techniques for improved crew coordination, workload management and error reduction," NTSB says. CRM training currently is required for pilots and other personnel involved in air carrier operations conducted under U.S. Federal Aviation Regulations Part 121, fractional ownership operations under Part 91 subpart K and commuter operations conducted under Part 135 in aircraft requiring two pilots or with more than 10 passenger seats. The safety board has repeatedly questioned why CRM training has not been extended to pilots who conduct air taxi, or on-demand, operations under Part 135.

"The cockpit environments and the duties of multi-person flight crews of Part 135 on-demand operations are

Florian Trojer/AirTeamImages.com

Air taxi pilots targeted for crew resource management training.

similar to those of Part 135 commuter operations," NTSB said. "Further, many Part 135 on-demand operators use sophisticated turbojet and turboprop equipment and can be affected by operational demands similar to those experienced by Part 135 commuter operators, such as schedule pressure and customer needs, which may influence the aeronautical decision-making process."

'Most Wanted' List

Part 135 CRM has been on NTSB's list of "most wanted transportation safety improvements" for several years. The safety board in June 2002 recommended revision of Part 135 to specify that air taxi operators with aircraft requiring two or more pilots must establish FAA-approved CRM training programs similar to those mandated by Part 121.

"Most air carriers have several days of dedicated CRM training at which accidents are reviewed and, in some cases, pilots examine their own communication styles to determine specific strengths and weaknesses that may affect crew coordination in the cockpit," NTSB said. "These courses also allow participants to interact with each other, obtain feedback, role play, learn strategies to improve workload and error management, recognize leadership qualities, and reinforce effective attitudes and behavior."

The recommendation was based on the investigation of the March 29, 2001, crash of a Gulfstream III in Aspen, Colorado. The report said that the pilots either did not have or only briefly had the airport in sight when they descended below the minimum descent altitude (MDA) while conducting the VOR (VHF omnidirectional radio) approach to Runway 15 (*Accident Prevention*, 11/02).[1] The Gulfstream was observed descending from a snow shower at low altitude and making a steep turn toward the runway before it struck sloping terrain about 2,400 ft (732 m) from the runway. The pilots, flight attendant and all 15 passengers were killed.

Among CRM deficiencies identified by NTSB in this accident were the pilot's inadequate approach briefing, the absence of required callouts during the approach, the pilot's exclusion of the copilot in decision making and the copilot's failure to "question or challenge the [pilot] or intervene when he placed the airplane in a potentially unsafe flying condition." The latter refers to the pilot's reduction of power below the minimum recommended setting and deployment of speed brakes, likely in an effort to "get below the snow showers and visually acquire the runway."

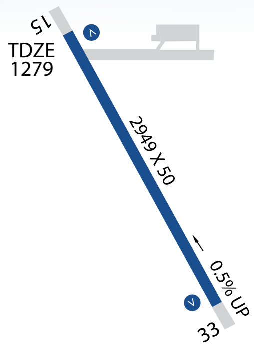
NTSB reiterated the recommendation in November 2003, following its investigation of the Oct. 25, 2002, crash of a Raytheon Beechcraft King Air A100 in Eveleth, Minnesota. The report said that the pilots' course deviation indicators (CDIs) likely were fully deflected when the airplane neared the MDA during a VOR approach and airspeed had dropped to 76 kt — 54 kt below the recommended approach speed — when the King Air stalled and crashed about 2 nm (4 km) from the runway, killing the pilots and all six passengers (*Accident Prevention*, 10/04).[2]

The report said that, contrary to CRM principles, "the evidence clearly indicates that neither flight crewmember was monitoring the airspeed indicator or CDI during the approach."

Responding to the recommendation in April 2004, the FAA told NTSB that an Aviation Rulemaking Committee was examining CRM training in the context of a thorough revision of Part 135 and that proposed rule making was expected in 2005.

In May 2006, NTSB again reiterated the recommendation following its investigation of the Nov. 28, 2004, crash of a Canadair Challenger on takeoff from Montrose, Colorado. Light snow was falling, but the crew used dry-runway performance data to plan the takeoff and did not ensure that the wings were clean (*ASW*, 8/06, p. 58).[3] The pilot, flight attendant and a passenger were killed, and the copilot and two passengers were seriously injured when the Challenger stalled and crashed about 636 ft (194 m) from the runway.

U.S. National Transportation Safety Board



A Runway Too Short

The most recent reiteration of the recommendation occurred on May 1, 2008, following the investigation of an accident that occurred in Cresco, Iowa, when the flight crew of a Cessna Citation 560 (Encore) attempted to escape severe weather by conducting a precautionary landing at an airport they had spotted.[4] The pilots did not use on-board resources, such as their charts and the flight management system (FMS) database, to obtain information on the airport and, thus, were not aware — until the last moment — that the runway was only 2,949 ft (899 m) long. The pilots were killed and the two passengers were seriously injured when the airplane overran the wet runway.

The accident occurred on July 19, 2006, during the fifth leg of a planned nine-leg trip. The Citation was managed by a Part 135 operator based in Jackson, Mississippi, but was being used by the owner that day for personal flights under the general operating and flight rules of Part 91. The operator employed six pilots and had three jets and one twin-turboprop airplane on its air carrier certificate. Noting that the operator did not have, and was not required to have, an approved CRM training program, the report said that such training would have benefitted flights conducted under Part 91 as well as Part 135.

U.S. National Transportation Safety Board

The cockpit burst on impact with a tree after the Citation overran the short runway at Cresco, Iowa. The accident report blamed 'poor CRM.'

Both pilots were rated as captains in the Citation. The pilot flying the accident leg of the trip had 13,312 flight hours, including 833 hours in Citation 560s. He was the operator's chief pilot. The copilot had 11,607 flight hours, including 557 hours in type.

The pilots began the trip with a departure from Jackson at 0600 local time. They flew to Gulfport, Mississippi; Destin, Florida; Meridian, Mississippi; and then to Oxford, Mississippi. The Citation departed with two passengers from Oxford at about 0920; the destination was Rochester (Minnesota) International Airport.

Severe Weather

The pilots did not specify an alternate airport on their instrument flight rules (IFR) flight plan. Although visual meteorological conditions were forecast for Rochester, the area forecast called for strong to possibly severe thunderstorms in the Great Lakes region.

As the pilots began their descent over central Iowa, ground radar depicted intense to extreme echoes in the area. "The echo tops … were depicted to 56,000 ft, with cells moving southeastward from 19 to 32 kt," the report said. "The regional radar mosaic … depicted two areas of organized echoes, one over northeastern Iowa and the second over southeastern Minnesota. Both systems merged in the general vicinity of the accident site and appeared as a bowing line with an intense leading edge."

At 1045, the copilot told Minneapolis Center that they were deviating east of course. "We're just going to keep heading this direction … until we get north of Rochester and then turn around and take a took at it," he said.

At 1051, the controller told the crew, "It's a heck of a bow hook we got going on there. … You'd have to go about a hundred miles or more north to get around the very northern edge of it. If you go around the south side, it's about eighty miles to get around."

Cockpit voice recorder (CVR) data indicated that the pilots discussed the weather and decided to "pick [their] way through it," the report said.

"Given the overwhelming evidence of severe weather conditions around Rochester, the flight crew exhibited poor aeronautical decision making by attempting to continue the preplanned descent to Rochester and by not diverting to a suitable airport."

'I'm Guessing'

The Citation was descending through 14,700 ft when the copilot established radio communication with Rochester Approach. Noting that the surface winds were from 340 degrees at 6 kt, gusting to 24 kt, and favoring the instrument landing system approach to Runway 31, the controller said, "But right now … we're showing weather echoes along that final approach course. Say your intentions."

The copilot told the controller that they would continue flying their present heading for 20 nm (37 km) and then "take a look at it on the radar." The crew then learned that visibility at the airport had decreased to 1/2 mi (800 m) and the gusts had increased to 37 kt in thunderstorms and heavy rain.

A few minutes later, the pilot told the copilot that he had an airport in sight. The copilot asked, "How long does the runway look?" The pilot replied, "I'm guessing 5,000 ft at least."

The copilot asked the approach controller about "the airport below us to the left," and the controller said that it was "Cresco, Iowa." (Cresco is about 43 nm [80 km] south-southeast of Rochester.)

The pilot said, "I guess, worst-case scenario, we could set here until it clears. … What do you think?"

The copilot said, "Cresco? Yeah, I mean I'm OK with that."

The pilot said, "Let's do that."

The copilot told the controller that they were going to land at Cresco and had the airport in sight. The controller cleared the crew to conduct a visual approach to the airport.

'Get Me Some Numbers'

The pilot asked the copilot to "get me some numbers … the landing numbers would be OK," and then said, "I'm going to have to put us down here. Hang on." A passenger told investigators the descent was so steep that he could see the runway through the windshield.

The copilot looked for information on the airport in a commercial airport guide. However, the Cresco airport — Ellen Church Field — was not listed in the guide because its runway is less than 3,000 ft long. "CVR evidence indicates that the flight crew did not use their on-board resources to get critical information about [the airport], including runway direction and length," the report said. "Further, the flight crew did not use on-airport resources, such as the wind indicator located on the left side of Runway 33." The indicator showed southerly surface winds.

The approach controller provided the common traffic advisory frequency (CTAF) to the crew before they canceled their IFR flight plan. The copilot announced on the CTAF that they were "turning final, landing to the, ah, north."

"The flight crew visually recognized during the final approach that the runway was shorter than the at least 5,000 ft they originally believed it to be [but] continued the descent and landing," the report said.

According to Cessna Aircraft, the required landing distance on a wet runway with a 10-kt (19-km) tailwind was 5,200 ft. The report noted that Cessna does not recommend landing a Citation on a wet runway with any tailwind component.

Soon before the airplane overran the runway, the copilot called for a go-around and the pilot called for full power. The Citation crossed a road and came to a stop when it struck a tree in a cornfield about 1,700 ft (518 m) from the end of the runway.

NTSB said that the probable causes of the accident were "the flight crew's inadequate aeronautical decision making and poor CRM." The board said that a contributing factor was inadequate CRM training for on-demand Part 135 pilots.

Action This Year?

The FAA originally intended to address CRM training in an omnibus rule-making proposal including all the recommendations generated by the Aviation Rulemaking Committee's review of Part 135 (*ASW*, 5/08, p. 30). The committee completed its work in 2005, with 167 recommendations for revisions. The FAA decided to group the recommendations into common topics for separate rule-making action.

The agency recently told NTSB that it has "initiated a rule-making project to require all Part 135 certificate holders, both single-pilot and dual-pilot operations, to implement FAA-approved CRM training for crewmembers and flight followers." The FAA said that it intends to publish proposed revisions for public comment by the end of 2008.

Notes

1. NTSB report no. DCA01MA034.
2. NTSB report no. NTSB/AAR-03/03.
3. NTSB report no. NTSB/AAB-06/03.
4. NTSB report no. CHI06FA193.

Fatal Distraction

A Bell 204B pilot was trying to manage a door that had opened in flight when the helicopter began a fatal dive to the ground.

BY LINDA WERFELMAN

A Bell 204B being used in an external load operation plunged nose-down and crashed after the pilot's side "bubble window" door opened in flight, distracting the pilot, the Transportation Safety Board of Canada (TSB) said in its final report on the accident.

The 10,700-hour pilot, the only person in the helicopter, was killed in the crash at 1800 local time on Sept. 24, 2006, at a drilling site 22 nm (41 km) southwest of Stony Rapids, Saskatchewan, Canada.

The TSB, in its findings on the accident's causes and contributing factors, cited the following:

- "The pilot's left-side bubble door opened during flight, likely because it was not closed and properly latched"; and,
- "In the pilot's preoccupation with the open door, it is likely that he allowed the helicopter to enter a low-g condition, which led to mast bumping and the in-flight breakup of the helicopter."

The pilot held a commercial pilot license and, of his 10,700 flight hours, about 3,000 were in long-line operations and 600 were in Bell 204/205 helicopters. He completed a Transport Canada pilot proficiency check in December 2005 in a Bell 205; the examiner described it as "a good ride with a very experienced pilot," the report said.

His initial ground training and visual flight rules flight training with the operator, Heli-Lift International, were conducted in July 2006 and included "an initial type-training refresher on the Bell 204 system operation and failures, emergency procedures, company procedures and flight

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A Bell 204 similar to this one crashed during external load operations.

exercises," along with recognition and prevention of specific abnormal flight conditions and associated recovery procedures, the report said. Training on the hazards associated with mast bumping — a condition in which the main rotor hub contacts the rotor mast, sometimes with enough force to cause separation of the main rotor system — was not included, and was not required.

The pilot held a Class 1 medical certificate and was described as being in good health. Although he had no recorded history of cardiovascular disease, an autopsy found more than 70 percent blockages of two coronary arteries. The autopsy could not determine whether the blockages had any effect on the pilot in this situation. The report did not give the pilot's age.

The investigation found that the helicopter had been maintained and certified in accordance with existing regulations, and had undergone a 100-hour inspection on July 23, about 80 flight hours before the accident. When the accident occurred, the helicopter had one minor defect involving the heater vent valve; the helicopter's serviceability was not affected. The helicopter was being operated within weight and center of gravity limitations. The report did not discuss when the helicopter was manufactured or how it had been used.

The helicopter was under contract to move two drilling rigs from site to site in a mineral exploration area. The pilot first repositioned the rigs in a weeklong job beginning Sept. 15, 2006 — his first assignment with the company. He did not fly again until Sept. 24, when he was called to begin moving the smaller of the two rigs.

Before the flight, the pilot hover-taxied the helicopter from its parking space at Stony Rapids Airport to a nearby fuel tank.

"A ground worker noticed during the taxi that the bubble door was slightly ajar, indicating that it was closed but not latched," the report said. "Before takeoff after the fueling, the ground worker again noticed that the door was slightly ajar. He walked over to the helicopter, pushed on the door and rotated the outside handle to the latched position. The ground worker then waved at the pilot, who departed for the 20-minute flight … to the old drill site."

The pilot landed the helicopter at a temporary helipad, out of the view of drill site workers, to install the long line and then moved to the drill site, where workers attached the first load of drill rods to the long-line hook. The helicopter lifted the load and departed from the site.

Three minutes later, the pilot radioed his colleagues that he had a problem with his door. A senior company pilot at work nearby responded, and the accident pilot asked if he could release the load. The senior pilot agreed and asked if the accident pilot could land the helicopter.

The accident pilot "indicated that he could not land because he was holding onto the bubble door with his hand and was afraid of losing the door," the report said.

There were no further radio transmissions from the pilot.

Witnesses saw the helicopter about 700 ft above ground level (AGL) and climbing in a nose-up attitude without its sling load. "The climb got progressively steeper until the helicopter was approximately 1,000 ft AGL," the report said. "The helicopter paused momentarily in a nose-high attitude and then dropped nose down. It descended steeply and at approximately 500 ft AGL, an explosion occurred. Smoke and flames trailed behind the helicopter until impact."

The explosion probably was a result of "the flailing of the transmission to engine main drive shaft after the main rotor separated from the helicopter," the report said. Distribution of the wreckage indicated that the helicopter had broken apart in flight.

The report said that, because the pilot had left the bubble door unlatched twice during flight preparations, it is likely that he had not properly latched the door after installing the long line. The sudden opening of the door in flight would have been "a startling event," the report said, although in an earlier event in the same helicopter, the door popped open and stayed 6 to 8 in (15 to 20 cm) open, in a trailing position, without affecting the pilot's ability to control the helicopter.

"The urgency in the pilot's radio transmissions and his stated action of trying to hold the door so he would not lose it indicates that he was unfamiliar with this type of event," the report said.

The pilot apparently was holding the door with his left hand — the hand that typically would have operated the collective control to adjust rotor blade angle, the report said.

"To slow the helicopter to the point where he would be able to close the door, he would have had to ease back on the cyclic control with his right hand to raise the nose of the helicopter and bleed off airspeed," the report said. "Without adjusting collective, the helicopter would climb in a nose-high attitude, as observed.

"The climb got progressively steeper before the nose suddenly dropped. The dropping of the nose is consistent with the pilot pushing forward on the cyclic control in an attempt to recover from the nose-high attitude."

This article is based on Transportation Safety Board of Canada Aviation Investigation Report A06C0154, Loss of Control — In-Flight Breakup, Heli-Lift International Inc., Bell 204B, C-GSHK, Stony Rapids, Saskatchewan, 22 nm SW, 24 September 2006.

Safety forum unravels clues to how unmanned aircraft systems could gain less-restricted access to U.S. airspace.

BY WAYNE ROSENKRANS

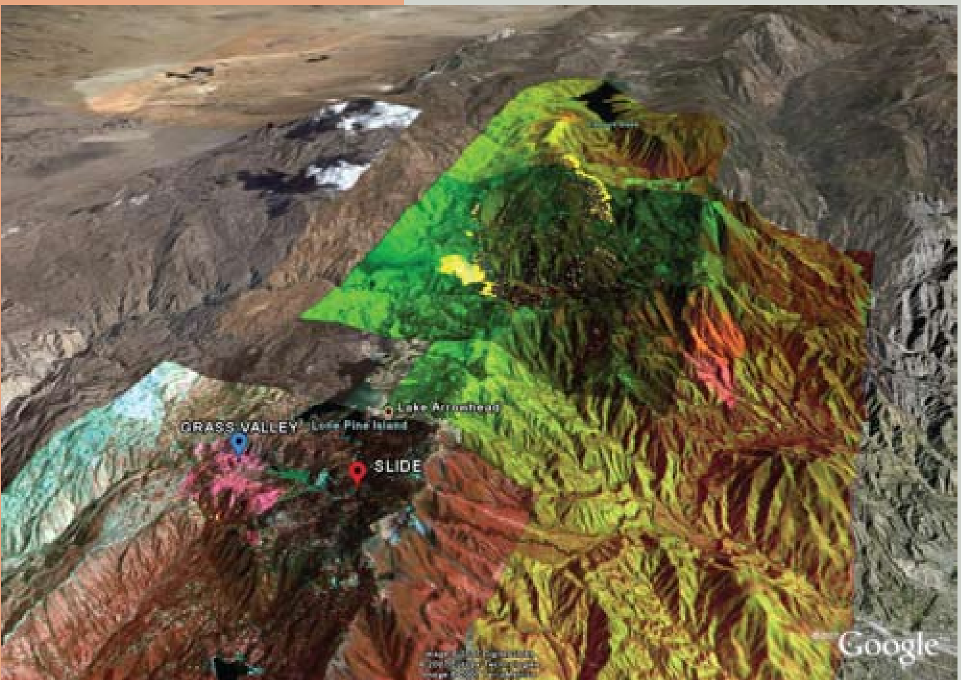
Detect, Sense and Avoid

Highly reliable *detect, sense and avoid* (DSA) technology as early as 2012 could begin to liberate large unmanned aircraft systems (UAS) from most of today's restrictions on sharing the U.S. national airspace system (NAS), according to several UAS manufacturers.[1]

In presentations to the U.S. National Transportation Safety Board (NTSB) Public Forum on Unmanned Aircraft Systems in April 2008 in Washington, however, they voiced concerns about whether UAS safety policy, airworthiness standards, operating regulations and other prerequisites for this coveted, relatively "unfettered" integration of UAS into the NAS will be ready in this time frame.

Prompted by the implications of one UAS accident in 2006[2] (*ASW,* 12/07, p. 42) and one in 2007,[3] the forum contrasted future integration of UAS into the NAS with current U.S. Federal Aviation Administration (FAA) certificate of waiver or authorization (COA) operations and other alternate means of regulatory compliance now available to the UAS industry. Participants also saw a case study of U.S. National Aeronautics and Space Administration (NASA) missions that

U.S. National Aeronautics and Space Administration



U.S. National Aeronautics and Space Administration

The Altair variant of the Predator B first flew wildfire-imaging missions for NASA in 2006. Above, data-linked infrared images similar to this example helped prevent injury after five U.S. firefighters were killed in a late October wildfire.

helped to save lives and property during wildfires in California and other Western states.

The typical UAS comprises an unmanned aircraft (UA) without a cockpit; a ground control station (GCS) occupied by the pilot(s) and other mission specialists; and command, control and communication equipment and data networks that link the GCS and the aircraft.

Wildfires and Pipelines

The NASA wildfire missions and U.S. Department of Energy applications were selected by the NTSB as prominent examples of non-military uses of UAS in the NAS. Historically, scientific projects involving UAS were conducted mostly within restricted areas, said Brent Cobleigh, deputy mission director for exploration, NASA Dryden Flight Research Center. NASA's uses for the General Atomics Predator B, for example, include surveillance of hurricane formation in the eastern Caribbean, polar ice melt measurement and high-altitude atmospheric research of long duration, he said.

In a cooperative emergency fire fighting support mission with the U.S. Forest Service and the National Interagency Fire Center, eight Predator B flights were conducted in mid-2007 with durations as long as 20 hours, Cobleigh said. On some, the aircraft loitered about one hour over each of 10 fires at locations in several states. It transmitted burn-area emergency response imagery for use by firefighters within five to 15 minutes.

The many public-sector operators of UAS could help reduce their risks while flying in the NAS by voluntarily adopting airworthiness, flight operations and pilot qualification standards equal to or stricter than the FAA's requirements for manned commercial aviation, said Randy Stewart, senior aviation policy officer, U.S. Department of Energy. Examples of the department's civil UAS applications include low-cost pipeline patrol and response to biological or radiological events without concern about pilot exposure.

"We currently have 17 COAs for UAS operations with six aircraft types in 2008–2009," Stewart said. By tightening standards in recent years, the department experienced — for manned aircraft and UAS combined — a 92 percent reduction in its fatality rate to 0.67 per 100,000 flight hours and a 64 percent reduction in its aircraft accident rate to 2.0 per 100,000 flight hours, he said.

Officials' negative attitudes about the value of airworthiness standards for UAS began to shift in 1995, he recalled, after the manufacturer of the Altus UAS found four design flaws and then implemented changes based on a comparison of its design to U.S. Federal Aviation Regulations (FARs) Part 23 requirements.

"We cannot wait until 2015 or 2025 — we have ongoing operations, and as a department we have to formulate policy that is adequate for the scope of our operations," Stewart said. "Something needs to be done to keep [UAS integration] on track now because UAS activity is occurring now."

FAA Flight Restrictions

The current policies and regulations enable two basic categories of UAS operation, said Doug Davis, manager of the 2-year-old FAA Unmanned Aircraft Program Office. One category enables unrestricted flights by military/government UAS operators — which are responsible for their own airworthiness — in airspace that is segregated from NAS users. The other category generally enables, on a case-by-base basis, restricted flights in the NAS if either the military/government operator

U.S. Air Force

Global Hawks routinely take off and land near manned aircraft using airports outside the United States, and they fly under instrument flight rules.

or the FAA has certified the UAS airworthiness. Operators that primarily use segregated airspace — special use airspace comprising restricted, prohibited and warning areas — include military services and government agencies, collectively called *public users.*

To enable flights in the NAS by public users, the FAA for 10 years has been granting COAs; 82 COAs were active as of April 2008, said Ardy Williams, air traffic manager–UAS, FAA Air Traffic Organization. Each is basically a waiver of some FARs, with risk mitigation by specifying operating limitations, for periods of three to 12 months. The FAA projects that up to 400 applications for COAs will be received in 2013, depending on regulations in effect then and other factors.

To enable flights in the NAS by a *civil user,* an entity other than a public user, the FAA can grant either a special airworthiness certificate, typically in the experimental category, or a type certificate. In each case, the FAA itself has certified the airworthiness of the UAS.

Around mid-2008, the FAA expects to complete a revision of its strategic road map for regulation of UAS with improved definition of work assignments, Davis said. Related activities include a focus on guidance for issuing special airworthiness certificates in the restricted category; review of applicability of FARs Part 23 airworthiness regulations to UAS; review of applicability of FARs Part 27 rotorcraft regulations to UAS; review of GCS technology; and review of automatic takeoff and landing technology.

The FAA Unmanned Aircraft Program Office and Air Traffic Organization also are developing several initiatives to study the effects of the growth of UAS operations on air traffic control and to provide standardized training on UAS to all air traffic controllers. "We routinely restrict the simultaneous or concurrent operation of unmanned aircraft with civil manned operations [in airport traffic patterns], particularly at civil use airports [and civil-military joint-use airports] that allow for those types of operations," added Bruce Tarbert, NAS Integration Team lead in this office. "We develop [airport] procedures on a case-by-case basis [and] ensure that a notice to airmen is issued. … If airfields are uncontrolled, we require UAS pilots to monitor the common traffic advisory frequency or unicom frequency … as a [risk] mitigation requirement."

Davis said that the FAA has prioritized its UAS activities based on industry economic projections. "We found several market surveys that indicated that over the next seven to eight years, the preponderance of unmanned aircraft are going to be under 20 lb [9 kg], so clearly we have a market need that is driving the direction that we are taking," he said. Among primary FAA activities to develop new policy, regulations and/or regulatory amendments and guidance for civil commercial UAS is a new aviation rulemaking committee that began meeting in May 2008. This committee will draft a regulation for the line-of-sight commercial use of UAS during daylight hours under visual flight rules [VFR] with limitations on maximum weight, airspeed and altitude, Davis said.

With FAA oversight and involvement of the U.S. Department of Defense (DOD), RTCA Special Committee 203 since 2004 has pursued consensus civilian standards for DSA functions and command-and-control functions for UAS among other tasks.[4] "Somewhere in the realm of 2020–2025, we will see a fully certificated avionics suite that will meet the full FAA requirement for civil UAS applications," Davis said.

Military Priority

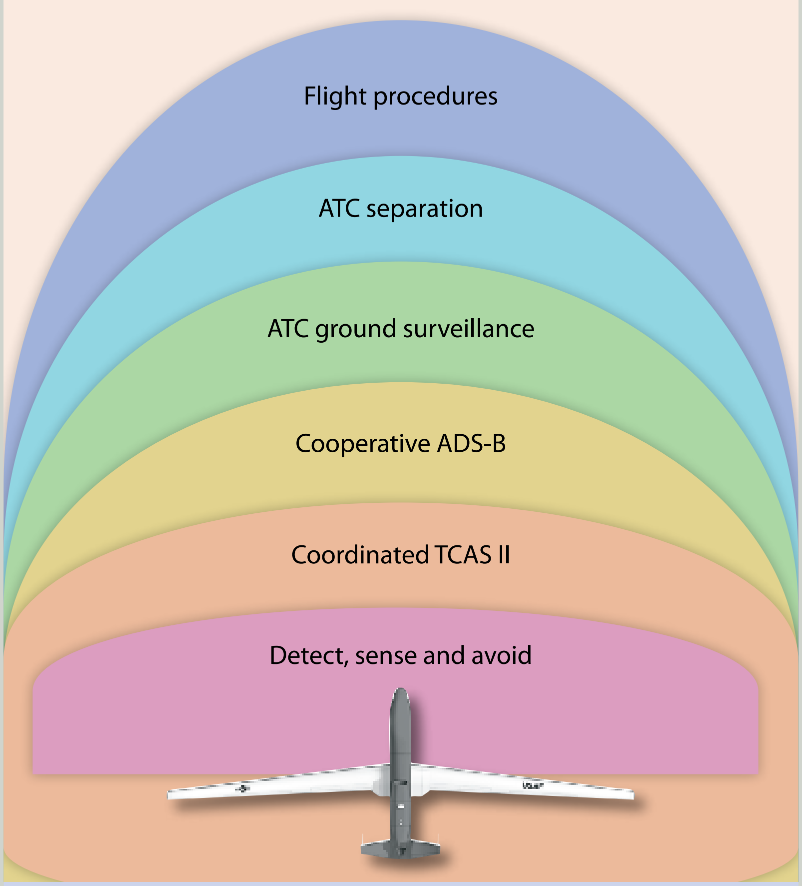
U.S. military services have developed UAS risk-analysis processes and safety mitigation methods that are instructive for operating civil UAS in the NAS, said Lt. Col. Charles Kowitz, chief of unmanned aircraft systems safety, U.S. Air Force Safety Center, citing examples from a safety assessment report requested by the FAA for the Northrop Grumman RQ-4 Global Hawk.

Assessment of 20 hazards affecting Global Hawk operations showed that risks of operating a UAS in the NAS can be more extensive and subtle than the risk of midair collisions. "If an unmanned aircraft creates deviations of altitude that unnecessarily preoccupy the attention of an air traffic controller, [that] essentially decreases the safety factor afforded to all the other participants in the NAS at the time," he said.

The main advantage of keeping a military UA inside special use airspace is the pilot's ability to fly "unfettered" compared with the constraints in the NAS, noted Lt. Col. Dallas Brooks, chief, unmanned systems integration policy, DOD Policy Board on Federal Aviation. "We have done a lot in the past to keep our major UAS operations away from heavily populated traffic areas," Brooks told the forum. "As mission needs increase, however, the pressure is on for more UAS operations and training, and it gets harder to do that. … As a last resort when we cannot use a COA … we consider, with great reluctance, a temporary flight restriction that essentially sterilizes airspace for our use."

A 2007 DOD–FAA memorandum of agreement created the opportunity to operate small military UAS in Class D airspace at about 100 DOD-controlled, non-joint-use airfields. "For small UAS — 20 lb [9 kg] or less — operations also

UAS Safety Layers Under Study for Collision Avoidance



Flight procedures	For example, under FAA visual flight rules, a magnetic course/ground track of 180–359 degrees requires flight at even thousands mean sea level (MSL) plus 500 ft if more than 3,000 ft above the surface but below 18,000 ft MSL.
ATC separation	Controllers provide route clearances, traffic information and radar vectors for aircraft separation.
ATC ground surveillance	Responses from interrogations of aircraft transponders are integrated with targets on ATC ground radar displays. ADS-B transmissions received by ATC then could be broadcast to aircraft equipped to display traffic information service–broadcast targets in the cockpit.
ADS-B	The 1090-MHz extended squitter version of this technology offers 40-nm (74-km) range in high-density environments and 90-nm (167-km) range in low-density environments.
TCAS II	Traffic advisory begins at distances as far as 40 nm; resolution advisory occurs 25–45 seconds before the closest point of approach.
Detect, sense and avoid	Technology under development would correlate and fuse inputs from DSA sensors, TCAS II and ADS-B to alert UAS pilots and enable the UA to automatically perform the appropriate collision-avoidance maneuver.

ATC = air traffic control; ADS-B = automatic dependent surveillance–broadcast; FAA = U.S. Federal Aviation Administration; DSA = detect, sense and avoid; UAS = unmanned aircraft system

Source: Northrop Grumman Integrated Systems

Figure 1

can be conducted in Class G airspace, in most cases from the surface to 1,200 ft above ground level [AGL] as long as we are over DOD-controlled lands, meaning bases and ranges," Brooks said.

Welcome to the NAS

Mont Smith, director of safety, Air Transport Association of America (ATA), told the forum, "This is a time in the history of airlines when finding methods to support the integration of UAS in the NAS — without causing delays, capacity reduction or placing current NAS users at increased risk — is of utmost importance to us." Nevertheless, ATA member airlines also have concerns — such as the risks of operating a 4.0-lb (1.8-kg) aircraft, for example, at or below 400 ft AGL in Class B or Class C airspace — because of potential proximity to an airliner that has experienced a failed engine at low altitude or is maneuvering during a required navigation performance (RNP) area navigation (RNAV) approach.

The ATA recommended that all UAS approved to operate in or near high-density traffic areas should have:

- GCS controls and displays with the "look and feel" of manned aircraft;
- Assessment of all human factors affecting the "synthetic cockpit";
- Full-motion flight simulator training for pilots of future "ultra-large payload" UAS; and,
- Synthetic vision/virtual reality display systems in the GCS that engage the attention of UAS pilots and help them maintain tactical situational awareness.

Airline Pilot and Controller Input

In May 2007, the Air Line Pilots Association, International (ALPA) adopted a policy of continued participation in FAA-industry efforts to safely integrate UAS into the NAS, said Ellis Chernoff, an airline captain and representative of the ALPA National Airspace Modernization Team.

"The end game is to have fully normalized, seamless UAS operations in the NAS," Chernoff said. "Airline pilots should not even notice that there are unmanned aircraft up there. … ATC rules must be the same regardless of the aircraft type."

Yet ALPA continues to draw industry attention to several issues:

- Standard operating procedures for in-flight emergencies vary among UAS types and operators, making it difficult for other NAS users to anticipate UA flight paths;
- Nonstandard pilot–ATC communications, such as telephone, should be acceptable only for UAS operating under a COA or special airworthiness certificate, and signal latency issues must be addressed for safety; and,
- In addition to collision risk, a UA that deviates from its assigned flight path or taxi instructions, causes an airport shutdown for an emergency landing, or strays into the approach paths of an airport could require pilots of manned aircraft to conduct a costly go-around with some increased risk involved.

All controllers need adequate UAS-related training, said Darren Gaines, air safety investigator and chairman of the Air Safety Investigations Committee, National Air Traffic Controllers Association (NATCA). NATCA's concerns include problematic assumptions about pilots' capability for visual contact; uncertainties about wake turbulence and cloud clearance; nonstandard communication methods; and incorrect use of ATC flight-following services.

"So much of what we do in ATC is visual when aircraft operate in Class B and Class C airspace or when operating visually," Gaines said. "The see-and-be-seen requirement seems to be deficient — the UAS pilots are not able to visually acquire aircraft in the vicinity, but a lot of the time, to maximize capacity, we expect [pilots] to visually acquire and follow another aircraft to a runway or to an airport, and to maintain that aircraft in sight."

UAS Manufacturer Insights

Pilot-UA interfaces have been a strong focus of attention by manufacturers, said Thomas Bachman, director, One System Common Systems Integration Team, AAI Corp. His company, for example, is working with the U.S. Army Aviation Engineering Directorate on common GCS designs for multiple types of military UAS based on a North Atlantic Treaty Organization standard for a more common architecture than used in the past, he said.

"GCSs were stove-piped — designed for a very specific UAS, built uniquely for the U.S. Department of Defense and taken into the field very quickly," Bachman said. "They were not really designed using established aircraft certification standards. Over the last four to five years, this has changed dramatically [toward designing] GCSs to the same standards as manned aircraft."

The UAS industry is seeking incremental access to the NAS over time, he said. But this will require near-term federal government funding to develop DSA; allocation of airspace other than military test ranges and NASA restricted areas as safe test areas for UAS; high priority to certification of data links and spectrum allocation for UAS;

completion of civil safety requirements and airworthiness certification standards; and a process for certifying subcomponents of UAS instead of complete systems only.

Sam Richardson, liaison to the FAA for experimental aircraft airworthiness certification and logistics program manager for the Sky Warrior/Extended Range Multi-purpose Program at General Atomics Aeronautical Systems — which manufactures the Predator UAS series — said that all variants of Predators combined had logged more than 450,000 hours by April 2008 and fly about 17,000 hours per month. Three of the company's UAS — Altair, Sky Warrior and Predator B — have military airworthiness certification by the DOD and FAA special airworthiness certification for restricted operation in the NAS, Richardson said. In April 2008, the Predator B also received FAA airworthiness certification under the agency's interim national policy.[5] "These aircraft are instrument flight rules [IFR]–capable and are currently flying IFR missions … over five continents, five oceans and many seas," Richardson said. "They are interspersed with manned aircraft coming in and out of international airports. The DOD's [UAS road map] — projecting file-and-fly capability by 2012 — is something that we really need to try to achieve rather than a 20- to 25-year process."

The Global Hawk provides an example of technologies relevant to UAS integration into the NAS, said Alfredo Ramirez, chief architect, High Altitude Long Endurance Systems Enterprise, Northrop Grumman Integrated Systems. Air Force researchers and Northrop Grumman were working as of April 2008 on flight tests of DSA systems. "Detect, sense and avoid research is well under way," he said. "The surrogate UAS — a Calspan Flight Research Group Learjet outfitted with electro-optical radar-ranging, TCAS inputs and ADS-B inputs — fuses all of this data to provide a resolution to the flight computer, so that [the autopilot] takes autonomous action, which is immediate. It is not inconceivable for this technology to be ready for use in a UAS in a matter of a couple of years. In five years, we could already be getting technical data to demonstrate its robustness."

For an enhanced version of this story, go to <www.flightsafety.org/asw/jul08/uas-forum.html>.

Notes

1. For purposes of approving UAS operations in the NAS, FAA guidance "applies only to those UAS operations affecting areas of the NAS other than active restricted, prohibited or warning areas," the FAA said. NTSB forum presenters used the term *NAS* in this context.
2. Regarding the April 25, 2006, crash of a Predator B UAS operated by U.S. Customs and Border Protection near Nogales, Arizona, the NTSB said that it "found that several factors related to pilot training and proficiency in dealing with emergency situations contributed to the accident" and identified other safety issues involving UAS equipment design and maintenance, operational contingency plans, safety risk management for UAS operation in the NAS and air traffic management of UAS.
3. NTSB's accident report on the Aug. 24, 2007, crash of a Raytheon Cobra, a small UAS, at a private airport in Whetstone, Arizona, said that the probable cause was a "student pilot's failure to follow proper procedures, specifically not verifying that the mode switch [of the manual pilot console] was in the automatic position before changing the pilot [data-link] address, which resulted in loss of aircraft control."
4. RTCA SC-203, established in October 2004, so far has published one of four planned products: *Guidance Material and Considerations for Unmanned Aircraft Systems,* issued in June 2006.
5. FAA Order 8130.34. "Airworthiness Certification of Unmanned Aircraft Systems." March 27, 2008.

The ground control station for the Predator B, like other UAS, in time will become less aircraft-specific and somewhat more like a cockpit.

U.S. National Aeronautics and Space Administration

Charter/on-demand operators carrying cabin aides should inform passengers that only the pilots and flight attendants are safety-qualified.

Role Recognition

BY WAYNE ROSENKRANS

U.S. operators conducting commuter and on-demand operations under Part 135 of U.S. Federal Aviation Regulations (FARs) in spring 2008 received guidance on notifying passengers about the unique role and limitations of cabin service employees/contractors not trained as flight attendants.[1] In the context of a chartered Bombardier Challenger 600 takeoff overrun accident at Teterboro (New Jersey, U.S.; *ASW,* 3/07, p. 30, and *ASW,* 10/07, p. 38) — in which passengers assumed that a *cabin aide,* a customer service representative provided by the operator, was qualified to lead the evacuation — flight crews have been advised to update passenger safety briefings in line with their "statutory duty to provide service with the highest possible degree of safety in the public interest."[2]

Specifically, they are responsible for "clearly identifying to passengers those crewmembers who are safety-qualified and those who are not" and "accomplishing all functions relating to passenger safety when no safety-qualified flight attendant is on board," said the U.S. Federal Aviation Administration (FAA). "Operators should ensure that passengers are aware that non-safety personnel are not trained or qualified to act in a safety-related capacity," the FAA said.

If no flight attendant is carried, the flight crew must clarify during the required safety briefing of passengers and cabin aide(s) that they — not cabin aides — will perform all safety functions during normal flight operations and in case of emergency. The guidance was aimed at directors of operations, chief pilots, trainers, flight attendants, pilots and anyone employed to provide cabin services during Part 135 operations. These personnel "should insist that operating manuals, training programs and operational control procedures ensure that no ambiguity exists during Part 135 operations" about the safety qualifications of people who interact with passengers anytime during a flight.

"U.S. air carriers periodically use persons in the cabins of [their] aircraft for the purpose of conducting certain passenger service activities such as serving beverages, conducting customer relations or acting as translators," the FAA said. "These persons are not assigned to flights to perform safety duties, and can be considered 'non-safety personnel.'" A cabin aide generally is not trained or qualified to perform cabin safety duties and is not equivalent to an airline flight attendant.

The FARs do not prohibit either commuter/on-demand operators or airlines operating under Part 121 from assigning non-safety personnel to flights. Among the FAA's safety concerns, however, is the possibility that such non-safety personnel — if not properly instructed by the operator — might interfere with flight attendants or other crewmembers. "Additionally, passengers could mistakenly consider [one of] these persons as a crewmember if not advised otherwise," the FAA said.

Operators using cabin aides for operations under an air carrier certificate will be expected to limit each cabin aide's scope of in-flight activities to passenger service. "They are a different type of cabin personnel and are not … responsible for cabin safety," the FAA said.

Another safety implication of this status is that pilots and flight attendants must treat cabin aides as passengers even if the operator has designated them as crewmembers. "[Cabin aides] must receive a pre-takeoff briefing, they must be seated in a passenger seat for movement on the surface, takeoff and landing, and they must stow their carry-on baggage," the FAA said, citing examples of the expected practices. "They must also comply with the seat belt requirements and crewmember instructions. They may not conduct any activities during movement on the surface."

If an operator designates cabin aides as crewmembers on flights, the cabin aide's duties and responsibilities must be included in the air carrier's general operations manual, the FAA said. Training for this crewmember also should be specified in this manual, a practice that addresses the problem of cabin aides being unaware that their training

© 2008 Jupiterimages Corporation

and qualifications generally are not equivalent to the safety training of flight attendants.

"These individuals should receive enough instruction so that they know what activities they may perform and equipment they may or may not operate so as not to interfere with flight attendants or other crewmembers," the FAA said. "If they operate cabin safety equipment, they must carry applicable parts of the operations manual, which should provide enough information to ensure that they understand their duties and procedures [to prevent interference]."

Proactive communication can prevent confusion, overcome passengers' erroneous assumptions and save time during an emergency.

The Teterboro accident report cited problems generated by the cabin aide's unfamiliarity with emergency door operation and related procedures. The FAA's response provides specific examples of what a cabin aide should *not* be expected to do, and how operators should influence the expectations of passengers when a cabin aide is aboard the aircraft.

"The activities assigned to these individuals should be clearly distinguishable to passengers from the duties assigned to other crewmembers," the FAA said. "They should not be permitted to operate any equipment or systems for which specific training is required by [the FARs] (e.g., electrical galley equipment, heating and ventilation controls for the cabin, and the public address system, except to perform language translator duties for passenger briefings). Additionally, these persons should not be permitted to conduct any portion of a required safety briefing or demonstration (e.g., use of seat belts, location of the emergency exits, use of oxygen, etc.)."

Proactive communication can prevent confusion, overcome passengers' erroneous assumptions and save time during an emergency. "Operators should employ methods to ensure that passengers do not mistake non-safety personnel as flight attendants or other crewmembers, and to identify crewmembers that are responsible for safety-related tasks," the FAA said.

Notes

1. U.S. Federal Aviation Administration. "Accomplishing Safety-Related Functions in Part 135 Operations." *Safety Alert for Operators.* SAFO no. 08010, March 20, 2008. The SAFO was issued with a supplement titled "Use of Non-Safety Personnel Onboard an Aircraft During Operations."

2. The FAA said, regarding this accident, that the flight crew and passengers had assumed incorrectly that an employee had been trained as a flight attendant — as required for airplanes seating 20 or more passengers — but actually this "person provided as a cabin aide to perform passenger-service functions was inadequately trained in safety-related functions, such as opening the cabin door to evacuate passengers. … Such a person might be mistaken by passengers as a fully qualified flight attendant."

Under New Management

Apron safety teams help five airports in Norway to parlay apron-risk analyses into localized safety solutions.

BY MAGNUS BJELKERUD AND ESPEN FUNNEMARK

Airlines today want shorter turnaround times at airports and zero ground accidents — aiming for ever more efficient ground-handling operations without compromising safety. Yet time pressures and associated factors they experience when handling an aircraft within the scheduled turnaround time keep creating safety challenges on airport aprons.[1] According to Flight Safety Foundation's Ground Accident Prevention program, ground accidents cost the airline industry billions of dollars per year, and industry leaders recognize human error as the main cause of these losses.

The apron environment is complex and requires a thorough analytical approach to risk management — a systems approach. In 2006, Det Norske Veritas (DNV), an independent foundation in Norway that provides international risk-management consulting services to many industries, conducted a risk analysis of the ground handling of fixed-wing and rotary-wing aircraft on the aprons at the five major airports in Norway operated by Avinor: Bergen, Stavanger, Trondheim, Bodø and Tromsø.

Anders Sætre, Avinor's safety manager for large airports, commissioned this 2006–2007 analysis as a step toward improving apron safety and to complement efforts to enhance Avinor's organizational safety culture. DNV analysts defined ground handling as limited to stand preparation, parking, handling and pushback operations.

Apron Risk Management

"The apron is one of the most dangerous workplaces in the world, and workers on the apron are faced with a lot of challenges," Sætre said. "We want to do our best to prepare each airport to implement a safe and efficient ground-handling process. We initiated this project to ensure safe operations airside on

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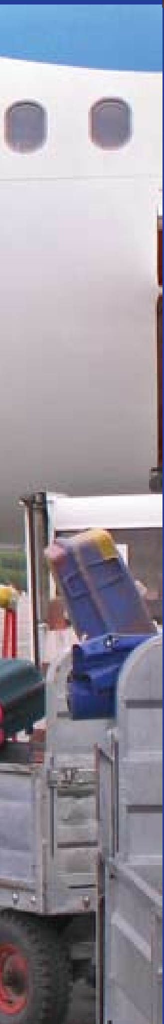

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the apron and, in addition, to support a parallel ongoing safety culture–enhancement program."

DNV and Avinor were not interested in calculating the exact costs of apron damage — they already knew the amount was very large. Nor was the objective to identify people to blame for apron hazards; this has not been found to be effective in reducing risk in the long term. Such generic approaches do not reduce apron risk.

Instead, DNV analyzed the apron processes from a system perspective with regard to human behavior, organizational issues, technical solutions and the interactions among these elements to reduce apron risk — a semi-quantitative man-technology-organization (MTO) approach.[2] They also wanted to find out what could be done to enhance the efficiency of ground-handling operations. To accomplish this, several broad questions were posed. Who are the actors in the system? What kind of human errors are committed? When do these errors occur? Why are these errors being committed? How can we avoid errors?

To answer these questions, a bottom-up approach was applied by placing front-line airport operations personnel at the core of the risk analysis.

Summary of Results

The main objective was to use the risk analysis to identify mitigating measures to cope with hazards on airport aprons. The airports then were able to consider in their planning processes this set of identified hazards and proposed risk mitigations. The project was considered innovative and constructive, yielding broad associated benefits. The position of apron safety on the agenda of each airport has been confirmed. Ground-handling operations have been modeled in detail with respect to roles, responsibilities and tasks. The risk picture of ground-handling operations at each airport has been developed with respect to the spheres of authority of Avinor, airlines and ground handlers. "Ownership" of responsibility to address airport safety challenges has been established.

Also, risk-based collaboration and related communication have been established among stakeholders at each airport through apron safety teams (ASTs) that continuously pursue risk reduction at each airport; increase the stakeholders' understanding and awareness of each other's responsibilities and everyday challenges in enabling safer and smoother turnarounds; initiate sharing of experiences and best practices across the airports; and clarify lines of communication and responsibilities.

"By admitting stakeholders to participate in the risk analysis for this project, we have been able to improve our safety culture," Sætre said. "Participants will be more conscious of the risks and needs for the mitigating processes — to live and work by them — and more competent in managing the risks related to ramp operations, and also have a better understanding of the reasons for having well-known and documented processes and procedures."

Safety Challenges

DNV analysts first had to address the key reasons for a typically high risk level on the airport aprons. Their analysis showed that safety was being put at risk by the time pressures created during the turnaround, with a large number of factors contributing to this risk level. A selection of the critical factors included lack of collaboration among the companies working on the apron; lack of communication among these companies; inadequate winter preparations and operations (snow clearance, ground deicing chemicals, sanding, etc.); and climate and/or rapidly changing weather conditions (wind, sun, fog, snow, rain, etc.).

Simultaneous apron activities occurring in the vicinity of aircraft; flight operations occurring close to parked aircraft; a mix of aircraft of different sizes, airframe designs and engine configurations; and a mix of ground vehicles (different in length, height, weight and function) were found.

Facility-related factors included inadequate design/layout of the apron; inadequate facilities (e.g., lack of designated parking spaces for trolleys/carts and vehicles, refuse bins for foreign objects, designated places for chocks, etc.); inadequate measures for ensuring the safety of an increasing number of passengers present on aprons (linked to the demand for shorter turnaround times); insufficient apron lighting, markings and signs; and diverse types of apron parking (terminal, remote parking, helicopter parking).

Other critical factors were inadequate flight information service for aircraft crews; inadequate training of all personnel involved in apron operations; stringent and complicated security regulations that may influence safety procedures; inadequate meetings and other safety information-sharing activities; and nonexistent contracts/agreements between stakeholder companies (e.g., Avinor and ground handlers).

Ownership Through Participation

Given that most errors, in one way or another, are committed by the humans who work on the apron, the overall picture is a mix of both direct and indirect causes. DNV set out to challenge these front-line operational experts by having them participate in a risk analysis performed as a number of steps. The first was to identify all stakeholders, ultimately including Avinor personnel comprising central and local management, air traffic services, ground services, and aircraft rescue and fire fighting services; ground-handling companies representing ramp handlers, fueling service providers, caterers and cleaners; and aircraft operators, represented by pilots.

The second step was defining system boundaries for apron-risk analysis. The

Photos: © Det Norske Veritas

physical area and related operations were limited to the aircraft parking stand; therefore, operations and activities on the maneuvering area (i.e., during landing, taxiing, movement outside the gate entry area and takeoff) were defined as outside the scope of this analysis.

The third step was to identify and model every stakeholder organization's daily operations and work by applying a work process breakdown analysis. The entire ground-handling process for airplanes was broken down into manageable parts — called process elements — which were analyzed separately. Analyses for rotary-wing aircraft also had to be performed.

Each main process element in the ground-handling work consisted of several activities. In each work process, a stakeholder organization deals with technical solutions, passengers and the environment. All these are exposed to risks due to human error.

To analyze the whole system, DNV addressed four risk categories: injury to ground-handling personnel; injury to boarding/disembarking passengers; damage to aircraft, fixed/mobile equipment on the stand or apron vehicles; and environmental damage — mainly, the release of fluids.

The analysis used a traditional risk matrix with five classes for both probability and consequence, with one matrix for each of the four risk categories. All the risks were registered using DNV's software-based risk management tool, EasyRisk, to simplify data retrieval, systemization and analysis. Using this tool, each airport monitors risks and identifies and classifies new risks as they arise. The classifications of the work process step hazards then were divided into three categories and given different colors: green for low risk, yellow for medium risk and red for high risk.

The third process step, preparing for ground-handling the aircraft; the fourth step, handling the arriving flight; the fifth step, handling the departing flight; and the sixth step, preparing for pushback/powerback/taxi out (Figure 1, p. 46) were the operational phases that contributed the greatest shares of the total apron risk. Common risk factors during these work process steps included intense activity in close proximity to the aircraft being handled, the relatively large number of personnel simultaneously involved, and parallel diverse activities within the short turnaround time.

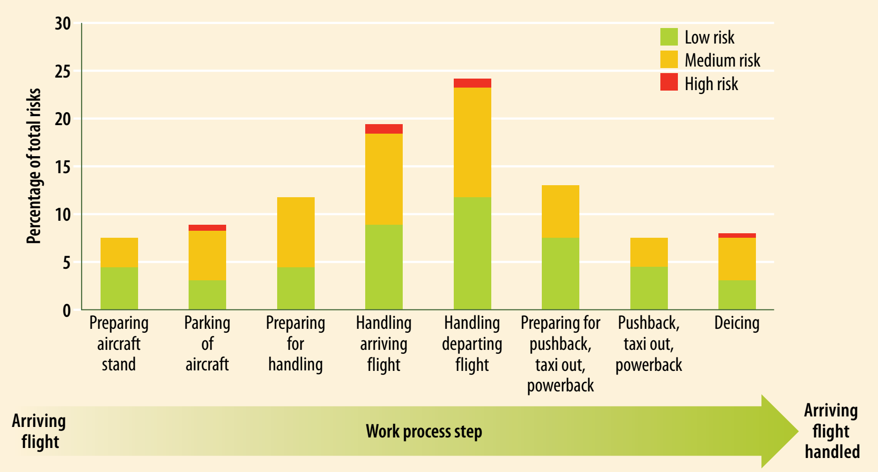
The analysis enabled numerous hazards to be identified and classified for the various work process steps using knowledge of the front-line subject matter experts. The same hazards could occur in several process elements, but with different classifications of probability. The same methodology could be used independently of airport size, geographical location or type of airport.

Identification and classification of hazards were based on DNV's information-gathering and analysis from 21 on-site workshops over 18 months. Three separate workshops — one on hazard identification, one on risk classification and one on identification of risk-reducing measures — were held at all five airports. The remaining six separate workshops covered apron safety for rotary-wing operations, with three each at Bergen and Stavanger.

Risk Mitigation

Another important result of the analysis was the identification of risk-reducing measures. This task was organized with the purpose of providing plans for how Avinor — alone or in cooperation with stakeholders — could make the ground-handling process safer and more efficient. The Avinor

Ground-Handling Risks for Each Work Process Step



Note: This risk analysis reflects ground-handling operations for fixed-wing aircraft at five major airports operated by Avinor in Norway: Bergen, Stavanger, Trondheim, Bodø and Tromsø.

Source: Det Norske Veritas

Figure 1

safety manager at each airport became responsible for further implementation of the defined risk-reduction measures.

Identifying risk-reduction measures beyond Avinor's scope of responsibility as airport operator, however, was not part of this analysis. Nevertheless, ground-handling agents and airlines — fixed-wing and rotary-wing operators — were encouraged to use internally the reports as a basis for similar evaluations. The DNV analysis identified several hundred measures.

Several airport-specific measures were implemented. A driving path was reconstructed to make sure fuel trucks are not in conflict with personnel, passengers or rotary-wing aircraft at Bergen Airport Flesland. The rotary-wing ground-handling process was changed at Stavanger Airport Sola. Steps were taken for rebuilding Terminal B at Tromsø Airport. A lift was installed in Terminal A for transportation of persons with reduced mobility at Trondheim Airport Værnes. And, airside garbage-handling routines were established to avoid foreign object debris being ingested into jet engines at Bodø Airport.

Other mitigating measures common to multiple airports were:

- Winter marking of lane lines for airplane stands and the deicing platform;
- Re-marking of stands and modification of terminal buildings due to the introduction of airplanes with winglets;
- Establishing routines to avoid simultaneous parking/handling of aircraft at adjacent stands;
- Providing designated areas for storing ground-handling equipment;
- Providing first aid equipment at each stand;
- Establishing routines for distributing information among airport personnel;
- Promoting routine collaboration among Avinor, airlines and ground-handling personnel for more safe and efficient operations on the apron;
- Further developing e-learning courses for new employees with input from experienced employees;
- Establishing an overall sign and marking plan at each airport to comply with Norwegian and international rules and regulations;
- Better adjustment of lighting on the apron — e.g., more light in dark areas, reduced temporary blinding of pilots on the flight deck; and,
- Fluorescent marking of vehicles, chocks, cables, electric pylons, etc., to increase conspicuity in all light/weather conditions.

Apron Safety Teams

To achieve safer operation of airports, other forums and discussion arenas had been in place at Norway's airports — for example, runway safety teams, airport safety committees, winter operations teams, etc. As a result of the DNV analysis, however, the need for another forum dedicated solely to apron safety became evident.

Among all the steps taken after the analysis, the introduction of an AST was regarded as the most significant. The AST was envisioned as a way to continue communicating about apron risks and collaborating using risk-analysis methodology.

"The implementing processes will have a great impact on safety culture and future safety levels on the aprons in Norway — especially using apron safety teams as one of our tools for achieving this at all airports," Sætre said.

For proper management of ASTs, input and feedback from the apron operational personnel have been essential. Managers need direction and knowledge from them on how to succeed. If this input is not received, it is difficult or even impossible to know the changing challenges and needs of the operational personnel. This may lead to dissatisfaction and distrust of the management, of the different companies, and the airport as a whole, and subsequently to higher risk.

To a large extent, airport management teams worldwide have established paper and/or computer-based systems for operational personnel to report accidents and incidents. But the reporting has not been comprehensive, leaving management without sufficient input for guidance. The persistence of this issue was confirmed by the DNV analysis. There are several reasons for such systems not to work as intended — for example, problems in the airport's safety culture, fear of losing jobs, not knowing current reporting routines (how to report, what to report), not enough time, etc.

Relying on this type of feedback for communication between management and staff may not be the optimal solution. A closer, more direct form of communication has proven necessary. Face-to-face meetings dealing with all aspects of safety make it possible to address more effectively problems that may arise.

Gaining Experience

Stavanger Airport Sola already has gained experience using the AST concept since its implementation in March 2008. "We want to transfer the good dialogue between the stakeholders at the airport that was established through the risk analysis," said Pål Ranestad, the airport's safety manager. "A common forum for operational personnel working on the apron will have a good effect on safety, enabling an increased understanding of the stakeholders' daily work and challenges."

A mandate for two ASTs through a specific procedure — designated as AST-F and AST-R, for fixed-wing and rotary-wing aircraft, respectively — already has become an integral part of this airport's local regulations.

Participants in ASTs preferably should have operational experience — for example, in the case of Avinor, management and operational personnel from the airport operator; representative(s) from handling agents, catering, cleaning and fueling; and pilots from the fixed-wing aircraft and rotary-wing aircraft companies that use the airport.

"The initiatives resulting from the DNV risk analysis were very well received by the participants, as an AST had been requested by the various stakeholders for some time," said Ranestad.

Each AST has, among other responsibilities, the standing assignment to prepare a report based on the advice and proposals identified in meetings with the airport manager. The team members also are expected to propose measures within their own organizations. Each AST also is charged with the following tasks:

- Development of action plans for apron safety;
- Collection, analysis and dissemination of information about apron safety;
- Determination of whether the apron has adequate signs and markings, including whether these are visible for the drivers of apron vehicles, and proposing any relevant changes;
- Collection of information from operators and personnel related to airport conditions that may have a negative effect on apron safety, and proposing measures and actions to increase the level of safety;
- Review of safety-related occurrences, proposing risk-reduction measures and ensuring transfer of experience across the stakeholder organizations; and,
- Serving as a hearing body in any cases, projects, processes or changes affecting apron safety. This includes, for example, changes in procedures, signs, markings and lighting during airport construction projects; acquisitions; and implementation of new technology at the airport.

"Shorter turnaround times demand faster and simultaneous operations," Ranestad concluded. "The challenge is to establish a smooth turnaround process that enables both parallel and sequential operations without compromising safety and regularity. Safety culture is built through proper forums for operational personnel. I see the apron safety team as the tool to communicate and contribute due to team members' standing as subject matter experts. I highly recommend that all airports establish an apron safety team."

Notes

1. The International Civil Aviation Organization defines apron as "a defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, fueling, parking or maintenance."
2. MTO essentially is a system-oriented analytical concept in human factors engineering that has been applied by Swedish nuclear regulators and by other industry safety models.

About the Authors

Magnus Bjelkerud and Espen Funnemark, both DNV senior consultants, in 2006 and 2007 conducted the apron risk analyses of the ground-handling operations at five Norwegian airports.
They thanked Anders Sætre and Pål Ranestad of Avinor and DNV colleagues for their contributions to this article and reviews.

Advancing ATM

Evolving air traffic management (ATM) is essential, said David McMillan, director general of Eurocontrol, and the need for change is quite clear. "The big challenge is that the industry is broadly healthy. This year we expect 27,000 operations a day [in Europe]; by 2020 that will rise to 50,000 a day."

Speaking at a Flight Safety Foundation Newsmaker Breakfast[1] in Washington, D.C., McMillan said the current ATC system "is a high-technology system managed in an old-fashioned way, each aircraft directly controlled," one controller at a time.

The two major efforts to move to a new ATM paradigm, the U.S. Federal Aviation Administration's (FAA's) NextGen program, and Europe's Single European Sky ATM Research (SESAR) effort, must end up with systems "that work together, with global interoperability."

The publication earlier this year of the ATM Master Plan, the final step of the SESAR definition phase, "is very important to get that level of commitment," McMillan said.

The approaches to planning NextGen and SESAR are quite different, with the European effort putting "a lot of planning into a detailed system, spending a lot of time working on the architecture of the system," McMillan said.

"It is not necessarily a good thing that SESAR is ahead [of NextGen]. We're spending a very significant amount of money." So far, it seems, "we both understand what the issues are in similar ways."

If the United States is not able to fund NextGen in the way it needs to be funded, "it would be a concern," McMillan said, "but so far we don't have that impression."

Organization of European air traffic control (ATC) is another challenging issue, McMillan said. "There are 70-odd ATC centers in Europe; there's a cost in that regardless of the technology you put in place."

In Europe, "we need to optimize the system at the level of the national service providers. Next is to develop a regional system," while looking at eventually operating on a European level.

Having said that, McMillan gave credit for the changes that have taken place since waves of delays washed over European airspace in the 1990s. However, "we do fear an increase [in delays] in 2009 and 2010 due to changes in Germany, the U.K. and Maastricht as new technology comes on," McMillan said. Worsening the delay outlook is the fact that over the past two summers weather events "have become more significant, plus we are going more toward [airline] hubbing."

Environmental concerns about aviation in Europe "focuses on CO_2 [carbon dioxide], but noise is still very big," McMillan said. Several ATM initiatives have helped, he said, pointing at the work of the CFMU (Central Flow Management Unit) to keep aircraft on the ground instead of holding en route, and new "flex use" of military airspace. However, the flex use potential "is not always used by airlines. We try to convince airlines to use it when it is available. A 6 percent reduction [in CO_2] can be achieved" if full use is made of the airspace, he said.

Continued attention to reducing airport noise also produces more CO_2, with noise-reducing routes adding to flight times and gas production.

"The biggest constraint in Europe is airport capacity, especially runway capacity," McMillan said. "The debates in Europe will center on what local people think about adding runway capacity. There needs to be an understanding of how much the world economy depends on mobility, but the battles will be fought locally."

Note

1. A Newsmaker Breakfast is an on-the-record, informal opportunity for the media to interact with aviation leaders from around the world.

McMillan

In-Slide Information

Most injuries resulting from emergency evacuations using inflatable slides are minor, but serious injuries can include fractured ankles, broken legs, major bruises and lacerations.

BY RICK DARBY

About 50 percent of emergency evacuations involving inflatable slide deployment during a 10-year study period resulted in injury, a report sponsored by the U.S. Federal Aviation Administration (FAA) has found.[1] Overall, about 10 percent of the injuries were serious, and in nine of the 10 years, serious injuries occurred in less than 20 percent of slide evacuations.

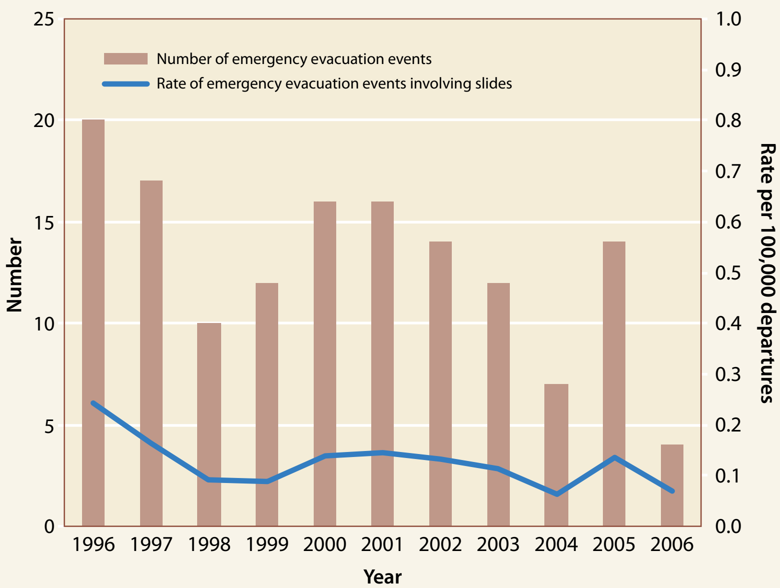
The 142 accidents and incidents included in the study database involved U.S. air transport aircraft operated under U.S. Federal Aviation Regulations Part 121, both scheduled and non-scheduled. The database included 441 minor injuries and 35 serious injuries.

To allow time for accident and incident reports to be completed, June 30, 2006, was chosen as a cutoff date for the events studied. Information sources included the FAA Accident/Incident Data System (AIDS), part of the Aviation Safety Information Analysis and Sharing (ASIAS) System; the U.S. National Transportation Safety Board (NTSB) Aviation Accident Database and Synopses; service difficulty reports; the U.S. National Aeronautics and Space Administration Aviation Safety Reporting System (ASRS); and several others. Because there were discrepancies among the sources, researchers conducted surveys to clarify the data.

"Three separate surveys were conducted," the report says. "The first survey was designed to obtain additional details on identified incident or accident cases, as well as to discover events that may not have been captured in the review for this research. The second survey was … designed to solicit information regarding the type, location and severity of injuries that may have been recorded by ARFF [aircraft rescue and fire fighting] units. The third survey was developed to solicit information about conditions faced by first responders during

Because there were discrepancies among the sources, researchers conducted surveys to clarify the data.

U.S. Air Carrier Emergency Slide Evacuations, 1996–2006

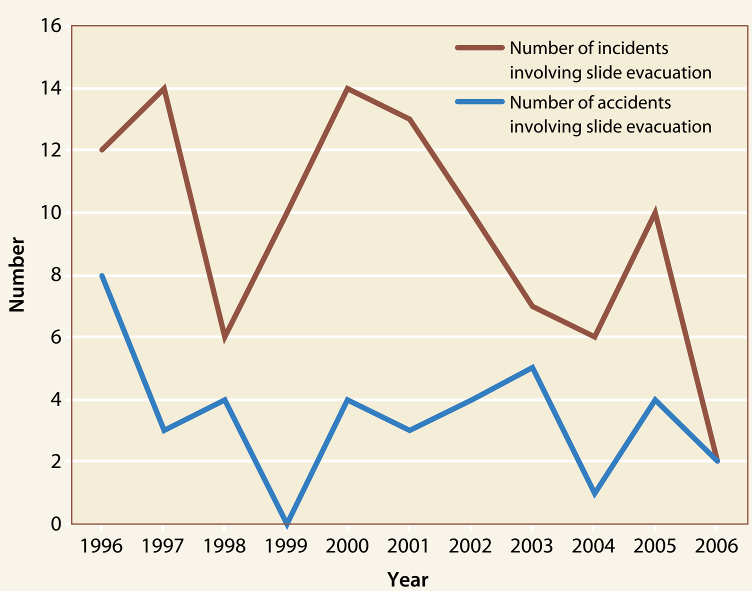


Note: 2006 data are through June 30.

Source: U.S. Federal Aviation Administration

Figure 1

U.S. Air Carrier Incidents and Accidents Involving Emergency Slide Evacuation, 1996–2006



Note: 2006 data are through June 30.

Source: U.S. Federal Aviation Administration

Figure 2

aircraft emergency evacuation and to seek their recommendations."

There was "a significant annual variation in the number of emergency evacuation events involving slides," the report says (Figure 1). "There has been an appreciable reduction in emergency evacuations since 1996." However, the variation in the rate per 100,000 departures, also shown in Figure 1, "given the low number of total events" was "not statistically significant."

The number of incidents involving slide evacuation exceeded the number of accidents involving slide evacuation in almost every year of the study period (Figure 2). "The emergency evacuation events classified as accidents are, on average, less than a third of total events," the report says.

The annual variation in the percentage of slide evacuations causing injury ranged from less than 30 percent to more than 70 percent, averaging 50 percent (Figure 3). "The nature of the injuries varies significantly, depending on the causes and conditions of evacuation," the report says. Injury categorization was based on the Abbreviated Injury Scale, a metric used by the U.S. government's highway safety agency. Based on available data, minor injuries incurred during the slide evacuations included sprains, friction abrasions, scrapes from slides, strains, abrasions and contusions. Serious injuries included fractured ankles, broken legs, major bruises and lacerations — injuries involving a cutting of the skin or other tissues.

The annual numbers of reported injuries in slide evacuations (Figure 4) varied from a maximum in 1998 to a minimum in 2004. Nevertheless, the report says, "There is no particular trend or underlying reason for such variations because the size and type of aircraft (e.g., cargo versus passenger operation) and behavior of passengers and crewmembers are significant factors in risk exposure levels." It adds that "in some cases, it is difficult to ascertain if all injuries have occurred on, or in conjunction with the use of, inflatable slides. This uncertainty is due to the poor documentation of injuries incurred during evacuation of commercial aircraft, and is especially the case for minor injuries."

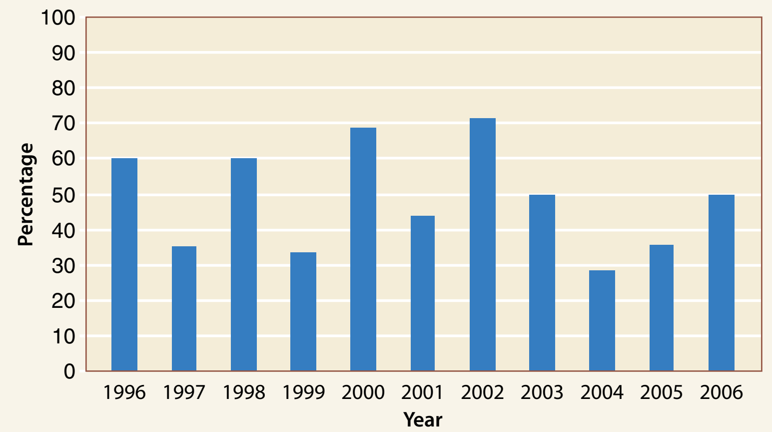
The percentage of serious injuries among all injuries associated with slide evacuations is shown in Figure 5 (p. 52). "Except in 2004, when only two events resulted in injury, less than 20 percent of emergency evacuation events involving inflatable slides caused serious injury in any given year in the study period," the report says.

Based on NTSB accident data, there appears to be no correlation between the rate of accidents and the rate of slide evacuations in most years (Figure 6, p. 52). "The rate of emergency evacuation is lower than the total accident rate, despite the fact that the emergency evacuation rate involves both accidents and incidents," the report says.

"As a part of this study, the performance of slides during high winds was examined within the scope of required regulations for evacuation using slides," the report says. "Since the total number of events is very low, there are no statistically significant effects that can be deduced from the existing data. Existing literature also points to a very low probability of mean wind speeds exceeding 25 knots — about six instances per billion departures, as derived from measurements at 601 airports. Nevertheless, because delayed landing or diversion may not be an option in an emergency, use of evacuation slides during conditions of high wind must be addressed."

The main challenges under high-wind conditions include maintaining the stability of slides and preventing slides from turning and twisting, the report says. "Flight crewmembers often instruct the first passenger down the slide to help stabilize the slide by holding it down," the report says. "In practice, however, passengers often walk away, and this task falls to the first responders. Following a crash, fire or other emergency, when all available ARFF personnel must respond to imminent hazards, assigning ARFF personnel to help with slide stability may be a problem."

Percentage of Emergency Slide Evacuations Resulting in Injury, U.S. Air Carriers, 1996–2006

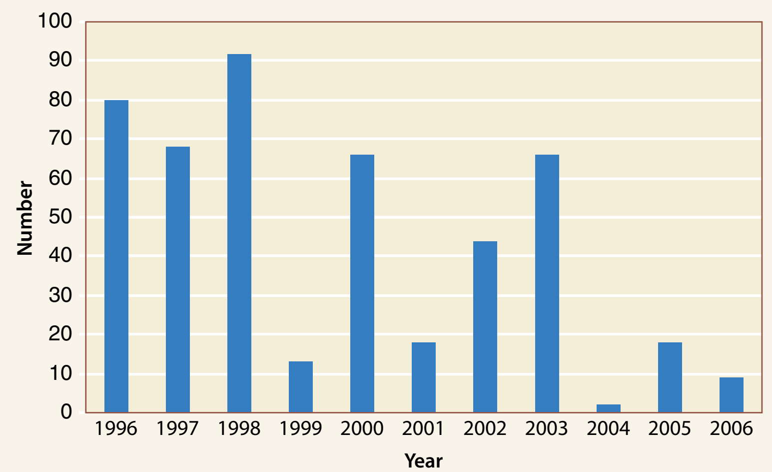


Note: 2006 data are through June 30.

Source: U.S. Federal Aviation Administration

Figure 3

Injuries Reported in Emergency Slide Evacuations, U.S. Air Carriers, 1996–2006



Note: 2006 data are through June 30.

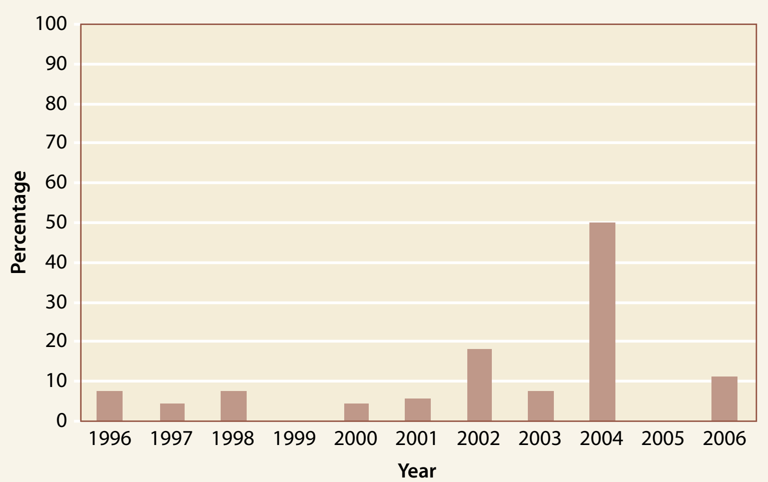
Source: U.S. Federal Aviation Administration

Figure 4

The researchers offered recommendations based on their survey of ARFF personnel and analysis of the available information on emergency evacuations:

- "Improvements are needed in communication, coordination and action planning

Serious Injuries as a Percentage of All Injuries in Emergency Slide Evacuations, U.S. Air Carriers, 1996–2006

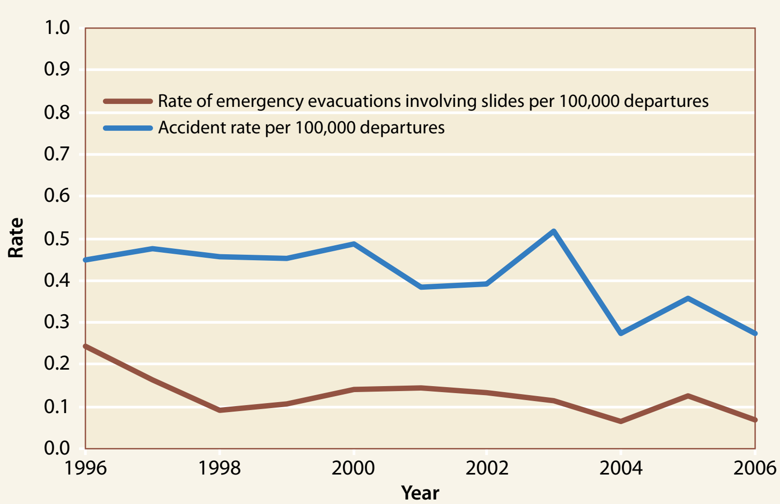


Note: 2006 data are through June 30.

Source: U.S. Federal Aviation Administration

Figure 5

Rate of Emergency Slide Evacuations Versus Accident Rate, U.S. Air Carriers, 1996–2006



Note: 2006 data are through June 30. Accident rates are based on data from the U.S. National Transportation Safety Board.

Source: U.S. Federal Aviation Administration

Figure 6

among rescue personnel at airports, flight crews and airline operation personnel." Airports should work with the control towers to establish discrete emergency frequencies for secure and rapid communication with flight crews during emergencies, and "hands-on training is needed to increase coordination and communication between ARFF units and flight crews so that unnecessary evacuations can be eliminated," the report says.

- "It would be beneficial for rescue personnel to train with the flight crews and operation personnel of various airlines on various aircraft. Training should focus particularly on the operation of slides during adverse conditions."
- "ARFF personnel assistance with slide evacuation should be concerned with the following: establishing sectors/slide zones and identifying hazards; identifying several predesignated multi-casualty incident staging areas on the air operating area; identifying a separate passenger area of refuge/assistance; ensuring proper slide deployment; stabilizing slides by holding them down; moving evacuees away from the slides quickly … ; assisting with passenger flow; dispersing fire-fighting agent to protect evacuees; and distinguishing controlled evacuation from emergency conditions."

Note

1. Motevalli, Vahid; Monajemi, Layla; Rassi, Maryline. "Evaluation and Mitigation of Aircraft Slide Evacuation Injuries." Airport Cooperative Research Program Report 2. Washington, D.C.: Transportation Research Board of the National Academies, sponsored by the FAA, 2008. Available via the Internet at <www.trb.org/news/blurb_detail.asp?id=9046>.

The Wiki Way to Aviation Safety Knowledge

Skybrary, a new initiative of Eurocontrol and ICAO, tracks the cumulative knowledge of the industry.

WEB SITES

Skybrary, <www.skybrary.aero>

Information accessibility and use often lag behind information accumulation. It isn't enough just for information to be "out there somewhere"; to be put into practice, there must be a relatively easy, fast and economical way to obtain it.

With that goal in mind, Eurocontrol, the European organization for air navigation safety, has launched a Web site called Skybrary, a repository of aviation safety knowledge accessible via the Internet.

The Web site describes Skybrary as "the single point of reference in the network of aviation safety knowledge" and says, "Skybrary is an initiative of Eurocontrol and ICAO [International Civil Aviation Organization] with the sole purpose of safety knowledge exchange." Flight Safety Foundation has partnered with Eurocontrol and ICAO in sharing information and providing content for the Skybrary knowledge base.

The initiative's goal is to capture authoritative aviation industry information and create cumulative knowledge — to populate, organize, refine and deliver a knowledge base with static and changing information that will influence and shape behaviors of aviation professionals, especially with regard to critical safety issues.

The Web site opens at the Operational Issues portal, where the user can select from 15 issue categories: air-ground communications, airspace infringement, bird strikes, controlled flight into terrain, fire, ground operations, human factors, level busts, loss of control, loss of separation, runway excursions, runway incursions, wake turbulence, weather, and general.

There are two additional portals. The Enhancing Safety portal contains six categories: airworthiness, flight technical, safety management, safety nets, theory of flight and general. The third portal is Safety Regulations: certification, ESARRS (Eurocontrol Safety Regulatory Requirements), licensing, regulation, and general.

Clicking on a category such as controlled flight into terrain reveals a description of the term and an index of related topics. Topic and subtopic articles tend to follow a pattern of descriptions, effects, defenses, scenarios, contributing factors, and solutions. Most articles contain embedded links to additional information and lists of related readings, including Eurocontrol's *Hindsight* magazine.

Knowledge elements in articles link to dynamic interactive modules such as media tool

Skybrary invites readers to register and participate in discussions about articles.

kits, safety alerts, ICAO and Eurocontrol documents, manuals, accident and incident reports, and other materials. Readers may view material from the Skybrary site online or print it at no cost. Documents appearing on linked Web sites may have other limitations or options.

Skybrary uses the "wiki" format instead of the traditional Web site format. A wiki — whose most famous example is Wikipedia — can be added to or edited by users, so that the information theoretically represents the collective wisdom of the user group rather than an individual or team. In the case of Skybrary, contributors and editors must be invited to participate in article development. Readers can follow the development of current and draft articles, such as authorship and subsequent changes in text. Skybrary invites readers to register and participate in discussions about articles.

The menu page for each category includes a "tool box." One item under the tool box is "special pages," with an extensive list of subcategories. The subcategories include items such as "articles with the most revisions," "articles with the fewest revisions," "most linked-to categories," "most linked-to images," "new pages" and "my watchlist."

There are three ways to search: browse by category, use the search engine — similar to the familiar Google search engine — and check the graphic wiki "mind map." The mind map illustrates topical relationships within major categories. For example, entering "TAWS" — terrain awareness and warning system — indicates that TAWS is related to topics such as "aircraft equipment," "controlled flight into terrain," "warning provided by TAWS" and "response to a TAWS alert." Some of these related subjects can be clicked to provide their own mind maps.

With permission from ICAO, the site includes a dedicated search engine for ICAO documents. At press time, key-searchable documents include ICAO Annexes 2, 10 and 11, and Documents 4444, *Procedures for Air Navigation Services, Air Traffic Management*, and 8168, *Procedures for Air Navigation Services, Aircraft Operations*.

Virtual Flight Surgeons, <www.aviationmedicine.com>

The Web site for Virtual Flight Surgeons (VFS) says it "is designed as a free Internet resource for pilots, controllers and AMEs [aviation medical examiners] to bookmark as a single comprehensive reference for aeromedical certification information and links to widely recognized authorities in medicine, aerospace medicine and the FAA [U.S. Federal Aviation Administration]."

The information resources section contains VFS medical articles on numerous aspects of aerospace physiology, nutrition, crew duty issues, fitness and health, and medical conditions. Articles in a searchable database can be read online or printed, and follow a standard format. For example, the article on skin cancer and melanoma informs pilots and controllers on identification, treatment, risk factors, FAA policy and related topics.

The Web site says it provides "an updated list of medications the FAA commonly authorizes for use during flight and aviation duties, plus restrictions on medication use and those medications the FAA does not normally approve for use." Readers can quickly determine FAA usage policy by searching on medication names.

There are extensive lists of Internet links under headings such as government aviation agencies; accident investigation and safety; aeromedical standards and regulations; air traffic control and security; and aeromedical libraries, programs and societies.

The VFS news section contains four years of the *Quarterly Aeromedical Newsletter* and a short bibliography of aviation safety medical articles. Newsletters and select articles are free to read online, print or download.

REPORTS

2008 May Report of the Auditor General of Canada: Chapter 3 — Oversight of Air Transportation Safety — Transport Canada

May 6, 2008. 17 pp. Available via the Internet at <www.oag-bvg.gc.ca/internet/English/aud_ch_oag_200805_03_e_30699.html>.

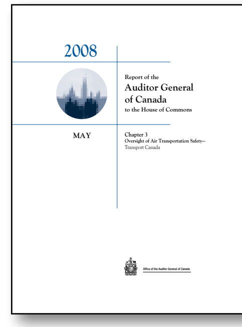
The report focuses on Transport Canada's transition to oversight based on safety management systems (SMSs), which will require operators to have in place a system for managing safety risks, rather than one based solely on conducting inspections. The auditor general found:

- "As the first civil aviation authority to put in place regulations requiring aviation companies to introduce SMS, Transport Canada developed its own approach. For example, it conducted pilot projects with airlines and small operators and used the results to establish milestones. It also monitored activities and made adjustments to ensure that all regions applied procedures consistently. However, in planning for the transition, the department did not document risks, such as the impact of the transition process on oversight of air transportation safety, and identify actions to mitigate these risks. Nor did it forecast the overall costs of managing the change;

- "Resources have been shifted from traditional oversight activities to SMS activities. However, the Department has not measured the impact of this on the frequency of traditional oversight activities;

- "Transport Canada has not yet identified how many inspectors and engineers it needs, with what competencies, during and after the transition. The impact of SMS is being addressed in the reorganization of the department's civil aviation program, now under way. Given that this is not expected to be completed before the end of 2009, Transport Canada could find itself unable to recruit the right mix of skills when it needs them; [and,]

- "The department has not developed short- and medium-term performance indicators — those that could signal a need for closer attention or action in a particular area — to measure the impact of its civil aviation activities."



The auditor general's recommendations included the following:

- "Transport Canada should establish a standard that defines an acceptable level of activity for oversight of the aviation industry, and it should specify how this will be measured during the transition to SMS and when the transition is complete. The department should analyze the data to assess the extent to which the standard is achieved;

- "Transport Canada should establish a national mechanism to provide the desired level of assurance that policies, procedures and processes for civil aviation oversight activities, including the assessment of risks, are followed consistently across all regions;

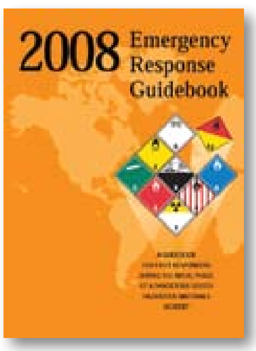
- "Transport Canada should put in place a national human resources plan for civil aviation as soon as possible. This plan should be aligned with the strategic plan, specify the required number of inspectors and engineers and their competencies, and include a recruitment strategy to meet these needs;

- "Transport Canada should develop a training strategy that is aligned with the human resources plan to be developed for civil aviation. The strategy should address required competencies, training needs, courses to meet those needs and a schedule for recurrent training; [and,]

- "Transport Canada should put in place a means to capture all information relevant to oversight of civil aviation safety in an integrated manner. This would allow the department to develop and track safety profiles

> for aviation companies and industry sectors and to assess the relative level of risk."

Transport Canada responded that it agreed with all the recommendations, and described how it was planning to achieve their goals.



Synthesis of AVAL Phase 1 Findings: ACAS on VLJs and LJs — Assessment of Safety Level AVAL Project

Eurocontrol. ACAS/08-037. March 31, 2008. Edition 1.3. 50 pp. Available via the Internet at <www.eurocontrol.int/msa/public/standard_page/ACAS_Safety_Studies.html>.

The airborne collision avoidance system (ACAS) is a "last resort" safety net against midair and near midair collisions between aircraft. In Europe, ACAS has been mandated since Jan. 1, 2005, for all civil turbine-engine aircraft over 5,700 kg/12,500 lb or seating more than 19 passengers. ACAS has been demonstrated to reduce the risk of midair collision by a factor of 5, the report says.

The anticipated introduction of very light jets (VLJs) and other light jets (LJs) weighing less than 5,700 kg, which are currently not required to be equipped with ACAS, is raising questions about their integration into the current air traffic management system.

The first phase of the AVAL (ACAS on VLJs and LJs — Assessment of Safety Level) Project sought to establish whether equipping these aircraft with ACAS would have an effect on the overall performance of the ACAS safety net.

If VLJs and LJs are not equipped with ACAS, they will not benefit from the additional safety margins provided by this system and will rely on air traffic control, where available, and the "see and avoid" principle for collision avoidance. However, this benefit needs to be quantified, the report says.

"This phase of the AVAL study has concluded that the decision about ACAS equipage mandate for VLJs and LJs can only be quantified through an in-depth investigation based on the encounter model approach used in previous ACAS safety studies," the report says. "The question of extending the current ACAS mandate to VLJs and LJs also carries technical and financial aspects that need to be examined."

REFERENCE MATERIALS

2008 Emergency Response Guidebook

U.S. Department of Transportation (DOT), Transport Canada and the Secretariat of Communications and Transportation of Mexico, with the collaboration of Centro de Información Química para Emergencias of Argentina. 376 pp. Tables, figures, glossary. Available in English and Spanish via the Internet at <http://hazmat.dot.gov/pubs/erg/guidebook.htm> or from Labelmaster.*

The guidebook, designed to aid first responders in hazardous-materials accidents, has been updated in its first new edition since 2004. Published in a format intended to maximize efficiency and ease of use, with five color-coded sections, it is available in several formats: as a book, compact disc and USB flash drive.

The foundation of many emergency response plans and incident management systems, the guidebook is intended by the DOT to be carried by all public emergency responders.

The latest edition's sections containing new or expanded information include:

- More than 50 amendments to correct shipping names and United Nations identification numbers of hazardous materials;
- Lists of whom to call for assistance;
- Updated lists of hazardous materials;
- Criminal and terrorist use of chemical, biological and radiological agents;
- An entry on lithium-ion batteries (see "Thermal Runaway," *ASW*, 3/08, p. 42); and,
- Ethanol entries and identification numbers.

The "initial isolation and protective action distance" table has been split into two tables to facilitate initial response actions for emergencies involving toxic inhalation hazards. Dangerous goods are listed both in alphabetical and identification number order.

Source

* Labelmaster <www.labelmaster.com/ERG> and other commercial suppliers.

— *Rick Darby and Patricia Setze*

Taxiway Touchdown

A nighttime circle-to-land maneuver misses the target.

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

Glide Path Lights in Unusual Location

Boeing 757-200. No damage. No injuries.

Weather conditions at Newark (New Jersey, U.S.) Liberty International Airport the night of Oct. 28, 2006, included surface winds from 280 degrees at 25 kt, gusting to 34 kt, 10 mi (16 km) visibility and a broken ceiling at 7,000 ft when the flight crew was cleared to conduct the instrument landing system (ILS) approach to Runway 22L. The 757, inbound from Orlando, Florida, with 148 passengers and six crewmembers, was descending through about 9,000 ft when air traffic control (ATC) told the crew to circle to land on Runway 29, said the report by the U.S. National Transportation Safety Board (NTSB).

The captain had about 24,000 flight hours, including 34 flight hours in 757s. The first officer, the pilot flying, had about 6,200 flight hours, including 388 flight hours in type. "The incident flight was the first officer's first approach to Runway 29," the report said.

The first officer disengaged the autopilot when the airplane intercepted the glideslope for Runway 22L, hand flew the 757 to the outer marker, which is 4.4 nm (8.1 km) from the runway threshold, and disengaged the flight director. At 900 ft, the minimum circling altitude, he maneuvered the airplane to line up with Runway 29, which is 6,800 ft (2,073 m) long and 150 ft (46 m) wide. Runway 29 and Runway 22L intersect near their approach thresholds.

"As he rolled the airplane level, he noted four white lights on the PAPI [precision approach path indicator] and pitched the airplane nose-down to capture the proper glide path," the report said. Both pilots believed that the PAPI was on the left side of the runway, the usual location. However, the PAPI for Runway 29 is on the right side of the runway.

"The flight crew believed that they had the runway centerline lights in view," the report said. "As the airplane descended below 300 ft, it flew through an intermittent rain shower, briefly reducing the flight crew's view of the runway. After clearing the rain shower, the flight crew confirmed final glide path alignment and noted that the PAPI appeared extremely bright compared to other lights."

The 757 touched down at about 140 kt. "As the first officer deployed the thrust reversers, the captain realized that they had landed on Taxiway Zulu and took control of the airplane," the report said. Taxiway Zulu is 75 ft (23 m) wide and is parallel to, and to the right of, Runway 29. The captain taxied the airplane to the gate without further incident.

The runway end identifier lights, the green high-intensity lights marking the edges of the approach end and the white centerline lights on Runway 29, as well as the green centerline lights on Taxiway Zulu, were illuminated. The taxiway also has blue reflective markers at its edges. "According to airport personnel, six aircraft made the same approach within 10 minutes of the incident aircraft and landed successfully on Runway 29," the report said.

The report noted that after the incident, the U.S. Federal Aviation Administration (FAA) approved Runway 29 area navigation transition procedures for the operator.

Landing Gear Damage Not Detected

Airbus A320-200. Substantial damage. No injuries.

The A320 was 5 nm (9 km) from Runway 09 at Bristol (England) Airport the night of Nov. 15, 2006, when the airport traffic controller cleared the flight crew to land and advised that surface winds were from 180 degrees at 23 kt, gusting to 33 kt. "There was no significant turbulence until the aircraft descended below 250 ft AGL [above ground level]," said the report by the U.K. Air Accidents Investigation Branch (AAIB).

When the commander disengaged the autopilot at 100 ft AGL, the aircraft suddenly rolled left.

When the commander disengaged the autopilot at 100 ft AGL, the aircraft suddenly rolled left. The commander rolled the wings level and continued the approach. "At about 70 ft AGL, there was another uncommanded roll to the left, but this was again corrected promptly by the commander," the report said. After he retarded the throttles and began the flare, the A320 sank. It touched down with a 30-kt crosswind and 10-kt tailwind; pitch attitude was 5.5 degrees nose-up. The first officer recalled that the right main landing gear touched down first, and she believed that the aircraft was going to become airborne again.

"The aircraft bounced slightly, and the commander was aware of the [first officer] calling 'go around,'" the report said. "However, he had already selected reverse thrust on both engines, and, with the spoilers deployed, he responded 'no.'" The crew brought the aircraft to a stop on the runway and then taxied to the stand.

The aircraft integrated data system generated a "LOAD <15>" report, which indicated a hard landing. The commander entered the report in the A320's technical log and gave the paper copy of the report to an engineer. "The commander also reported that they had landed quite hard and [asked] the engineer [to] have a look around the aircraft; his main concern was that there may have been evidence of a tail scrape," the report said.

The engineer had not seen a "LOAD <15>" report before. He consulted the aircraft maintenance manual and decided that a hard/overweight landing check was required. This check calls for the airplane to be placed on jacks if external damage is found. The engineer decided that placing the A320 on jacks was not necessary. "The check did not reveal any visible signs of damage, and the engineer released the aircraft back into service," the report said.

The next day, a different flight crew was unable to retract the landing gear on takeoff. The electronic centralized aircraft monitor (ECAM) displayed multiple warnings, including a partial failure of the anti-ice system and an inoperative no. 1 engine thrust reverser. After the crew cycled the landing gear, "the gear retracted correctly, but the other warnings remained, together with others that cycled on and off," the report said.

The crew declared an urgency and flew the aircraft in a holding pattern. "The crew decided to divert to Manchester, an airfield with a long runway, where the weather conditions were good and, because it was their main operating base, where appropriate maintenance support was available," the report said.

The crew lowered the landing gear before leaving the holding pattern. "The crew subsequently completed the 'Overweight Landing

Check' before making a gentle touchdown on Runway 24L at Manchester," the report said.

The automatic post-flight report indicated a problem with a gear-position sensor. The sensor was replaced, and an engineer released the aircraft to service. The flight crew that landed the A320 at Manchester then departed in the aircraft for a ferry flight back to Bristol. "After takeoff, the landing gear failed to retract, and the crew were presented with almost the same warnings as on the previous flight," the report said. "They reselected the landing gear down, declared a 'PAN' and returned to land at Manchester."

The aircraft was taken to a hangar and placed on jacks. "During the jacking, it became evident that the right main landing gear had suffered severe internal damage," the report said. "The internal upper diaphragm tube had ruptured, allowing the inner sliding tube to overextend. … The attached axle and the main wheels were only prevented from detaching by the torsion links."

Elevator Separates During In-Flight Upset

Learjet 36. Substantial damage. No injuries.

Two Learjets rendezvoused over the Pacific Ocean, about 100 nm (185 km) west of North Island Naval Air Station in San Diego, the morning of Dec. 1, 2006, to participate in tests of a U.S. military command and control system. Visual meteorological conditions (VMC) prevailed in the area, but the horizon reportedly was difficult to discern.

The accident airplane was flown 1,000 ft below and slightly behind the other Learjet for the first test. "The run was uneventful except for increasing communications difficulties with the test controllers," the NTSB report said.

While attempting to re-establish communication with the controllers, the flight crew of the lead airplane began a left orbit at about 25,000 ft. While maneuvering the accident airplane to an in-trail position at the same altitude, the pilot lost sight of the other Learjet and rolled right. "Unable to see the horizon or the other airplane, he attempted to transition to instrument references," the report said. "But his vision was still impaired by the glare from the sun, delaying his recognition of the airplane's attitude."

The Learjet was in a 70-degree right bank and a 50-degree nose-down attitude when the pilot began to recover. "The pilot moved the thrust levers rapidly to idle, rolled to a wings-level attitude and began the dive recovery," the report said. "He noted that the airspeed seemed to stabilize at 380 KIAS [knots indicated airspeed]. Both crewmembers felt that the pull-up was completed smoothly, without excessive g force."

The Learjet was in a 70-degree right bank and a 50-degree nose-down attitude when the pilot began to recover.

The pilots said that the airplane shuddered during the dive recovery, but they "did not recall any rolling tendencies or vibration of the control yokes … or any unusual noises other than the loud wind noise," the report said. However, the equipment operator, who was seated in the cabin, heard a very loud bang before the shuddering ceased.

The dive recovery was completed at 16,000 ft. The pilots noticed no unusual handling qualities as airspeed decreased to 200 KIAS. "The crew conducted a controllability check by slowing it to 150 KIAS and lowering the landing gear," the report said. "Again, the airplane exhibited no unusual flight characteristics."

The crew flew the airplane back to base and landed without further incident. A post-flight inspection revealed that the right elevator was missing. The report concluded that the Learjet's design stress limits likely had been exceeded during the upset and recovery.

Hot, Flat Approach Results in Overrun

Cessna Citation 560. Substantial damage. No injuries.

The pilot told NTSB investigators that surface wind direction was variable and velocity was 3 to 5 kt when he conducted a visual approach to the 4,200-ft (1,280-m) runway in Hamilton, Montana, U.S., the morning of July 10, 2006. During final approach, the pilot observed airspeed fluctuations of plus/minus 10 kt and increased his target approach speed from 98 to 108 kt.

The pilot said that just after he flared and reduced power to idle, the Citation encountered a gust of wind that caused it to float and touch down between 1,000 and 1,300 ft (305 and 396 m) beyond the runway threshold. He was not able to move the thrust-reverse levers beyond the "DEPLOY" position to increase reverse thrust. He then applied maximum wheel braking but did not notice any significant deceleration.

The copilot told investigators that the pilot had conducted a long, flat approach and crossed the runway threshold 10 kt too fast. The copilot said that the Citation touched down about 2,200 ft (671 m) beyond the threshold and that he did not feel any braking occur until the airplane was about 500 ft (152 m) from the departure end of the runway.

The Citation overran the runway onto rough, swampy terrain. The nosegear collapsed, and the wings and right main landing gear were damaged substantially.

At the airplane's landing weight and with an approach speed of 108 kt, calculated landing distance was 3,100 ft (945 m); the calculation does not include the landing performance provided by reverse thrust. A Cessna representative told investigators that when the Citation's thrust-reverse levers are moved to the "DEPLOY" position, the reversers deploy fully in about two seconds and a solenoid releases the levers so that reverse thrust can be increased. "If a pilot applies pressure to the reverser levers prior to the time the solenoid releases them — and that pressure is maintained during and after the time the solenoid is activated — the reverser lock-out pin may not be able to release, and the levers will not be able to be moved past the 'DEPLOY' position," the report said.

TURBOPROPS

Propeller Feathers During Go-Around

Convair 580A. Substantial damage. One fatality, two serious injuries.

The flight crew of the fire-fighting aerial tanker was conducting stop-and-go landings at the airport in La Ronge, Saskatchewan, Canada, during a training flight on May 14, 2006. "The first two circuits were unremarkable; all altitudes, speeds and aircraft performance were as expected for the exercises being carried out," said the report by the Transportation Safety Board of Canada (TSB).

The third approach was not stabilized. The contract training captain, who had 750 flight hours in type and was the pilot flying, used an airspeed of 103 KIAS instead of the recommended 120 KIAS, a power setting that was less than half the normal setting, and a flap setting of 28 degrees rather than the 24 degrees selected for the first two approaches.

Sink rate increased to about 1,280 fpm on short final approach, and the aircraft descended almost to ground level. The captain called for increased power. The first officer rapidly advanced both power levers, and power increased beyond the maximum limit, triggering the autofeather system. The captain retarded the power levers to a position that he believed would produce maximum power, but the autofeather system already had begun to feather the left propeller and shut down the left engine. "The autofeather was not called out or identified as an emergency," the report said.

The Convair bounced when it touched down about 200 ft (61 m) beyond the runway threshold, with 4,750 ft (1,448 m) of runway remaining — which was more than sufficient to complete the landing, the report said. However, the captain rejected the landing. Airspeed was about 94 KIAS — 2 kt lower than V_1 — when the go-around was initiated. Soon after the aircraft became airborne, it entered a slight left bank that the captain was unable to correct. The landing gear was retracted during a momentary indication of a positive rate of climb and the flaps were retracted at 95 KIAS. "Once the flaps were retracted … the angle of bank increased uncontrollably," the report said. "The aircraft started to descend and collided with trees and terrain in a wooded area on the airport property." The first officer was killed; the captain and a pilot occupying the observer's seat were seriously injured.

The autofeather system in the Convair activates when it senses that a high power setting has been selected — that is, one or both power levers are beyond a specific position — but propeller thrust is less than 500 lb. "This 'committed' type of autofeather system does not incorporate a timed delay; such a device would allow for transient propeller thrust during engine 'spool-up,'" the report said. "Testing of a similarly equipped aircraft revealed that it is possible to induce an unwarranted activation of the aircraft's autofeather system by rapidly advancing the power levers when the propellers are in a low-thrust condition."

Caught Between Layers

Cessna 208. No damage. No injuries.

Soon after departing with 10 passengers from Broome, Western Australia, for a visual flight rules (VFR) charter flight to Talbot Bay, the morning of June 20, 2007, the pilot found that he would not be able to climb to his planned cruise altitude of 5,500 ft because of clouds. "The pilot therefore decided to level the aircraft at about 2,500 ft and continue toward Talbot Bay," said the Australian Transport Safety Bureau report. About 10 minutes later, another cloud layer began to build below the float-equipped Caravan.

"Approximately 35 to 40 minutes into the flight, the weather conditions deteriorated further," the report said. "The pilot reported showers and 'a wall of cloud' ahead, around which he was unable to divert." The pilot, who did not hold an instrument rating or a night VFR rating, decided to return to Broome.

The aircraft was between cloud layers and 83 km (45 nm) from Broome when it encountered rain showers that significantly reduced visibility. The pilot began a left turn toward an area he recalled as having better visibility. "The pilot reported that, following the turn, he began to feel disoriented and had difficulty controlling the aircraft's roll attitude," the report said.

The pilot radioed on the common traffic advisory frequency of a local airport that he needed assistance. The flight crew of an aircraft 130 km (70 nm) northeast discontinued an approach to assist the pilot. They coached the pilot on using his flight instruments to maintain control. "The crew of the assisting aircraft reported that, about five minutes after the initial radio contact, 'the pilot of the [Caravan] sounded less stressed and advised us he was in level flight,'" the report said. "The pilot of the Caravan subsequently advised that he was continuing to Broome [and] required no further assistance."

The report said that the pilot assumed an "elevated risk of collision with terrain" when he conducted a descent through the lower cloud deck without knowing the lowest safe altitude in the area or the minimum sector altitude. "The pilot indicated that he was using a global positioning system (GPS) moving map display to provide an indication of the surrounding terrain," the report said. After descending clear of the clouds at an undetermined altitude, the pilot landed without further incident.

The pilot assumed an "elevated risk of collision with terrain" when he conducted a descent through the lower cloud deck.

Grease Contamination Leads to Gear Failure

Beech B200. Substantial damage. No injuries.

When the flight crew attempted to retract the landing gear during departure from Caen, France, on March 24, 2007, they heard an unusual noise and saw that the "GEAR UNSAFE" light remained illuminated. A reflection of the nosegear in the engine cowlings showed that the nosegear "appeared to be extended, but at a slight angle from its normal down position," the AAIB report said. "The crew selected the landing gear down and obtained two green lights for the main gear but no such indication for the nosegear. They then selected it up again, but the nosegear remained in its previous position."

The crew continued toward the destination, Stapleford Aerodrome in Essex, England, but decided to divert to Southend Airport in Essex, where the operator's maintenance organization was based. The "GEAR UNSAFE" light remained illuminated when they extended the landing gear. "They then attempted to lower the nosegear using the manual extension system, but without success," the report said.

Airport emergency services were standing by when the Super King Air touched down on its main landing gear. As briefed, the copilot feathered the propellers and shut down the engines while the commander held the nosegear off the runway as long as possible. The nosegear collapsed when it touched down at an estimated groundspeed of 65 kt. The pilots and the five passengers were not injured.

Examination of the nosegear showed that all the threads in the nut on the screw-driven actuator had been stripped. The wear had occurred over time due to water contamination of the grease inside the actuator. The contamination had reduced the lubricating properties of the grease and corroded the screw. "The corrosion pits formed were likely to have increased the roughness of the screw and accelerated wear of the nut," the report said. Based on the incident investigation, the AAIB recommended that the FAA require periodic lubrication and more frequent inspections of the nosegear actuators in B200s.

PISTON AIRPLANES

Power Loss Leads to Ditching

Douglas DC-3. Destroyed. One minor injury.

The crew had delivered mail to St. Thomas, U.S. Virgin Islands, and were returning to San Juan, Puerto Rico, the morning of July 19, 2006, with no cargo aboard the DC-3. The airplane was at about 100 ft AGL on takeoff, and the first officer, the pilot flying, had just called for the landing gear to be retracted when the left engine lost power.

The captain took control, verified that the left engine had failed and feathered the propeller. "The airplane would not maintain altitude, and the airspeed dropped to about 75 kt," the NTSB report said. The captain told the two passengers to don their life vests and then ditched the airplane in the Caribbean Sea about 1 mi (2 km) from the runway. One passenger received minor injuries.

"All aboard managed to exit the airplane through the cockpit overhead escape hatch onto the life raft as the airplane remained afloat," the report said. "About 10 minutes later, the airplane sank nose-first straight down [and] came to rest at the bottom of the ocean, in about 100 ft of water." The DC-3 was not recovered.

Decision to Reject Landing Made Too Late

Piper Chieftain. Destroyed. One fatality, one serious injury.

The flight crew was conducting a 30-minute positioning flight on March 8, 2006, from Vancouver, British Columbia, Canada, to pick up cargo at the Powell River airport, which is uncontrolled and has no advisory service. On arrival, the crew established the airplane on a right downwind for landing on Runway 09, which is 1,106 m (3,629 ft) long.

The TSB report said that a cold front was passing through the area, and, during the Chieftain's approach, the surface winds changed from 120 degrees at 6 kt to 200 degrees at 10 kt, gusting to 37 kt. Visibility decreased from 10 mi (16 km) to 4 mi (6 km) in rain showers and ice pellets.

The aircraft was low and fast on final approach. The crew conducted a go-around and prepared for another visual approach. "It is evident that any cues received on the first approach were not sufficiently compelling to the crew to cause them to abandon their stop at Powell River or to change runways," the report said. "The downwind condition on [final] approach contributed to the aircraft landing long and with a high groundspeed."

The Chieftain touched down with about 550 m (1,805 ft) of runway remaining and began to hydroplane on the wet runway. "At some point after the touchdown, engine power was added in an unsuccessful attempt to abort the landing," the report said. "The aircraft overran the end of the runway and crashed into an unprepared area within the airport property." The copilot was killed, and the pilot was seriously injured.

Broken Manifold Causes In-Flight Fire

Piper Cherokee 6. Destroyed. No injuries.

During a scheduled flight from Juneau, Alaska, U.S., to Kake on June 11, 2007, the passengers complained about an odor in the cabin. The pilot suspected an exhaust leak but found nothing abnormal when he examined the engine after landing. During the subsequent takeoff with two new passengers aboard, the pilot heard a loud bang and saw flames near his feet. The passengers saw smoke appear near the rear of the cabin and become so dense that they no longer could see the pilot, the NTSB report said.

The pilot retarded the throttle and landed the airplane on the runway. He then helped the passengers evacuate. The pilot told investigators that in his haste to get out of the airplane, he had not turned off the electric fuel-boost pump, which continued to pump fuel through a melted fuel line. The fuel pooled on the ground and was ignited, destroying the Cherokee.

Examination of the engine revealed that fatigue fractures had caused a large piece of the right exhaust manifold to separate. "Hot exhaust gases burned a hole in the heater shroud at the point where it attaches to the scat tubing which provides heated air to the vents in the rear of the passenger cabin," the report said. "The hot exhaust gases also were deflected by the firewall onto the fuel line attached to the engine-driven fuel pump. … According to airplane records, the exhaust system had been inspected in accordance with the operator's approved inspection program 2.9 flight hours prior to the accident."

HELICOPTERS

Controls Bind During Sling Operation

Eurocopter AS 350B2. Substantial damage. No injuries.

After completing sling-load operations at a mining site in Kamarang, Guyana, on Feb. 6, 2005, the pilot began coiling the 120-ft (37-m) longline on the ground below the Canadian-registered helicopter. After descending to about 10 ft AGL, the pilot felt a control restriction in the anti-torque pedals. "The pilot also recognized that he now had considerable physical difficulty controlling the cyclic and collective sticks, and was close to losing attitude control of the helicopter as it gyrated in the pitch, roll and yaw axes," the TSB report said.

At about 20 ft AGL, the pilot retarded the throttle, and the helicopter descended rapidly. "Immediately before impact, the pilot applied considerable force to raise the collective lever, which likely reduced the rate of descent," the report said, noting that the pilot is a "tall and powerful man." The helicopter bounced and came to rest on its skids. The hard landing fractured the left skid tube and a flexible arm on the main rotor head.

Examination of the helicopter revealed several anomalies, including contamination of the hydraulic fluid and the circuit boards that control the hydraulic system. However, the cause of the flight control malfunction was not determined. The report cited several recent AS 350 accidents and incidents involving flight control problems caused by hydraulic system malfunctions. "The AS 350B2 can be controlled without hydraulic servo actuators, but it requires the pilot to exert considerable muscular effort," the report said. "The best course of action is for pilots to be well-trained and prepared for hydraulics-out flight, and for the hydraulic servos to be maintained within fine tolerances."

'Overpitching' Cited in Tail Rotor Strike

Robinson R22 Beta. Substantial damage. No injuries.

The pilot was air-taxiing the helicopter backward while preparing to depart from a field near his home in Ballyragget, Ireland, for a business flight on April 10, 2007. He told investigators that his "overpitching of the flight controls" caused a "seesaw motion" of the helicopter that resulted in a tail rotor strike, said the report by the Irish Air Accident Investigation Unit.

The pilot lowered the collective, and the helicopter landed hard but remained upright on its skids. "Post-accident inspection showed that the tail rotor blades had disintegrated, damage was caused to the tail rotor gearbox as a result of severance of the tail boom, the right skid was damaged and rivets popped on the main gearbox fairing assembly," the report said.

Preliminary Reports

Date	Location	Aircraft Type	Aircraft Damage	Injuries
May 2, 2008	Rumbek, Sudan	Beech 1900C	destroyed	21 fatal
The airplane crashed about 45 km (24 nm) from Rumbek after both engines lost power during a charter flight from Wau.				
May 9, 2008	Muanda, Democratic Republic of Congo	Bell 206L-1	destroyed	1 fatal
The LongRanger crashed and sank in the Atlantic Ocean during a positioning flight between tanker ships.				
May 9, 2008	Ada, Michigan, U.S.	Cessna 208B	destroyed	1 none
The Caravan struck trees after losing power on approach to Traverse City during a cargo flight.				
May 10, 2008	La Crosse, Wisconsin, U.S.	Eurocopter EC 135	destroyed	3 fatal
The emergency medical services helicopter struck the top of a ridge during a nighttime positioning flight.				
May 13, 2008	Cranbrook, British Columbia, Canada	Bell 206B	destroyed	4 fatal
The JetRanger was on a pipeline-inspection flight when it developed engine problems and crashed in a residential area, killing one person on the ground.				
May 15, 2008	Esperanza, Peru	Cessna 210M	destroyed	5 fatal, 1 NA
The airplane crashed in a forest about 50 km (27 nm) west of Esperanza during a passenger flight to Pucallpa.				
May 16, 2008	Pohnpei, Federated States of Micronesia	Boeing 727-200	minor	5 none
The cargo airplane overran the runway while landing and came to a stop in shallow water.				
May 17, 2008	Mumbai, India	Boeing 777-200	substantial	4 none
Four engineers preparing the parked 777 for a flight escaped injury when the nosewheel collapsed.				
May 17, 2008	Stehekin, Washington, U.S.	de Havilland DHC-2	substantial	2 fatal, 3 minor
The wheels on the amphibious landing gear were extended when the Beaver was landed on Lake Chelan. The airplane flipped over and came to rest inverted. Two passengers were killed.				
May 23, 2008	Billings, Montana, U.S.	Beech 1900C	destroyed	1 fatal
The airplane crashed into a warehouse soon after taking off for a nighttime cargo flight.				
May 24, 2008	Avalon, California, U.S.	Aerospatiale AS 350D	destroyed	3 fatal, 3 serious
The helicopter was at about 300 ft on approach to Catalina Island when witnesses heard a pop and saw flames emerge from the engine. The pilot and two passengers were killed when the aircraft struck the ground.				
May 25, 2008	Brussels, Belgium	Boeing 747-200	destroyed	5 none
The flight crew reportedly rejected the takeoff after hearing loud bangs. The cargo airplane then overran the 9,800-ft (2,987-m) runway.				
May 26, 2008	Goma, Democratic Republic of Congo	Antonov An-32	destroyed	5 NA
The An-32 was departing for a cargo flight when the crew reported engine problems and turned back to the airport. Two occupants reportedly were injured when the airplane overran the runway on landing.				
May 26, 2008	Chelyabinsk, Russia	Antonov An-12	destroyed	9 fatal
Soon after taking off for a positioning flight, the crew reported smoke in the cockpit and were attempting to return when the cargo airplane crashed in a field about 15 km (8 nm) from the airport.				
May 29, 2008	Panama City, Panama	Bell UH-1N	destroyed	11 fatal, 1 NA
Two of the three crewmembers and all the passengers, who were Chilean and Panamanian police officials en route to an anti-terrorism conference, were killed when the helicopter crashed into an office building,				
May 30, 2008	Tegucigalpa, Honduras	Airbus A320	destroyed	5 fatal, 118 NA
A tropical storm was producing high winds and heavy rain when the A320 overran the 6,112-ft (1,863-m) runway on landing and struck several motor vehicles before coming to a stop against an embankment. The captain, two passengers and two motorists were killed. At least 81 passengers reportedly were injured.				
May 30, 2008	Lillo, Spain	Pilatus PC-6	destroyed	2 fatal, 9 NA
A wing reportedly separated from the airplane during a skydiving-training flight. Nine skydivers jumped from the PC-6 before it struck terrain.				

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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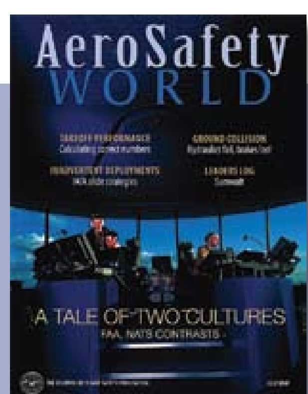

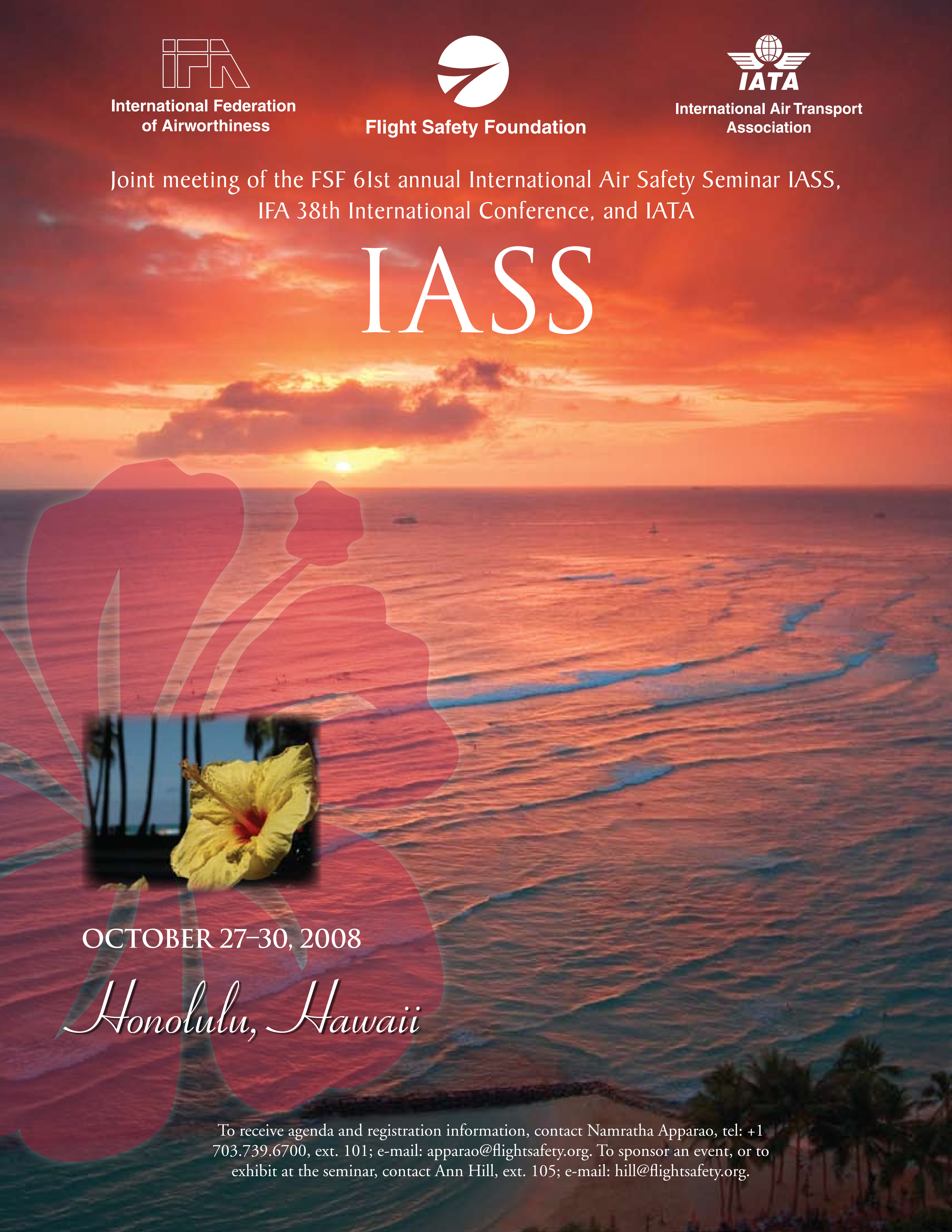
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