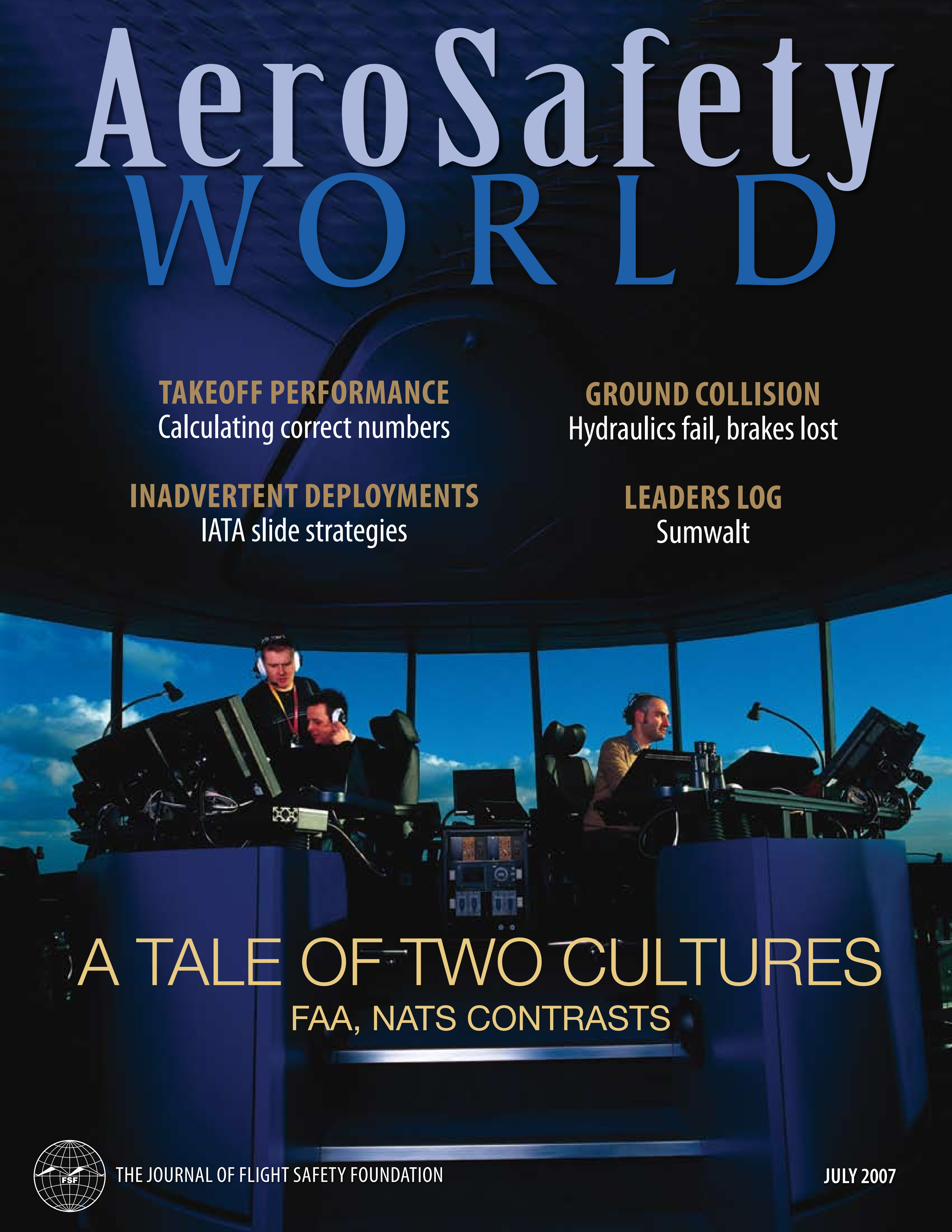
AeroSafety WORLD

TAKEOFF PERFORMANCE
Calculating correct numbers

GROUND COLLISION
Hydraulics fail, brakes lost

INADVERTENT DEPLOYMENTS
IATA slide strategies

LEADERS LOG
Sumwalt



A TALE OF TWO CULTURES
FAA, NATS CONTRASTS

THE JOURNAL OF FLIGHT SAFETY FOUNDATION

JULY 2007

REALITY Check

In the last couple of months I have had the pleasure of having some frank conversations about how the Foundation can make a difference.

Everybody agrees on one thing: Making a difference today is less about invention than it is about implementation. Based on accident rates in areas such as Europe and North America, it is pretty clear that we know how to run a remarkably safe system. Yet, in some other parts of the world, the accident rate is comparatively bleak and shows few signs of improvement. It isn't necessarily because safety professionals in those regions don't know how to do their jobs. Often, it is because these people are *not allowed* to do their jobs.

Let me give you a real example. I have worked with a courageous, talented and outspoken woman, Maimuna Taal. Ms. Taal was the director general of civil aviation (DGCA) of the Republic of The Gambia. She did a great job improving safety oversight with little more to work with than her considerable force of will. She was also a leader among her peers. When someone from another developing country would claim they couldn't do anything because of lack of resources, she would remind them forcefully that it didn't cost anything to tell a dangerous operator, "No!"

One day, Taal was confronted with a dangerous operator who was flying two dilapidated Boeing 747s that had just been "reflagged" under questionable circumstances in Sierra Leone. The operator was applying to fly Haj pilgrims out of Gambia. True to form, she said no. Subsequently, this same operator was turned down by the DGCA of Nigeria, and finally by the DGCA of Saudi Arabia.

That was good news for safety, but it worked out badly for Taal; this operator had lots of money and connections. A few days later, the president of Gambia had Taal thrown in prison on a series of hastily concocted charges.

Back-door communication with the international press prompted some to come to her defense, providing the visibility that she thinks may have saved her life. Eventually, she was released from prison, but she remained in Gambia until she could clear her name. Late this May, after two years of continuations and dozens of court appearances, she finally was acquitted of all charges.

This sort of thing happens all the time. The only thing that makes this story unusual is that Taal fought back. I used an example from Africa, but I could have just as easily used examples from Asia, Eastern Europe or elsewhere. Sitting comfortably in the developed world it is easy for us to ignore the circumstances of a DGCA's sudden departure. Too often we reassure ourselves by sending their replacement a congratulatory letter and new set of training materials. Then we congratulate ourselves for contributing to safety in the developing world.

Those of us who are in a position to help must realize that it doesn't work if we focus only on the easy technical and training issues, leaving the really tough political problems for people like Taal to handle alone. Things have to change, and that process starts with somebody telling the truth, even if it isn't pretty.

William R. Voss
President and CEO
Flight Safety Foundation

AeroSafetyWORLD

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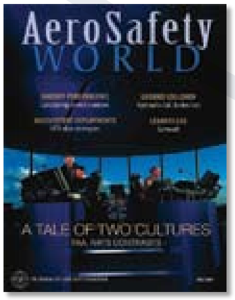

About the Cover
Providers of air traffic services define their safety cultures in different ways.
NATS

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

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Serving Aviation Safety Interests for More Than 50 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 1,000 member organizations in 142 countries.

Member**Guide**

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Poisonous

Communication is key to developing a positive safety culture. This is clearly stated in every story, every column printed in this journal on the subject. You've read it before and you'll continue to read it, because without effective communication, there cannot be a productive safety culture within any organization.

This is why it is alarming to watch what is going on in the United States, where, it must be said, labor-management relations and communications are poor within the Federal Aviation Administration's (FAA) Air Traffic Organization (ATO) (see story, p. 12).

Once upon a time it was much worse. That was 26 years ago, when the Professional Air Traffic Controllers Organization (PATCO), seemingly convinced that the FAA administrator at the time was the devil incarnate, walked off the job in the face of a threat that they'd be fired, which they were. My description of PATCO's attitude might seem harsh unless you have seen some of the literature that organization was sending its membership.

Today the situation is not that bad, but the paucity of communications on safety mirrors what is happening on the labor relations front, where the FAA plays defense against a nearly daily barrage of press releases from the National Air Traffic Controllers Association (NATCA) alleging one safety problem after another. Some of NATCA's charges are sufficiently grounded to have attracted the attention of the U.S. National Transportation Safety Board (NTSB). Not eager to jump into a labor dispute, NTSB nonetheless produced a recommendation that the FAA look into controller fatigue issues.

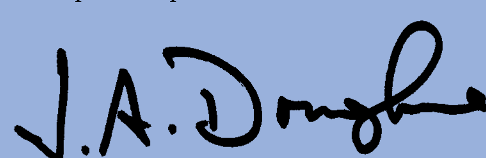
There is a good news aspect to this situation: The U.S. air traffic control system remains, for now, the best in the world for its size, and probably any size, at safely handling in real time such a huge number of airplanes in any kind of weather.

How this FAA vs. NATCA situation developed is a story for another sort of publication. We are concerned about fixing it. Sadly, the alignment of the stars is not favorable for a speedy cure.

FAA Administrator Marion Blakey is poorly positioned to lead reconciliation after last year's failed NATCA contract talks, and her five-year term at the agency expires in mid-September. And while transportation issues in general, and aviation more specifically, have largely been spared the past six years' partisan mud wrestling in Washington, D.C., it is unclear that the Republican administration of President George W. Bush and a Congress controlled by Democrats will confirm a new administrator before Bush's term ends in January 2009.

The prospect of a temporary caretaker administrator compounds a leadership vacuum that got serious several months ago, when the previous head of the ATO, the highly regarded Russ Chew, left to become JetBlue Airways' chief operating officer. He has not been replaced.

Both sides are largely talking past each other, trying to make their case and garner support; the situation has the potential to become downright poisonous. With minimal safety communication now going on as traffic builds and a new air traffic control system is in development, a way must be found for leadership to take extraordinary steps to establish communication channels that work, and to keep them open.



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

Death of the Company Flight Safety Magazine?

I first must applaud the Flight Safety Foundation and those contributors who have helped *AeroSafety World* become the best flight safety publication anywhere. I was pleased to see that you are now offering *ASW* free of charge via the FSF Web site. This is an important step to enhancing the safety awareness of everyone in our industry.

Sadly, I believe that if certain disturbing trends continue, *ASW* may eventually be the only significant flight safety magazine left. While browsing a Web site that is popular with aviation professionals, I recently spotted the following comment:

"I am a pilot manager of a large airline. I have contributed here many times, but I am posting this thread under a new username to ensure the anonymity of [myself] and my airline.

"I recently spent a great deal of time putting together an in-house, pilot-orientated flight safety magazine containing the usual collection of [statistics], featured incidents and advice. The top brass have vetoed publication of the magazine because of concerns about its contents getting into the public domain and any possible adverse publicity."

As a specialist in flight safety for an airline operator, I have faced similar resistance from senior management when attempting to publish a flight safety magazine which, among other things, included the results of our investigations into events that occurred in our operation. A recent media blitz which attempted to raise concerns about the safety of the industry in general, and of one major carrier in particular, has made the situation even worse. The media reports were filled with accusations without the benefit of clear evidentiary support. Their only source of information was a government-run database of incident reports which does not provide consistent feedback as to the results of investigations. Nowhere did the reporters mention the excellent safety record of the industry or of the targeted carrier in particular.

The readership was not told of the benefits gained from any of the investigations into these events. When challenged on the legitimacy of their reports, the reporters defended themselves by saying that the public has a right to know. Should that not mean that the public also has a right to know the whole story?

Media reports such as these only put pressure on our industry to keep our incident reports underground, so that corporate images can be protected from an overly litigious consumer base and an insatiable media need for "news."

Flight safety publications have often mentioned the saying, "Learn from the mistakes of others, as you'll never live long enough to make them all yourself." In the face of ever-increasing pressure on senior managers to keep their skeletons in the closet, the availability of safety information will only diminish.

I encourage my fellow safety professionals to ensure that everyone within your organization subscribes to the online version of *ASW* and reports safety issues to organizations such as the U.S. National Aeronautics and Space Administration Aviation Safety Reporting System or operator organizations that guarantee confidentiality.

Name and airline affiliation withheld by request

Editorial note: Letters intended for publication must include the writer's name and affiliation. In keeping with the Foundation's support of confidentiality in reporting safety issues, we will publish letters anonymously when circumstances warrant.

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

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

JULY 9–12 ➤ CBAA 46th Annual Convention, Trade Show and Static Display. Canadian Business Aviation Association. Calgary, Alberta. Janet Maslin, <jmaslin@cbaa.ca>, <www.cbaa.ca/portal/convention>, +1 613.236.5611, ext. 225.

JULY 23–25 ➤ Asia Pacific Aviation Summit. Terrapinn Limited. Sydney, Australia. Vanessa Riley, <vanessa.riley@terrapinn.com>, <www.terrapinn.com/2007/aviation>, +61 2 9021 8808.

AUG. 6–9 ➤ Unmanned Systems North America. Association for Unmanned Vehicle Systems International. Washington. <info@auvsi.org>, <www.auvsi.org/symposium>, +1 703.845.9671.

AUG. 8–10 ➤ Wildlife Hazard Management Workshop. Embry-Riddle Aeronautical University, Center for Professional Education. Seattle-Tacoma International Airport, Seattle. Billy Floreal, <florealb@erau.edu>, <www.erau.edu/ec/soctapd/seminar_progs.html>, +1 386.947.5227.

AUG. 9–11 ➤ Latin American Business Aviation Conference and Exhibition (LABACE2007). National Business Aviation Association and the Associação Brasileira de Aviação Geral. São Paulo, Brazil. Dan Hubbard, <dhubbard@nbaa.org>, <www.labace.aero>, +1 202.783.9360.

AUG. 27–30 ➤ ATA Non-Destructive Testing Forum. Air Transport Association of America. Orlando, Florida, U.S. <ata@airlines.org>, <www.airlines.org/operationsandsafety/events/2007+NDT+Forum+Web+site.htm>, +1 202.626.4000.

AUG. 27–30 ➤ ISASI 2007, 38th International Seminar. International Society of Air Safety Investigators. Singapore. Chan Wing Keong, <chan_wing_keong@isasi07.org>, <www.isasi07.org>, +65 6541 2800.

SEPT. 3–6 ➤ Asian Aerospace 2007. Reed Exhibitions. Hong Kong. Clive Richardson, <clive.richardson@reedexpo.com.hk>, <www.asianaerospace.com/index.html>, +852 2824 0330.

SEPT. 5–6 ➤ 19th FAA/ATA International Symposium on Human Factors in Maintenance and Ramp Safety. U.S. Federal Aviation Administration and Air Transport Association of America. Orlando, Florida, U.S. <ata@airlines.org>, <www.airlines.org/operationsandsafety/events/2007+HF+Symposium+Web+site.htm/>, +1 202.626.4000.

SEPT. 10–13 ➤ Bird Strike 2007 Conference. Bird Strike Committee Canada and Bird Strike Committee USA. Kingston, Ontario, Canada. Carol Liber, <events@theplanner.net>, <www.birdstrikecanada.com/2007conf.htm>, +1 604.276.7471.

SEPT. 11–15 ➤ 17th ACI Africa Annual Assembly, Regional Conference and Exhibition. Airports Council International. Arusha, Tanzania. <events@aci-africa.aero>, <www.aci-africa.aero/en/index.php?idp=4&>.

SEPT. 16–20 ➤ 55th International Congress of Aviation and Space Medicine. International Academy of Aviation and Space Medicine. Vienna, Austria. <icasm2007@imperial-tours.com>, <www.icasm2007.org/>, +43 1 535 69 70.

SEPT. 17–19 ➤ Air Medical Transport Conference. Association of Air Medical Services. Tampa, Florida, U.S. Natasha Ross, <nross@aams.org>, <www.aams.org/Content/NavigationMenu/EducationMeetings/AMTC2007/default.htm>, +1 703.836.8732.

SEPT. 17–19 8th Annual Aviation Industry Suppliers Conference. SpeedNews. Toulouse, France. <conferences@speednews.com>, <www.speednews.com/Conference/euroconference.html>, +1 310.203.9603.

SEPT. 17–19 ➤ World Low Cost Airlines Congress. Terrapinn. London. Caroline Thoresen, <Caroline.Thoresen@terrapinn.com>, <www.terrapinn.com/2007/wlca/Custom_16556.stm>, +44 (0) 207 092 1230.

SEPT. 19–21 ➤ Russian International Business Aviation Exhibition. JetExpo. Moscow. <info@jetexpo.ru>, <www.jetexpo.ru>, +7 495 739 55 22.

SEPT. 19–22 ➤ 12th Aviation Expo/China 2007. C5 China and Organizing Committee of Aviation Expo/China 2007. Beijing. <info@C5-China.com>, <www.cpexhibition.com/aviation>.

SEPT. 25–27 ➤ NBAA2007: Helping Businesses Take Flight. National Business Aviation Association. Atlanta. Donna Raphael, <drapahel@nbaa.org>, <web.nbaa.org/public/cs/amc/2007>, +1 202.478.7760.

SEPT. 26–27 ➤ 7th Annual CIS, Central and Eastern European Airline Engineering and Maintenance Conference. Aviation Industry Group. Prague, Czech Republic. Ruth Martin, <ruthm@aviation-industry.com>, <www.aviationindustrygroup.com/index.cfm?pg=247&archive=false&offset=1>, +44 (0) 207 931 7072.

OCT. 1–2 ➤ UKFSC Annual Seminar: Technical Innovation and Human Error Reduction. U.K. Flight Safety Committee. Heathrow. <admin@ukfsc.co.uk>, <www.ukfsc.co.uk/annual%20seminar.htm>, +44 (0) 1276 855193.

OCT. 1–4 ➤ 60th Annual International Air Safety Seminar. Flight Safety Foundation, International Federation of Airworthiness, and International Air Transport Association. Seoul, Korea. Namratha Apparao, <apparao@flightsafety.org>, <www.flightsafety.org/seminars.html#iass>, +1 703.739.6700, ext. 101.

OCT. 2–4 ➤ Helitech 2007. Reed Exhibitions. Duxford/Cambridge, U.K. Sue Bradshaw, <sue@helitech.co.uk>, <www.helitech.co.uk/>, +44 (0) 20 8439 8894.

OCT. 10–14 ➤ CAMA Annual Scientific Meeting. Civil Aviation Medical Association. San Diego. James L. Harris, <Jimlharris@aol.com>, <www.civilavmed.com/Meeting_Events.htm>, +1 405.840.0199.

OCT. 16–18 ➤ Aviation (Asia) Fire Conference 2007. International Aviation Fire Protection Association. Singapore. <iafpa2007conference@yahoo.com.sg>, <www.iafpa.org.uk/conference/Singapore/>, +65 6541 2523.

OCT. 17–19 ➤ ERA General Assembly 2007. European Regions Airline Association. Athens, Greece. <info@eraa.org>, <www.eraa.org/inside-era/generalassembly/Welcomeera2007.php>, +44 (0) 1276 856495.

OCT. 28–31 ➤ 52nd Annual Conference and Exposition. Air Traffic Control Association. Washington. Gail Hanline, <gail.hanline@atca.org>, <www.atca.org/atca52nd.asp>, +1 703.299.2430.

NOV. 1–2 ➤ 8th Safeskies International Aviation Safety Conference. Safeskies Australia. Canberra, Australia. Val Stephens, <safeskies@bigpond.com>, <www.safeskiesaustralia.org/index.html>, +61 2 6236 3160.

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

Data Sharing

Government aviation officials from Europe and the United States are pressing for increased sharing of safety data.

Meeting in Prague, Czech Republic, at the annual European Union–U.S. International Aviation Safety Conference, more than 400 aviation safety specialists from around the world examined the safety benefits that would result from an increase in the sharing of information.

The conference, chaired by the European Aviation Safety Agency and the U.S. Federal Aviation Administration, is intended to encourage cooperation and mutual recognition of safety standards.

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Most Wanted

U.S. National Transportation Safety Board Chairman Mark V. Rosenker says he is disappointed with the response from the U.S. Federal Aviation Administration (FAA) to the NTSB's list of "most wanted" safety improvements.

In testimony before the aviation subcommittee of the U.S. House Transportation and Infrastructure Committee, Rosenker said that, of six recommendations on the list that are addressed to the FAA, five have received an unacceptable response. Those five recommendations involve "reducing dangers to aircraft flying in icing conditions, preventing runway incursions, improving audio and data recorders and requiring video recorders on aircraft, reducing accidents caused by human fatigue and improving crew resource management for [U.S. Federal Aviation Regulations] Part 135 (air taxi) operators," the NTSB said.

Rosenker said that the FAA is progressing slowly on the sixth item, which calls for eliminating flammable fuel/air vapors in the fuel tanks of transport category airplanes.

"The issues on our Most Wanted list tend to be those that are among the most complex and difficult to implement," Rosenker said, noting that the FAA has implemented NTSB safety recommendations in a number of other areas. "While the FAA has made some progress, I am disappointed that there are so many recommendations on this list that are in an unacceptable status."

Later, Peggy Gilligan, FAA deputy associate administrator for aviation safety, told the subcommittee that the FAA takes action on "the vast majority of the NTSB's recommendations" and that FAA officials "always value the intent of the recommendations, even if we are unable to do exactly what the [NTSB] recommends.

"Their recommendations represent the ideal; our consideration of those recommendations must, by law, factor in certain realities."

Passengers First

Passenger-carrying aircraft will receive priority for safety audits, surveillance and other resources under a new policy adopted by the Australian Civil Aviation Safety Authority (CASA).

For purposes of safety regulation, the policy creates three classes of aviation activities: passenger transport, including regular public transport and charter flights; aerial work, including emergency medical services, law enforcement and agricultural flights; and general and freight-only, including most private operations, flight training, recreational and sports flights, cargo-only flights and other non-passenger-carrying operations.

"Passenger-carrying flights get the highest priority in terms of safety because the people flying on these aircraft are not expected to know about or control safety," said Bruce Byron, CASA chief executive officer. "Passengers quite rightly rely on the aviation industry and CASA to manage safety on these flights.

"People who are flying on aircraft operating in the aerial work class … are knowledgeable about the safety of these flights, as they have assigned in-flight duties. This higher level of safety knowledge and involvement places these operations in the middle of the safety hierarchy. People flying in the general and freight-only class are involved in aviation as pilots, crew or as participants who understand relevant safety issues."

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Vortex Measurement

Eurocontrol and French aviation agencies have begun a study of wake turbulence at closely spaced runways with installation of equipment to measure wake vortices generated by aircraft landing at Paris Charles de Gaulle International Airport.

Light detection and ranging (LIDAR) equipment incorporating an infrared laser is being used to measure the vortices and their movement.

"Monitoring of wake vortices is a crucial element to improve safety and increase runway capacity," Eurocontrol said. "Knowledge of the behavior of wake vortices under specific meteorological conditions could be used to reduce the separation minima recommended by ICAO [the International Civil Aviation Organization] for wake turbulence avoidance. In particular, the safety of individual flights will be enhanced by reduction of wake vortex encounters via improved prediction and detection."

Peter Eriksen, head of Eurocontrol airport research, said the study is intended to yield information that will allow for "practical recommendations that could improve the use of closely spaced parallel runways in Europe."

© Lockheed Martin Coherent Technologies

African Aviation

African governments are establishing a continent-wide aviation safety authority modeled on the European Aviation Safety Agency. The goal of the African Civil Aviation Authority is to aid in development of a unified aviation safety strategy across the continent.

In the East African nations of Kenya, Tanzania and Uganda, a regional agency is being established to oversee implementation of the International Civil Aviation Organization's standards and recommended practices. The East African Community Civil Aviation Safety and Security Oversight Agency (CASSOA) will be the first such agency in any African sub-region.

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Air Charter Safety

The new Air Charter Safety Foundation (ACSF) — developed by the charter industry and the National Air Transportation Association (NATA) — has been established to work for safety improvements within the air charter industry worldwide.

"The most effective way to raise the safety bar across an entire industry is through the efforts of an independent and dedicated nonprofit foundation," NATA President James K. Coyne said in announcing the new foundation.

The ACSF will engage in research and education, and will collaborate with other organizations on some projects, including Flight Safety Foundation (FSF), which will be a partner in presentation of an air charter safety seminar, said FSF President and CEO William R. Voss.

The ACSF will be chaired by Charlie Priester, who is chairman of Priester Aviation in Palwaukee, Illinois, U.S.

© Ken Babione/iStockphoto

About-Face on Age Limits

The Executive Board of the Air Line Pilots Association, International (ALPA) has ended its opposition to proposals to increase the mandatory retirement age for U.S. airline pilots to 65.

The board voted in May to end decades of support for mandatory retirement at age 60 — the age limit in effect in the United States since 1959.

Earlier this year, Marion Blakey, administrator of the U.S. Federal Aviation Administration (FAA), said that the FAA would propose a new rule to allow commercial pilots in two-member crews to continue flying until age 65, as long as the other crewmember is younger than 60. The change is based on action by the International Civil Aviation Organization (ICAO), which in 2006 increased the mandatory retirement age for airline pilots to 65 (*ASW*, 2/07, p. 11).

The ALPA executive board said that the organization opposes — for flights within the United States — the provision calling for at least one pilot in every two-pilot crew to be younger than 60, "unless the necessity for this mitigation for the long term is clearly shown" by future data analysis.

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Airspeed Awareness

In response to icing incidents involving Model 208 and 208B Cessna Caravans, the U.S. Federal Aviation Administration (FAA) has issued an airworthiness directive (AD) that requires operators of these aircraft to install low-airspeed awareness systems.

AD 2007-10-15 — which took effect June 21, with compliance required by Sept. 21 (*Accident Prevention*, February 2006) — also requires operators to incorporate the S-1 Cessna known-icing equipment supplement into the airplane flight manual.

The FAA said that the low-airspeed awareness systems are necessary because "the accident/incident history of the Model 208 indicates that pilots have not been diligent in the management of the aircraft when operating in icing conditions, as aircraft performance can decay very quickly." In addition, the aural stall warning system does not always provide pilots with adequate time to avoid a stall, the FAA said.

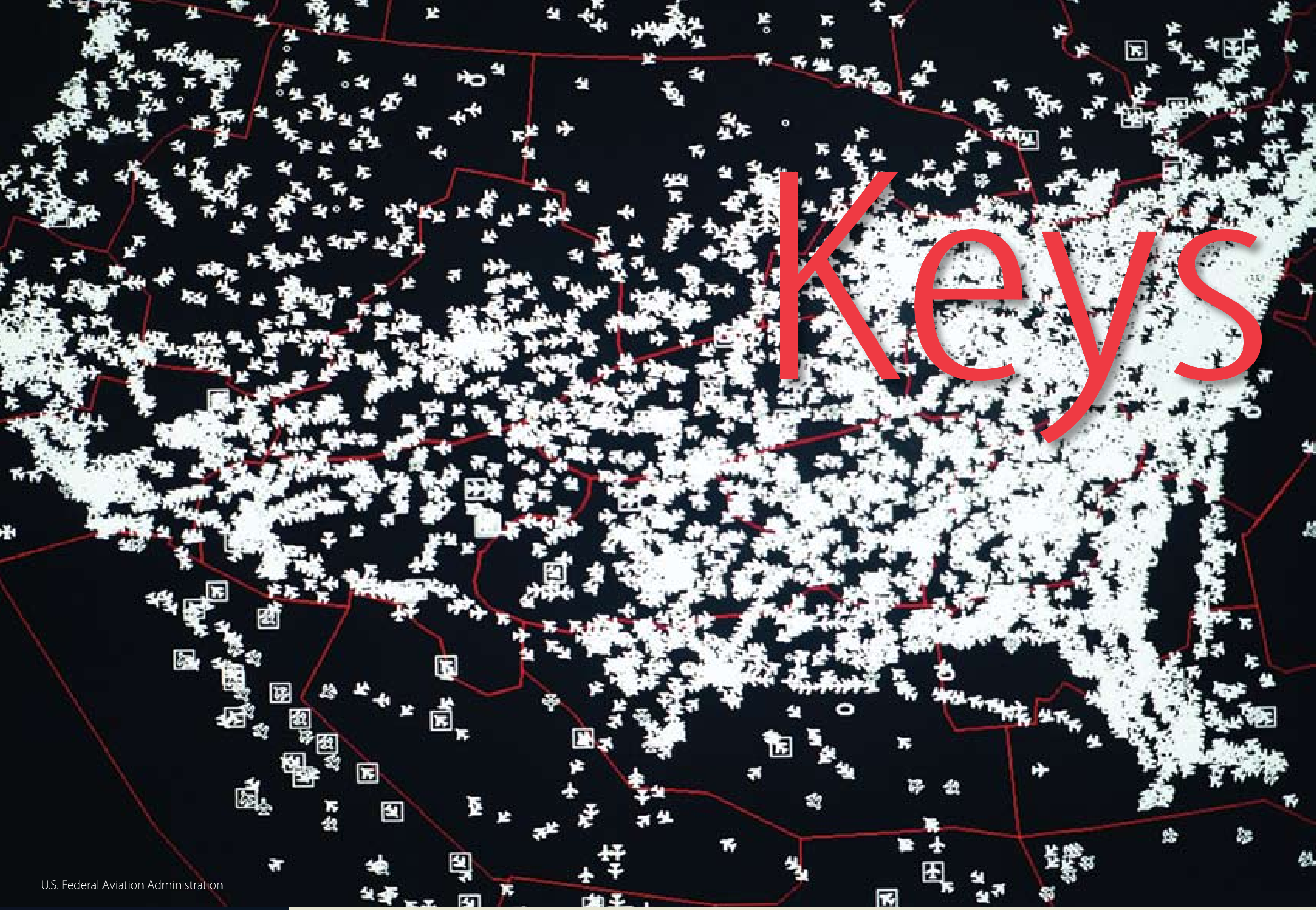
"The low-airspeed awareness system addresses each of these concerns by providing an alert with sufficient time to allow pilots to take the proper corrective action," the FAA said.

U.S. National Aeronautics and Space Administration

In Other News …

The government in **Australia** has allocated funds to provide for mandatory drug and alcohol testing in the aviation industry by the end of the year. Plans call for employers to develop their own testing programs for pilots, flight attendants, air traffic controllers, baggage handlers and ground personnel; the Civil Aviation Safety Authority will conduct random testing of private pilots and contractors. … The **International Air Transport Association** (IATA) is urging implementation of the Single European Sky — a plan to unite Europe's 35 air navigation service providers — within five years. In a letter to German Chancellor Angela Merkel, IATA said that, in addition to increased efficiency and more effective routings, the union would result in a substantial reduction in carbon dioxide emissions. … **Sandia National Laboratories** and **Boeing Commercial Airplanes** are working together to assess the feasibility of using hydrogen-powered fuel cells for back-up power in military and civilian aircraft.

Compiled and edited by Linda Werfelman.



Keys

U.S. Federal Aviation Administration

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The FAA cites its safety record as proof a positive safety culture exists within its Air Traffic Organization. Others don't necessarily agree.

BY LINDA WERFELMAN

Safety culture, as defined by the U.S. Federal Aviation Administration (FAA), is the "product of individual and group values, attitudes, competencies and patterns of behavior that determine the commitment to, and the style and proficiency of, the organization's management of safety." Among the primary characteristics of a positive safety culture is "communications founded on mutual trust," the FAA says.[1]

How does the FAA itself measure up in terms of the quality of the safety culture in place at the more than 300 FAA air traffic control facilities nationwide? Those most closely involved with the FAA Air Traffic Organization (ATO) differ in their assessments.

"Safety is our passion," said Robert A. Sturgell, FAA deputy administrator and acting chief operating officer of the ATO. "The ATO, and the FAA as a whole, have a very strong safety culture. … Pretty much everything this organization does is about safety."

On the other hand, Darren T. Gaines, chairman of the National Air Traffic Controllers Association (NATCA) Air Safety Investigations Committee, said that the ATO "actually practices a blame and punishment culture" that has deteriorated over time. The organization is "a long way from emulating a just culture," he said.[2]

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to Safety

Non-punitive incident reporting is a cornerstone of air traffic control's multi-layer safety management in the United Kingdom.

BY ANNE PAYLOR | FROM LONDON

In the United Kingdom, the regulator, service providers — including NATS, originally National Air Traffic Services — and industry have, over time, put in place a unique multi-layer system that fosters the optimum collection and dissemination of data to track and address potential or actual safety issues. It is a system that, for the most part, players agree works well.

The top layer of the U.K. system is mandatory incident reporting at the regulatory level. The Civil Aviation Authority (CAA) Mandatory Occurrence Reporting Scheme (MORS) has developed over the past 30 years and made, the CAA believes, "a real contribution to flight safety in U.K. civil aviation." The CAA describes MORS as "one of the most important safety data resources for the CAA and industry."

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NATS

'Emphasis on Safety'

The ATO — the largest provider of air traffic services in the world — was established by the FAA in 2004, in response to a directive from the president and Congress calling for development of a more effective, performance-based air navigation services organization. Data compiled for the organization's 2006 annual report show that air traffic controllers working for the ATO guide about 50,000 aircraft through the National Airspace System (NAS) every day. In the fiscal year that ended Oct. 1, 2006, the ATO met safety targets for reduced operational errors — errors involving aircraft separation requirements — and runway incursions. The annual report characterizes the U.S. air traffic system as the safest in the world.

"Our employees develop, test and deploy a variety of programs, systems and procedures to continually enhance aviation safety," the report said. "The emphasis on safety permeates the organization at every level, from the technician in the field to the vice president on the executive council."

Sturgell said that in recent years, work has been done on various concepts that "can help move the safety ball forward," including development of a just culture and of safety management systems (SMSs) — a structure of systems to identify, describe, communicate, control, eliminate and track risks.

He signed an order in March 2007 for implementation of an ATO SMS; plans call for the SMS to be fully implemented by 2010.

Tony Mello, acting ATO vice president for safety services, said that guidelines were established in 2005 for applying the SMS process to any changes being made in the NAS.

"Any new procedure, any change to the NAS, we will run through the SMS process and do a safety risk-management document on it," Mello said. "I think we're maturing very well through it."

It is widely accepted that primary elements of an SMS are confidential, nonpunitive incident reporting systems, which the International Civil Aviation Organization (ICAO) characterizes as excellent tools for hazard identification. For the most part, these reporting systems are not yet in place within the ATO, although top FAA officials are "big believers in those kinds of systems," Sturgell said, adding that the ATO has plans to implement them.

"Being a former pilot, programs like ASAP [aviation safety action program, a voluntary safety reporting program that exists at many airlines] have proven to be very successful in helping the industry proactively address safety

U.S. Federal Aviation Administration

issues," Sturgell said. "It's our full intention to move down that road in the air traffic organization."

ASAPs are designed to encourage employees to voluntarily report safety information that "may be critical to identifying potential precursors to accidents," the FAA said in an advisory circular describing the programs.[3] "The … FAA has determined that identifying these precursors is essential to further reducing the already low accident rate."

ASAPs are intended to help resolve safety issues through corrective action, not punishment. The safety data that are collected through ASAP reports are analyzed, and the information is "used to develop corrective actions for identified safety concerns and to educate the appropriate parties to prevent a reoccurrence of the same type of safety event," the FAA said. A key provision of most ASAPs is that employees report safety-critical information without fear that it will result in legal enforcement action or disciplinary action against them.

The FAA began an experimental ASAP program in spring 2007, but only for technicians working in a couple of ATO locations, Sturgell said; that program is likely to be expanded within 12 to 18 months to include all ATO technicians. ATO management already has discussed with NATCA the "long-term goal" of establishing a similar ASAP program for air traffic controllers, he said. In addition, a program established in 2002 to reduce runway incursions has a nonpunitive voluntary-reporting component.

Russell Gold, a staff engineer in the engineering and air safety division at the Air Line Pilots Association, International, said use of an ASAP would mark "a very interesting transition" for the ATO. "A nonpunitive type of environment … that's an environment they've never worked in before," he said.

Gaines and other NATCA officials said that an ASAP program specifically for controllers would be one of the most important elements of a strong ATO safety culture.

"An ASAP program for controllers would go a long way toward fostering a safety culture within the ATO," Gaines said.

Nevertheless, he added, "An ASAP program requires strict oversight and an element of mutual respect and trust with the employer. ATO is a long way from achieving this. …

"There are individual managers at some facilities that try to do the right thing. However, they are severely restricted as to how they are allowed to manage their facilities. … The 'culture change' must begin at the top of the organization."

U.S. Federal Aviation Administration

The recent relationship between the ATO and its controllers has been strained — so strained that, in an August–September 2006 survey of ATO employees, only 9.3 percent said that they trust FAA management, and 8 percent said that they considered managers honest in sharing information with their workers.[4] The survey was taken about the same time that the FAA, responding to unsuccessful contract negotiations, authorized what it calls a contract — and what NATCA refers to as "imposed work rules."

Sturgell recognized the lingering tension but said that it does not affect the ATO's safety culture.

"The one area that the FAA and NATCA completely agree on is that safety is the foundation of this organization, and we would not compromise that," Sturgell said. "Granted, labor discussions are tough, but you have to separate the institutional labor-management issues from the safety issues. I think both sides keep that, first and foremost, in mind."

Gaines, however, said that the safety culture has suffered because controllers have no satisfactory forum for raising safety issues.

"Controllers are worried about possible discipline if they bring up any adverse policy, procedure or event dealing with safety implications," Gaines said. "We are the largest air traffic service provider in the world and one of the few without the ability for controllers to adequately report safety deficiencies."

This has not always been true, he said, citing a program no longer in effect that had allowed controllers to provide formal input into the technology and programs that affected their jobs, including radar and communications systems; the airport movement area safety system (AMASS), which alerts controllers to potential ground collisions at airports; and airport surface detection equipment (ASDE), which provides controllers with information on aircraft and other vehicles on runways and taxiways.

Gaines also cited a program that included a NATCA liaison to the FAA Office of Runway Safety; the liaison was responsible for raising safety issues and helping to develop methods of addressing them.

"Controller liaisons and project representatives … helped engineer a workable product for controllers in the field … and assist in designing appropriate training for controllers," he said. "This was a great concept, as controllers designed equipment and procedures for controllers."

This program also is no longer in place, Gaines said.

Confidential Hotline

When an ASAP is implemented within the ATO, it will be in addition to an existing confidential telephone hotline reporting program that allows ATO employees to report "anything they consider unsafe, potentially unsafe or hazardous," Sturgell said. "They're the people on the front line who see and hear and know what affects the NAS, so we encourage honest and open reporting of anything, directly to us or through means … such as the hotline."

Up to three reports a week are submitted using the hotline, Sturgell said. Each report is forwarded to people within the ATO who are responsible for the specific area involved, and ATO officials subsequently follow up to ensure that the problem has been resolved, he said.

In addition, controllers can report safety concerns to their immediate supervisors or to the facility manager, Sturgell said.

"It's really the first line they can go to," Sturgell said. Controllers are most likely to raise safety concerns at the local level. These concerns typically involve a procedural issue that relates to one airport's particular method of doing things.

For example, he said, one recent concern dealt with a separation issue involving the movement of aircraft on converging runways in Memphis, Tennessee. A controller took the issue to the local manager, who raised it with superiors; the same issue was the subject of a hotline report. Eventually, the controller's concern was reported to officials at ATO headquarters, where a proposed procedural change was being developed in compliance with the SMS process, Sturgell said.

ASRS Option

In addition to ATO reporting programs, controllers have the option of filing confidential reports of safety problems with the U.S. National Aeronautics and Space Administration Aviation Safety Reporting System (ASRS).

They may exercise this option relatively infrequently, however. Of 20,805 reports submitted to ASRS from September 2006 through February 2007, 1,278 — 6 percent — were filed by controllers. The vast majority of reports (88 percent) were filed by pilots.

A sampling of controller reports compiled by ASRS in January 2007 discussed a variety of concerns, including a faulty radio frequency; observations of aircraft in an instrument landing system (ILS) "critical zone," where they interfered with the glideslope signal for aircraft being flown on ILS approaches; and controller errors in assessing required separation between en route aircraft.[5]

The ATO's evaluation of the reports submitted by controllers to ASRS indicates that the majority discuss unsafe conditions related to pilot actions rather than procedural problems or safety concerns that directly affect controllers, Mello said.

Lingering Issues

As of October 2006, more than 14,600 controllers were employed in ATO facilities. FAA plans call for the hiring of nearly 1,400 new controllers in 2007 and more than 15,000 controllers during the next decade, as many of those now on the job become eligible for retirement. Hiring plans include a range of authorized staffing numbers for all ATO facilities, "giving the agency greater flexibility to match the number of controllers with traffic volume and workload," the FAA said.[6]

NATCA repeatedly cited understaffing at ATO facilities as one of several factors — along with the resulting fatigue and low morale — that it says are damaging the ATO safety culture.

NATCA officials say that the FAA's hiring plans are inadequate because the number of retirements will far exceed the agency's projections.

"Without a concerted effort to attract experienced controllers and retain our current work force, the [air traffic control] system will continue to lose controllers, and that will mean flight delays, runway incursions and increased chance of aviation disasters," NATCA President Patrick Forrey said in testimony in March 2007 before a congressional subcommittee.

"NATCA has found a direct relationship between staffing and safety, one that becomes even clearer over time, as the cumulative effect of long shifts, forced overtime, increased time on position and decreased personal time for family, rest and relaxation take a brutal toll on the mind and the body.

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This, in turn, affects reaction times, judgment, focus and alertness. Fewer controllers in a facility means a rise in operational errors and runway incursions and a higher risk of safety problems due to the decreased margin of safety and lack of any room for error."

Forrey also complained of "jailhouse-like work rules," that he said have forced sick controllers to report to work and to remain on the job, required one controller to use vacation or personal leave time to retrieve a pair of eyeglasses from his car in the parking lot, and banned all radios — including weather radios used to monitor local weather bulletins, especially tornado warnings.

"Just days after the radio ban took effect, a severe weather system spawned tornadoes near both DuPage Tower in Illinois and Lincoln Tower in Nebraska," Forrey said. "With FAA management having removed radios from all towers under the imposed work rules, neither facility's controllers knew of the impending danger nearby.

"At [Lincoln] … tornado sirens sounded, an event that, according to controllers' own orders, mandates the use of weather radios, radios and televisions to monitor the weather. But there was nothing in the tower to use. At DuPage, a tornado came within two miles [three kilometers] of the tower. But controllers had no way of seeing it because heavy rains reduced visibility to a quarter of a mile [403 meters]. … The next day, the controllers notified the supervisor and stated that the radio that was in the tower, which management took away, would have alerted the staff sooner. The supervisor replied, 'You should have looked out the window.'"

On May 30, Sturgell said in a message to ATO employees that, in addition to the array of weather data already available to controllers, weather radios would be provided in air traffic control towers to "provide an additional level of assurance for our controllers that they are receiving as much weather information as required to meet their personal needs."

'State of Fatigue'

The U.S. National Transportation Safety Board (NTSB) also has expressed concern about the effects of fatigue on job performance by air traffic controllers. In safety recommendations issued in April to the FAA and NATCA, the NTSB said that it had investigated several incidents between 2001 and 2006 that "provide clear and compelling evidence that controllers are sometimes operating in a state of fatigue because of their work schedules and poorly managed utilization of rest periods between shifts, and that fatigue has contributed to controller errors."

The NTSB also cited its ongoing investigation of the Aug. 27, 2006, crash of a Comair Bombardier CRJ-100 during takeoff from the wrong runway at Blue Grass Airport in Lexington, Kentucky. The flight crew had been cleared for takeoff on the 7,000-ft (2,135-m) Runway 22, but mistakenly taxied onto Runway 26, which was only half as long. Forty-nine of the 50 people in the airplane were killed, and the airplane was destroyed.

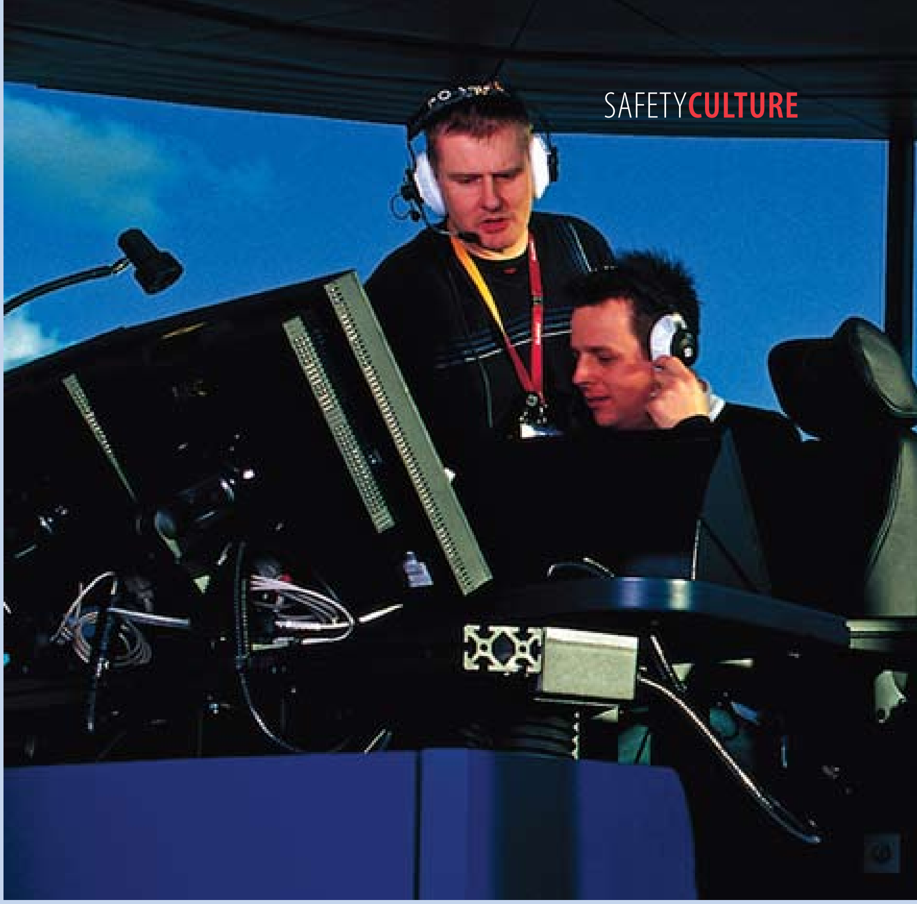
The air traffic controller who issued the clearance — the only controller in the tower at the time of the accident — told investigators that after providing the clearance, he had turned away from the tower's windows to perform an administrative task; he did not see the airplane move onto Runway 26 and did not witness the crash.[7]

The controller had worked from 0630 until 1430 local time the day before the accident, napped for about two hours and returned to work from 2330 until the accident at 0607 the following morning. At press time, investigators had not determined whether controller fatigue might have influenced the controller's actions related to the accident.

"Such limited sleep can degrade alertness, vigilance and judgment," the NTSB said in issuing safety recommendations that called on the FAA and NATCA to work together to "reduce the potential for controller fatigue" by revising work-scheduling policies to ensure adequate rest periods and minimal shift rotations. ●

Notes

1. U.S. Federal Aviation Administration (FAA). Advisory Circular (AC) 120-92, *Introduction to Safety Management Systems for Air Operators*. June 22, 2006.
2. A "just culture," in which everyone is treated fairly, is considered one of the primary elements of safety culture. Safety specialists agree that in a just culture, people usually are not punished for unintentional errors.
3. FAA. AC 120-66B, *Aviation Safety Action Program (ASAP)*. Nov. 15, 2002.
4. Barr, Stephen. "Federal Diary: FAA Has Some Unhappy Controllers." *The Washington Post*, April 23, 2007.
5. U.S. National Aeronautics and Space Administration Aviation Safety Reporting System (ASRS). *ASRS Database Report Set: Controller Reports*. Jan. 23, 2007.
6. FAA. *FAA's Updated Hiring Plan Matches Controller Staffing to Air Traffic*. March 7, 2007.
7. U.S. National Transportation Safety Board (NTSB). *Update on NTSB Investigation Into the Crash of Comair Flight 5191*. Sept. 25, 2006.



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MORS specifically relates to "any incident which endangers or which, if not corrected, would endanger an aircraft, its occupants or any other person," as defined by the U.K. Air Navigation Order (ANO). Such incidents are detailed in Civil Aviation Publication (CAP) 382, but it is up to those involved to determine whether "endangerment is a factor" and thus whether the incident should be reported.

The CAA receives approximately 10,000 reports every year. Each is recorded and analyzed to ensure that the authority is aware of hazardous incidents and defects. The information is then disseminated as widely as possible to ensure that individuals and/or organizations can learn from them. In addition, the safety implications of each occurrence are assessed so that necessary remedial action can be taken.

The scheme has been operating since 1976, and the database now contains more than 150,000 records.

Significantly, the ANO says that "the sole objective of occurrence reporting is the prevention of accidents and incidents and not to attribute blame or liability."

However, NATS, the primary service provider, found that MORS was failing to capture some occurrences "that we knew were happening, but which were not being reported because they did not meet the reporting criteria specified by MORS," Steve McKie, head of safety performance and communication with the NATS Division of Safety, told *AeroSafety World*. "We recognized that MORS was the visible tip of the iceberg; we wanted to see what was going on beneath the surface."

NATS believed that access to data outside the MORS criteria limits could help improve trend analysis, which in turn would enable the company to identify potential safety or operational problems before they could contribute to a reportable incident or accident.

With this objective in mind, the recently privatized NATS in 2003 implemented a second layer of purely voluntary reporting, which it describes as a safety observation system. It uses the same electronic reporting form as MORS, but filters out non-mandatory reports for in-house analysis.

"About one-third of all reports processed through NATS come under the safety observation umbrella," said McKie. The rest are channeled through to the CAA. Safety observation reports are then distributed to the appropriate department within NATS to be handled accordingly.

Like MORS, the NATS safety observation scheme is non-punitive, or as NATS prefers to describe it, "just." McKie explained that the whole NATS safety management system is based on "just culture," as defined in the company's *Safety Management Manual*. The safety observations system, he said, "provides checks and balances to that."

"We do of course reserve the right to act in cases involving gross negligence or willful operation outside the company's safety rules," said McKie. "So we prefer to define it as a 'just' rather than 'no-blame' culture. But the ultimate aim is to learn from the experience rather than punish the individual. Fear of punishment tends to discourage people from reporting. We want our people to talk to us; we want to know when there's a problem or potential problem that we can fix before it becomes a serious issue."

Reporting rates are up, from just over 1,600 in 2005 to 1,700 last year, but McKie said that when compared with the number of aircraft handled, the reporting rate per 100,000 movements was actually up 10 percent. The number of serious incidents remained largely unchanged.

"We are very happy about the increase," McKie said. "The more data we can get, the clearer the picture we get about the very real actions we can take to improve safety. Frankly, we would be happy to see the number of reports double. We derive very clear benefits from non-mandatory safety reporting; it helps us to detect the incidents we haven't yet had."

The system originally had a protracted manual feedback process, which meant that the person reporting an incident did not know for some time what action was taken in response to their report. This has now been streamlined, and all reports can be tracked on line.

"This gives people confidence that something positive is being done with their report and that submitting it is not a waste of time," said McKie.

NATS is also improving investigator training for the 120 or so investigators it has at four en route centers and 16 airport units.

Controllers believe that the NATS system is a useful tool, and despite considerable skepticism at the outset, it is now highly regarded, according to John Levesley, president and CEO of the U.K. Guild of Air Traffic Control Officers (GATCO). "The just culture element of it is particularly important," he said, "and controllers can see improvements made in direct response to reports."

Because the safety observations system is restricted solely to NATS staff, the company is starting to share de-identified incident data with a number of airlines with which it has established safety partnership agreements.

"Within a closed forum environment, the airlines and NATS share sensitive data from our respective in-house reporting systems in confidential surroundings," McKie said. This allows for pilot input into the NATS system and, McKie said, NATS sees the benefits, especially in terms of early trend identification, in further expanding these safety partnership agreements.

In addition, NATS supports the Confidential Human Factors Incident Reporting Program (CHIRP), which is the third layer or safety net in the U.K. incident reporting chain.

CHIRP is an independent, confidential — though not anonymous — reporting system for all individuals employed in or associated with commercial and general aviation in the United Kingdom. It allows them to confidentially report incidents arising from human errors for analysis by the CHIRP Charitable Trust at Farnborough, England.

Set up in 1982, CHIRP specifically keeps the identity of each reporter confidential — anonymous reports are not normally acted upon because they cannot be validated. Personal details are not retained but are returned to the reporter on closure of the report. Only with the specific approval of the reporter is the information made available, in a de-identified form, to those who can take action to remedy the problem.

Important information, after being de-identified, is also disseminated through CHIRP publications and through quarterly reports mailed to every licensed commercial pilot and controller in the United Kingdom.

"CHIRP provides a means by which individuals are able to raise issues of concern without being identified to their peer group, management or the regulatory authority," said Peter Tait, chief executive of CHIRP.

Although initially targeted at pilot groups, CHIRP in 1986 was expanded to include air traffic control (ATC) in a bid to stop disaffected controllers airing in the media grievances about the lack of infrastructure to accommodate the then-booming charter business. Today, an average of 25 to 30 of the 500 or so air transport reports each year are from controllers.

"Approximately half are related to phraseology issues between controllers and pilots," said Tait. "Other key issues include inaccurate readback, handling/operations issues such as third party reports of pilots displaying poor airmanship, and human factors problems with equipment resulting from technological innovations."

Tait said that controllers tend to use CHIRP as a second line of reporting if they believe, for example, that not enough is being done in response to a report into the NATS safety observation system. It is also open to

NATS

controllers who work for providers other than NATS, some of whom may not have access to an in-house reporting system.

"We are a conduit for information from the reporter to a … review by people who are in a position to take action," Tait said.

The fact that there are not more reports from controllers could reflect an improved safety management culture within NATS, said Tait, who pointed out that effective voluntary reporting systems inevitably have a positive impact on labor relations.

"The availability of an open or just company scheme with a non-punitive regulatory approach and the safety net of a CHIRP system removes many of the frustrations that tend to dominate the staff-management relationship," said Tait. "That relationship can then focus on terms and conditions of employment rather than safety-related issues."

Tait said he believes the U.K. multi-layer system is unique and works because of the implicit trust that exists between professional groups, shored up by a professional culture that differs from those in many other countries.

In Europe, poor incident reporting has been a consistent challenge to Eurocontrol's efforts to assess the region's safety situation. For example, a recent runway incursion study showed the United Kingdom to have a high rate of incidents compared with most of its European neighbors. This was subsequently attributed to the fact that many European states were unable to accurately report the level of runway incursions and had few data on the situation in their country, good or bad. As data collection has begun to improve, the number of runway incursions coming to light has also increased.

Year after year, the Eurocontrol Performance Review Commission (PRC) has reported lack of data as being an obstacle to safety improvement efforts. It argued that, as long as the region had only limited information on the safety situation, it was difficult to identify where improvements needed to be made.

In its recently published 2006 report, the PRC finally reported progress.

The report says, "Incident reporting has improved significantly since 2001, which gives better visibility on ATM [air traffic management] safety issues, and more opportunities to prevent accidents. … This is encouraging."

However, it points out that incident reporting "remains inadequate in a number of states."

The report says this is primarily a result of significant legal impediments in many states and an immature safety reporting culture "in a significant number of ANSPs [air navigation service providers]."

The PRC says the legislative framework underpinning the aviation safety reporting systems in a number of states is inadequate, hindering these states from implementing systems that protect the identity of the reporter and contain the elements for a just culture. It says that effective legislation "is crucial to the development of aviation safety in general and of 'just culture' in particular."

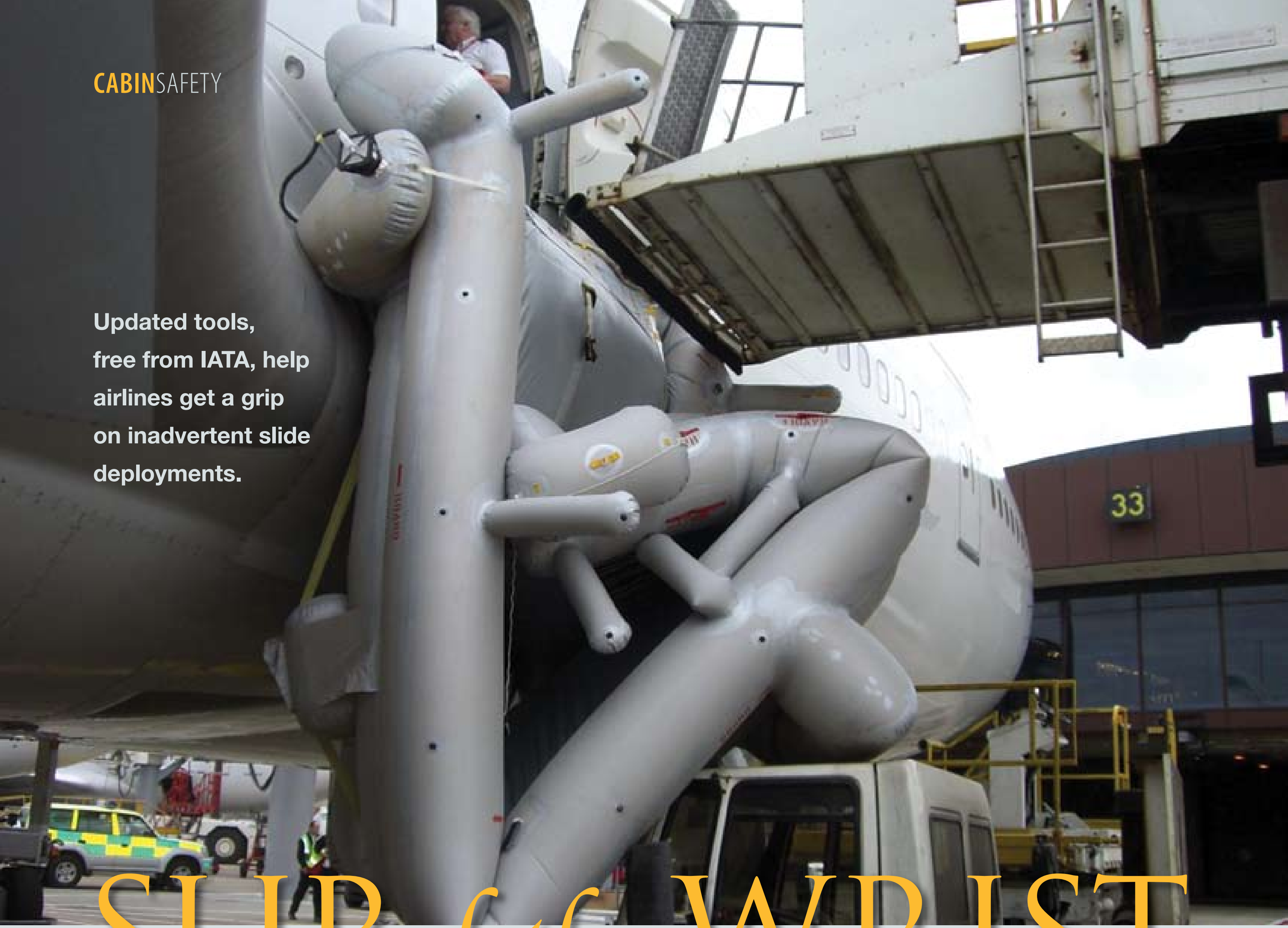
It recommends that Eurocontrol, states and possibly the European Commission should tackle legal issues "with the relevant priority," and it says an improvement to the safety reporting culture is "equally important, even if it may be more difficult to achieve."

The PRC says that "in the absence of other indicators on which quantified targets could be set concerning ATM safety," it supports the target that all European ANSPs and national ATM regulators "should reach the agreed minimum level of safety management and regulation maturity (70 percent) by the end of 2008." ATM safety maturity scores reflect the presence of the relevant safety processes and documentation. Maturity levels above 70 percent are considered as acceptable at this stage.

The PRC 2006 report says the assessed safety maturity of ANSPs in Eurocontrol member states "has improved from an average of 55 percent in 2002 to 70 percent in 2006," but it warns that 19 ANSPs remained below acceptable levels.

Concerning the maturity of national ATM regulators, the PRC says the situation is "less satisfactory." The average level rose from 52 percent in 2002 to 65 percent in 2006, with one state not responding and three others still below the 40 percent maturity level. "Only 14 regulators were at or above the acceptable maturity level (70 percent) in 2006," the report says.

"Safety maturity needs to reach a sufficient level in all states," the report concludes. "This, *inter alia*, is a prerequisite for safety performance review." ●



Updated tools, free from IATA, help airlines get a grip on inadvertent slide deployments.

SLIP *of the* WRIST

BY WAYNE ROSENKRANS

Cabin safety specialists seeking resources to reduce the risk of inadvertent slide deployments have a difficult task. Working against them is a perception that the cause is obvious: Someone opens an airplane door without conducting the standard operating procedure (SOP) for disarming the mechanism, such as a girt bar, that deploys the slide for an emergency evacuation. Casual observers may assume, too, that other events simply involve undetected or uncorrected door/slide equipment problems. The reality is more complex.

"The financial resources required to conduct more training or to run awareness campaigns are often a bottleneck," says Martin Maurino, manager, safety analysis, Safety, Operations and Infrastructure at the International Air Transport Association (IATA). "This is why IATA provides cost-analysis tools in the *Cabin Operations Safety Toolkit* to help managers determine and present to senior management a plan that shows a return on investment and the long-term savings."[1]

The best strategy so far has been for airlines to select from a variety of recommended solutions. "There is no 'one size fits all' solution," Maurino said. "Strategies to help improve this problem revolve mostly around proper use of on-board technology that already exists and is under-utilized, as well as robust SOPs and enhanced training to raise cabin crew awareness of threats and also show them how to apply proper counter-strategies to mitigate the risk of [inadvertent] slide deployment. In terms of personal safety, cabin crew must be aware of the physical harm that can come from opening an armed door, as much to themselves [as] to people outside the aircraft. The costs and operational impacts of a slide deployment are significant, and this hurts the airline's bottom line, which in turn hurts the crews themselves during financially difficult times."

Real World Examples

Environmental conditions distracted a cabin crew in an example of one of the most common types of reported events. "[The Airbus A320] was parked … for an indefinite weather delay [and] was getting very warm," a March 2001 incident report said. "The auxiliary power unit and no. 1 high-pressure bleed valve were inoperative. The flight attendant asked the captain if [the cabin crew] could open the rear … door to get some relief. The flight attendant opened door [but had forgotten] to disarm the door, causing the slide to deploy. The aircraft was taxied back to the gate."[2]

Recycling a door — that is, reopening and reclosing it because of an incorrect arming indication — has led to some events. "An inadvertent slide deployment by our … flight attendant on door 1L [happened] just prior to pushback," said a first officer's voluntary report in April 2002. "The jetway had already been removed from the aircraft, and the gate agent had already left. … Prior to pushback and engine start, the [electronic centralized aircraft monitor] showed that the 1L door was not armed. The captain made a brief public address announcement and said only '1L.' … The captain and [I were] on the flight interphone, the captain [selected] one chime and there was a brief discussion about trying to cycle [the door] again. At that point, we could hear the 1L door unlock and begin to open. The [Position C] flight attendant said, 'Wait, it's still armed,' just as the slide [deployed]. We were running late because of a last-minute aircraft swap; the crew coming off [had] said that [door] 1L was difficult to arm. … Later that evening [at another airport], the other crew said that they had written … up [the problem] and that maintenance … was going to re-rig the door on the overnight [stop] so they wouldn't take a delay. Perhaps if maintenance had performed a more thorough fix when [the problem] was first reported, it would have reduced the chances of this slide deployment."[3]

In another event, an Airbus A300 captain incorrectly opened a door in August 2006. The captain's report said, "[I] went to the main crew entry door to arm the door for departure. [I] closed the door … armed the door [and] stored the safety pin. [I] tested the arming tone. It checked [OK]. [I] checked the two overhead door indicators. Both were red [indicating failure to arm]. I failed to reverse my sequence and attempted to recycle the door with the door handle. Upon lifting the door handle, slide activation [began] as designed except that the stairs were still in position. The door blew open, but the slide did not activate [fully, it] just partially separated from the door container. … The slide was unable to be safetied [that is, secured with a pin to prevent inflation]. Maintenance ended up having to deploy the slide to be able to remove and replace the unit."[4]

Unlike this maintenance check, an inadvertent slide deployment can cause injury with almost no warning.

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Credible Sources

A core team comprising representatives from 12 airlines and Airbus began in 2004 to develop the *Toolkit* material under IATA's coordination. Most representatives were cabin safety managers, heads of cabin crew training, flight crew safety managers/directors and specialists from equipment manufacturers. "Another 20 airlines and Boeing [Commercial Airplanes representatives] then reviewed the material and provided feedback prior to finalizing the *Toolkit,*" Maurino said. The project advanced soon after the team settled on methods for consistently determining what data from proprietary airline operations reports show about how these events have occurred. IATA's Cabin Safety Task Force in early 2007 published the third revision of *Toolkit* modules dedicated to this issue, refining the guidance.

A follow-up report on the initiative — based on 210 air safety reports to IATA's Safety Trend Evaluation Analysis and Data Exchange System (STEADES) from Jan. 1, 2003, through Dec. 31, 2005 — found that cabin crewmembers caused 47 percent of inadvertent slide deployments and that events in 2005 mainly involved widebody aircraft; 70 percent of events disrupted operations; and during the three-year period, the number decreased.[5] IATA members soon realized that no airline suffers this problem alone.

"Many of the [member] airlines were surprised to find that others echoed the same problems/causes they experienced in terms of slide deployments … regardless of the region of the operator," Maurino said. "Those with success stories shared their expertise, and others applied it."

Data Clarify Causes

Member airlines provided proprietary occurrence data, case studies, cost breakdowns, SOPs and training material to the task force on a confidential basis. "All was de-identified by IATA," Maurino said. Boeing and Airbus also briefed the task force on their respective design philosophies, defense mechanisms and technology to prevent inadvertent slide deployments.

"The IATA Safety Department analyzed data to evaluate the rates of deployment by fleet and also conducted statistical analysis on incidents," he said. Sector data — number of events divided by number of sectors flown by those carriers — were used to study events by fleets. IATA staff, working with the task force and the Line Operations Safety Audit (LOSA) Collaborative at the University of Texas at Austin, U.S., also developed a version of the threat-and-error management (TEM) method for cabin operations. "The task force itself looked at case studies and conducted detailed analysis of events using the TEM framework … to identify recurrent contributing factors and develop prevention strategies," Maurino said.

Toolkit Highlights

The *Toolkit's* modules begin with a review of normal door operation using IATA best practices as SOPs, while acknowledging that elements of existing airline SOPs may have to supersede module elements. One module, illustrated with close-up color photographs of type-specific door and slide controls, focuses on items that the task force calls "advantages" and "drawbacks" — characteristics that might cause problems if not well understood — of several door designs.

Best practices for normal situations include:

- Cross-checking the arming/disarming of the opposite door by walking across the cabin for a close-up visual check;
- Using the interphone to confirm arming to the purser(s) — sometimes called in-charge cabin crew or in-flight service managers;
- Assigning the purser to centrally cross-check arming status with on-board technology such as a flight attendant panel;
- Assigning the flight crew to centrally cross-check door status from the electronic centralized aircraft monitor on the flight deck;

Wayne Rosenkrans

Correct use of aircraft-specific technology — such as the interface elements for this Airbus A380 door — is one of the basic defenses.

- Providing SOPs that help ensure that doors are not armed or disarmed without an explicit order from the flight crew or purser;
- Assigning two cabin crewmembers — an operator and a checker — to conduct any internal door–opening SOP; and,
- Reinforcing by training that, because of the risk of being ejected from the airplane to the ground, a crewmember must not attempt to keep closed any armed door that has been opened.

The *Toolkit* provides additional guidance for "specific situations" — those generating threats and requiring extra vigilance — because they disturb routines and make human errors more likely. These include ferry, delivery or positioning flights without passengers; return to the departure gate; refueling with passengers aboard the airplane; malfunction of a door; in-flight reassignment of cabin crew stations; and reopening of a door.

Also covered are human factors risks and mitigations for fatigue; mixed-fleet duty, leading to confusion and negative transference of skills; distractions and time pressure; deviation from SOPs and nonpunitive reporting as a countermeasure; multi-tasking; environmental conditions, such as frozen condensation causing a stuck girt bar; and the human-machine interface. Other modules provide case studies; explain the reduction of risk when doors automatically are disarmed whenever they are opened from the outside; and offer current advice for SOP developers, checklist/placard/memory aid designers and cabin safety instructors.

Early STEADES Trends

The 2006 STEADES report was the first to begin quantifying possible effects of this initiative, according to Maurino, but the task force looks forward to perhaps a 50 percent reduction in events by the end of 2010. "When adding up all the cases of inadvertent slide deployments caused by cabin crew (including pursers), a downward trend (from 63 percent of all deployments in 2003 to 47 percent in 2005) was noted," the report said. "Cabin crew distraction, time pressure and multi-tasking/workload were among the main contributing factors on the rise in 2005. … Ground crew were second to cabin crew … [with] a slight increase in the number of these events." Maintenance personnel ranked third in causing inadvertent slide deployments.

For 2004 and 2005, IATA researchers analyzed the last two years of cabin crew–related inadvertent slide deployments by phase of flight. About half of the events occurred during the arrival phase — taxi-in and parking at the gate — making it predominant. About one-fourth of the events happened during the departure phase — boarding, pushback or taxi-out. The remainder occurred during other phases.

The majority of events in 2004–2005 were linked to specific situations. "Despite a decrease, these remain significant," the report said. "In 2005, the main [specific] situation … was reopening of cabin doors. There was a noticeable increase in this factor from 28 percent … in 2004 to 66 percent in 2005. … Reassignment of cabin crew stations in flight … is often linked to [confused] door responsibility among cabin crew and the absence of a briefing to clarify which crewmember is responsible for which door after stations are switched." The task force also recommended that pursers be the focus of a specialized training emphasis.

Each iteration of the *Toolkit* has received positive feedback — such as the letter from the CEO of a large airline that said the airline "had problems with [inadvertent] slide deployments and applied the *Toolkit* with great results," Maurino said.

Some airlines plan to update their prevention strategies based on ongoing monitoring to better link the initiative to measurable results. "The [*Toolkit's*] third revision … allows airlines to conduct line observations to monitor how SOPs are being implemented and how effective training is, and to correct these if necessary," Maurino said. "We are in constant contact with IATA members, and they often come to us, share their successes and ask for guidance if needed. We keep track of these interactions."

The free *Toolkit* material can be downloaded from <www.iata.org/whatwedo/cabin_safety/toolkit>. ●

Notes

1. International Air Transport Association (IATA). *Cabin Operations Safety Toolkit: Inadvertent Slide Deployment Prevention.* Third revision, 2007. Other elements of the *Toolkit* cover turbulence management; cabin safety management systems; and a cabin safety quality system.
2. U.S. Federal Aviation Administration (FAA). Aviation Safety Information Analysis and Sharing (ASIAS). Accident and Incident Database (AID) report no. 20010330009209C, March 30, 2001.
3. U.S. National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System (ASRS). Report no. 543627, April 2002.
4. NASA ASRS. Report no. 707177, August 2006.
5. IATA. *STEADES Safety Trends Analysis.* "Monitor and Cross-Check: Inadvertent Slide Deployments, 2003–2005." Issue 1, 2006. STEADES is IATA's Safety Trend Evaluation Analysis and Data Exchange System.


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Planning the DEPARTURE

Takeoff performance myths and methods

BY PATRICK CHILES

On July 16, 2003, the flight crew of a Boeing 737-800 planned a reduced-thrust takeoff based on performance calculations for the full runway distance at Manchester, England. They had not read a notice to airmen advising that available runway distance was reduced for removal of rubber deposits. The aircraft was close to rotation speed when the crew noticed vehicles and repair equipment at the departure end of the runway. They decided to continue the takeoff, which surely must have gotten the workers' attention when the aircraft cleared their vehicles by about 50 ft. The crew had correctly determined that there was not enough stopping distance remaining; nevertheless, an engine failure at that moment would almost certainly have been disastrous.[1]

Four months later, on the night of Nov. 11, 2003, a Cessna Citation Excel was being taxied for takeoff after a quick turnaround at Wheeling, Illinois, U.S. "Short runway, full fuel, with a stab[ilizer] that is not moving," the captain mused. "This could get interesting." As the aircraft was taxied onto the runway, annunciator lights likely warned that the horizontal stabilizer was not configured properly. The configuration warning horn sounded as the first officer advanced the power levers for takeoff. However, the flight crew did not take action to reject the takeoff until the first officer found that he could not rotate the aircraft. The Citation was substantially damaged when it overran the 5,000-ft (1,524-m) runway, but the pilots and their three passengers were not injured. Investigators found that, due to an electrical fault, the stabilizer could not be moved from the cruise position to the takeoff position.[2]

These events illustrate the need to clearly understand the nuances of takeoff performance, because assumed margins frequently are incorrect.

The U.S. Federal Aviation Administration (FAA) *Takeoff Safety Training Aid* notes that studies of 74 accidents and serious incidents involving rejected takeoffs (RTOs) showed that more than half occurred after the takeoffs were rejected at airspeeds greater than V_1 — which, simply stated, is the maximum speed at which a crew must take action to reject the takeoff. Most of the accidents were overruns after RTOs were initiated at "high speed," defined as 120 kt or more.[3]

The FAA has been working with Europe's Joint Aviation Authorities (JAA), which now is transferring many of its functions to the European Aviation Safety Agency (EASA), to harmonize regulations affecting takeoff performance, focusing on certification standards, wet and contaminated runways, obstacle analysis, runway lineup distance, 10-minute thrust time limit, and operating standards.

The Basics

Five factors affect every takeoff: field length, tire speed, brake energy, climb performance

and obstacle clearance. They create a variety of policy choices for the operator. Some examples are:

- An unbalanced field length policy;[4]
- Improved climb or "overspeed," using excess field length to improve climb gradient;
- Obstacle avoidance procedures, which a flight management computer (FMC) cannot duplicate without an internal obstacle database;
- Flap retraction heights above the 400-ft regulatory minimum;
- Increased takeoff thrust time limit; and,
- Runway lineup distance.

These choices are reflected in dispatch performance-calculation software or runway analysis tables, but they could be unknown to the end user — the pilot or dispatcher — or unavailable in the aircraft's FMC. Thus, FMC-derived takeoff "V-speeds" may not match dispatch performance calculations or provide adequate terrain/obstacle clearance. Any takeoff policy choices that may not be duplicated aboard the aircraft should be explained to crewmembers in the event they need to rely solely on FMC calculations.

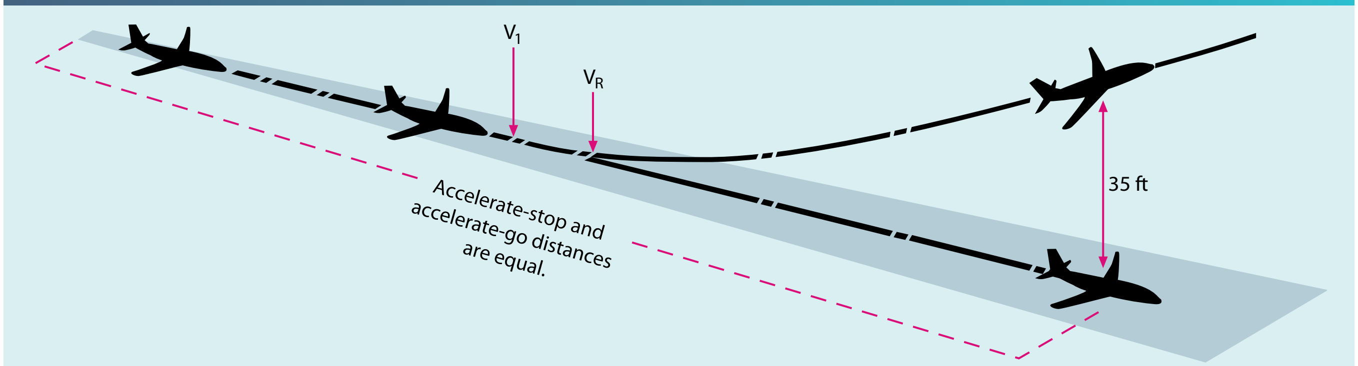
V_1 Conundrum

Despite almost 10 years of efforts to eliminate a common misconception about V_1, it is still widely referred to as "takeoff decision speed." To emphasize that V_1 is *not* a decision speed, the FAA and JAA in 1998 introduced the following two-part definition:

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

Most pilots know that, during certification, manufacturers of transport category airplanes typically designate V_1 airspeeds that result in balanced field lengths, or equal accelerate-stop and accelerate-go distances (Figure 1, p. 28). Takeoff configuration, weight, altitude and temperature are among the factors that must be considered by the manufacturer when designating

Balanced Field Length



Source: Adapted from SimuFlite Learjet 55 Cockpit Reference Handbook

Figure 1

V_1 speeds — and by the pilot or dispatcher when selecting the appropriate airspeed from among the data published in the airplane flight manual (AFM).

Accident and incident reports, however, show that misconceptions about V_1 linger. Of course, the pilot-in-command has the authority in an emergency to do whatever is necessary for safety. But consider that a typical jet transport accelerates at 4 to 6 kt per second; if a no-go decision is made at V_1, it may already be too late to bring the aircraft to a stop on the runway. In almost all cases, action to reject a takeoff must be taken no later than reaching V_1.

It is important to remember, however, that V_1, accelerate-stop, accelerate-go, etc., are based on an *engine failure*. Many operators specify lower maximum airspeeds — 80 kt or 100 kt, for example — at which action to reject a takeoff should be made in response to malfunctions or abnormalities such as a blown tire or a warning light. Conversely, some training materials and company standard operating procedures (SOPs) specify limited but dire conditions — a control system failure or a fire warning, for example — in which a post-V_1 RTO is justified.

Accident and incident reports show that misconceptions about V_1 linger.

What Is New

One result of the FAA/JAA harmonization was refinement of takeoff performance certification standards. This has resulted in subtle changes that are keys to understanding the basis of the data in the AFM. For instance, it is now allowable to take credit for thrust reversers in calculating takeoff performance on a wet runway.

Other changes have affected the certification allowance for pilot reaction time and whether continued acceleration or a constant speed is assumed during this period. A specific aircraft model undergoing significant design evolution, resulting in separate certification tests, could have subtly different assumptions underlying the takeoff performance data.

Another result of harmonization is FAA Advisory Circular (AC) 120-91, *Airport Obstacle Analysis*. In draft form for several years before its publication in 2006, the AC already had become a commonly accepted resource for developing procedures to comply with takeoff limitations specified in regulations. One effect of the new guidance is clarification of obstacle clearance margins during an engine-out takeoff; the FAA margins now are more closely in line with those of JAA and the International Civil Aviation Organization (ICAO).

The specific wording in U.S. Federal Aviation Regulations (FARs) Part 135, for charter operators, and Part 121, for airlines, requires only that the engine-out net takeoff flight path must clear any obstacles by 35 ft vertically in an obstacle accountability area (OAA) defined as

200 ft (approximately 60 m) laterally — that is, 200 ft on each side of the intended track — from the end of the runway to the airport boundary, and 300 ft (90 m) laterally outside the airport boundary.

In contrast, the JAA/ICAO standard is a "splay" — an increasingly wider OAA — that begins at 90 m at the runway end and increases by an 8-1 ratio to a maximum width of 600 m (about 2,000 ft). Although this splay makes takeoff performance analysis more rigorous, it offers a sound safety margin because it recognizes that the effects of wind or course guidance errors tend to increase with distance.

In AC 120-91, the FAA recommends an increasing OAA similar to the JAA/ICAO splay beginning 4,800 ft (1,463 m) from the end of the runway (Figure 2). Thus, there now is some difference between the FARs standards and the acceptable compliance methods spelled out in the AC; but it can be understood that the 200/300-ft margin is a minimum width at which the OAA splay begins. Within this lateral path, all obstacles must be cleared by at least 35 ft vertically. There is also a more involved flight track analysis method that must include consideration of wind and course guidance error. This allows for a smaller OAA and can be used for procedures based on required navigation performance (RNP).

For either method, there are two fundamental obstacle-clearance techniques. The simplest is to continue climbing at V_2 — takeoff safety speed, or the minimum airspeed at which the aircraft can maintain the required climb gradient with one engine inoperative — straight out on the runway heading. However, if obstacles are sufficiently high or close to the runway, it may be advantageous to create a turning procedure to avoid them. While there is some loss of performance in the turn, it can be offset by a shallower gradient. When turns are planned, they should not begin until after the aircraft is at least 50 ft above the runway end, and they should not exceed 15 degrees of bank.

In general, V_2 provides stall protection to only 15 degrees of bank. To design an obstacle-clearance procedure for a more steeply banked turn, V_2 must be increased to provide

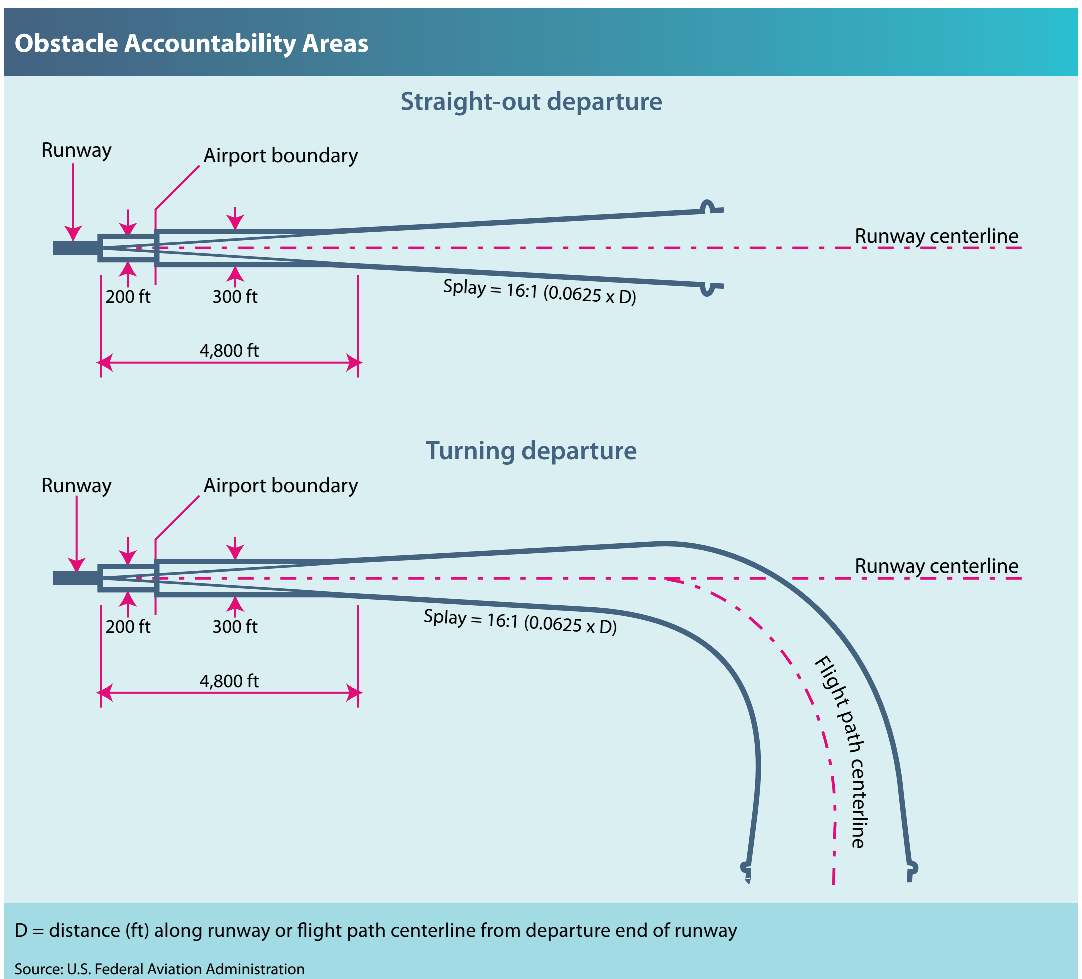


Figure 2

an equivalent stall margin. One method is to use the following formula, in which V_2 is knots true airspeed and Φ, the Greek letter *phi*, is bank angle in degrees:[5]

$$V_2\Phi = V_2/\sqrt{\cos\Phi}$$

For either method, an accurate source of obstacle data is required. There are a number of government and commercial sources, and it is the operator's responsibility to use the best data available for its specific needs.

Gradients Vary

Although some corporate and charter operators use published standard instrument departure (SID) procedures for obstacle clearance in the absence of other information, the intent of an engine-failure obstacle-clearance path is not necessarily the same as meeting the climb gradient specified by a SID.

AC 120-91 states that "one-engine-inoperative procedures do not need to meet TERPS [*United States Standard for Terminal Instrument Procedures*] requirements," upon which SIDs are designed. The AC also says that meeting a SID climb gradient "does not necessarily assure that one-engine-inoperative obstacle-clearance requirements are met."

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U.S. TERPS, and ICAO *Procedures for Air Navigation Services–Aircraft Operations* (PANS-OPS), are intended for normal, all-engine operations. The minimum 3.3 percent (200 ft per nm) climb gradient required for a published departure procedure is a constant angle. However, transport category airplane certification standards are based on engine-out conditions and result in the climb performance data provided in the AFM.

Further, certification standards require that a two-engine aircraft, for example, be capable of maintaining at least a 2.4 percent gross climb gradient at the beginning of the second segment of the departure — theoretically, when the aircraft is 35 ft above the end of the runway, clearway or stopway, and after the landing gear is retracted. Unlike the TERPS climb gradient requirement, this is a "point in space" gradient taken at the beginning of the segment and not a constant angle. Nor could it be. Engines lose thrust with altitude, and if a constant speed is held throughout the climb, the climb gradient typically decreases with altitude and resembles a decaying curve. To account for this, certification standards specify net takeoff flight paths that provide an increasingly greater margin over distance against the gross takeoff flight path.

While there is an obstacle-clearance consideration in SIDs of 48 ft per nm, it assumes normal all-engine performance. An engine-out takeoff is certainly not a normal condition and takes precedence over any SID or other departure procedure.

Both U.S. and European regulators encourage the examination of SIDs in mountainous regions to plan for engine failures at later stages in the climb, specifically after the point at which an emergency engine-out flight path may diverge from the charted procedure. The question becomes: If the aircraft is committed to the SID, will it be able to maintain adequate terrain clearance with a post-V_2 engine failure, or will it need some escape path? This type of analysis can be arduous and requires all-engine performance data in addition to the AFM data.

Defining Contaminants

The recent 737 runway overrun at Chicago Midway International Airport, among other things, refocused attention on common definitions of runway contaminants.[6] The JAA already requires manufacturers to supply "advisory information" that must be considered in dispatch performance calculations. The information can be derived from flight tests or from existing certification data, and must include runway contaminants such as compacted snow, slush or standing water, and the different definitions of braking action.

The FAA has yet to formally define runway contaminants. The regulatory language in Part 135 and Part 121 only allows the use of approved AFM data for landing on dry, wet or "slippery" runways. There is no definition of what constitutes a slippery runway, and there is no guidance on how to legally dispatch an aircraft when runway conditions are known to be worse than just wet.

No consensus was reached during efforts to harmonize the definitions and requirements for takeoff and landing on contaminated runways, in part due to the complexity of runway contamination and the potentially severe performance penalties posed by some contaminants. Slush, for example, significantly increases drag on the landing gear and, when thrown up onto the airframe, can severely affect the aircraft's aerodynamics. One manufacturer likened the combined effects of slush to having an extra engine, operating at reverse thrust.

The FAA's Aviation Rulemaking Advisory Committee studied various methods to mitigate the performance penalties and economic penalties associated with contaminated runway operations, but no satisfactory solution was found. Among options that a majority of the group supported was to fully harmonize the FARs to the JAR-OPS 1 standard or to use the JAA contaminant definitions and base takeoff-performance calculations on an all-engines-operating condition.[7]

In the meantime, the FAA has allowed manufacturers to provide the European advisory data to U.S. operators with the same aircraft types in their fleets. The FAA has deemed the data acceptable to use as supplemental information while further action is taken to define contaminants and performance calculation methods. However, U.S. operators should be aware that this type of information, being "advisory" and not "approved," does not include the same distance factors applied to the AFM data, such as credit for the use of thrust reversers.

Performance Monitoring

Much of this discussion has concerned preflight predictions of takeoff performance. But, during the actual takeoff roll, is there any protection from an unanticipated mechanical failure or simple human error?

The MK Airlines 747 accident in Nova Scotia, Canada, illustrated that calculation methods may be perfect but offer no protection if they are based on incorrect assumptions. The Boeing Laptop Tool software for calculating the 747's takeoff performance data worked as designed, but it had no way of detecting that the flight crew had mistakenly carried over a lower payload weight from their previous leg (*ASW*, 10/06, p. 18).[8] There was no cockpit display to advise the crew that their thrust-to-weight ratio was insufficient to lift off the runway, a terrible fact realized too late to stop.

This accident renewed interest in on-board takeoff performance monitoring. The U.S. National Aeronautics and Space Administration's Langley Research Center demonstrated a takeoff performance monitor in a 737 in the late 1980s, and there has been other research work. However, no organization has taken a leading role in developing the concept, and there are as yet no commonly accepted methods, algorithms or cockpit displays.

There was no cockpit display to advise the crew that their thrust-to-weight ratio was insufficient to lift off the runway.

The MK Airlines accident prompted the Transportation Safety Board of Canada to recommend a requirement that transport category aircraft be equipped with a takeoff performance monitoring system. In response, Transport Canada said that it cannot require installation of a system that does not exist. However, the two organizations have agreed to work together on preliminary research to determine if a system could be designed to give flight crews an "accurate and timely indication of inadequate takeoff performance" (*ASW*, 5/07, p. 8).

Going Forward

There has been substantial movement, particularly in the last 10 years, toward harmonization of U.S. and European requirements and standards for takeoff performance calculation. Efforts to standardize wet runway takeoff performance, RTO time sequences, brake wear and use of 10-minute takeoff thrust have been completed. Obstacle clearance methods now have a more common basis, although some minor differences remain.

Efforts to define runway contaminants continue, and some significant changes in takeoff performance calculations may be presented to U.S. operators when rule making is under way.

Despite progress in these areas, full harmonization has yet to be realized. Common sense tells us that what works for the European Union should likewise work in the United States: Airplanes are airplanes, runways are runways, and terrain is terrain. But with anything technical or regulatory, the devil lies in the details. ●

Patrick Chiles is the technical operations manager for the NetJets BBJ program and a member of the Flight Safety Foundation Corporate Advisory Committee.

Notes

1. U.K. Air Accidents Investigation Branch report no. 3/2006.
2. U.S. National Transportation Safety Board (NTSB) report no. CHI04FA031. NTSB said that the probable causes of the accident were "the flight crew's intentional operation with known deficiencies in the aircraft and their delay in aborting the takeoff when a no-takeoff warning was presented."
3. U.S. Federal Aviation Administration (FAA). *Takeoff Safety Training Aid*. Section 2, "Pilot Guide to Takeoff Safety." <www.faa.gov/pilots/training/>.
4. An unbalanced field length policy allows consideration of extra distance provided by clearways and stopways, in addition to available runway length, in calculating takeoff performance. Thus, accelerate-stop and accelerate-go distances might not be equal.
5. Allen, Carl (Alaska Airlines). "One Airline's Method for Calculating Engine Failure Turn Procedures." A presentation to the Boeing Performance and Flight Operations Engineering Conference, Seattle, Washington, U.S., September 2003.
6. NTSB report no. DCA06MA009. The preliminary report said that snow was falling Dec. 8, 2005, when the landing aircraft slid off the runway and came to a stop on a road. None of the 103 aircraft occupants was injured; one person on the ground was killed, and 12 others received minor injuries.
7. Stimson, Don (FAA). "Harmonization of FAR/JAR Airplane Performance Requirements: Status and Future Plans." A presentation to the Boeing Performance and Flight Operations Engineering Conference, Seattle, Washington, U.S., September 2003.
8. Transportation Safety Board of Canada. *Reduced Power at Takeoff and Collision With Terrain, MK Airlines Limited, Boeing 747-244SF 9G-MKJ, Halifax International Airport, Nova Scotia, 14 October 2004*. Aviation Investigation Report A04H0004.

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No Brakes, No Steering

A Northwest Airlines DC-9 struck an A319 after losing hydraulic pressure.

BY MARK LACAGNINA

The captain's decision to shut down the left engine while taxiing a McDonnell Douglas DC-9-50 with a known right hydraulic system problem was blamed for the airplane's collision with an Airbus A319-100 on the ramp at Minneapolis–St. Paul (Minnesota, U.S.) International Airport on May 10, 2005. Fluid in the DC-9's right hydraulic system had leaked from a fractured valve before the airplane landed in Minneapolis, and the subsequent shutdown of the left engine resulted in insufficient hydraulic pressure to effectively operate the brakes, steering and thrust reversers, said the report by the U.S. National Transportation Safety Board (NTSB).

Both airplanes were substantially damaged when the DC-9 rolled under the tail of the Airbus and came to a stop with the trailing edge of the A319's right wing embedded in the roof of its flight deck. The captain of the DC-9 received serious injuries, and the first officer, two flight attendants and two passengers received minor injuries. Three flight attendants and one passenger aboard the A319 received minor injuries. Three ramp workers also received minor injuries.

The DC-9, operated by Northwest Airlines, had departed about an hour earlier with 94 passengers for a return flight to Minneapolis from Columbus, Ohio. The first officer, who had more than 7,000 flight hours, including 3,985 flight hours as a DC-9 second-in-command, was the pilot flying. He said that soon after the flaps and slats were retracted on departure, the "MASTER CAUTION" light and the "RUDDER CONTROL MANUAL" light illuminated.[1] He observed that pressure in the right hydraulic system was about 1,000 psi; normal pressure is about 3,000 psi.

The captain, who had about 20,000 flight hours, including 6,709 flight hours as a DC-9 pilot-in-command, noticed that fluid quantity in the right hydraulic system was decreasing rapidly. "The captain reached over to turn off the hydraulic pumps but later noticed that he had only selected the right engine hydraulic pump switch to the 'LOW' position instead of 'OFF,'" the report said. "He then corrected the switch position to 'OFF' and finished the 'Hydraulic Pressure Low' and 'Fluid Loss' [checklist procedures]."

The DC-9's left hydraulic system and right hydraulic system have fluid reservoirs and engine-driven pumps. The right hydraulic system also has an electrically driven auxiliary pump (Figure 1, p. 34). An interconnected alternate pump can pressurize the left system or a portion of the right system if an engine-driven pump fails. However, hydraulic fluid cannot be routed from one system to the other.

Confusing Condition

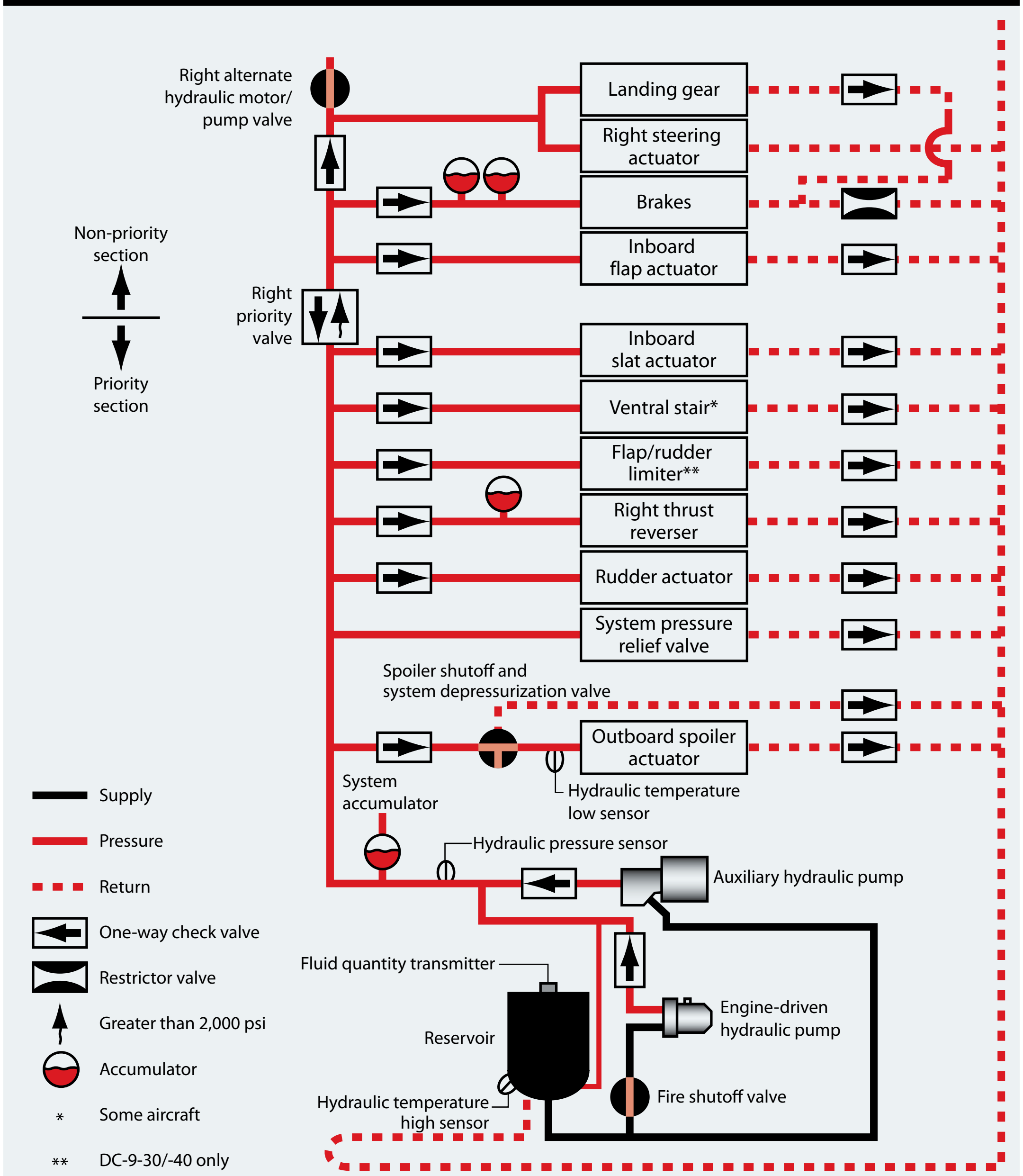
The first officer asked the captain whether they should turn back to Columbus. The captain replied, "We're going to talk to everybody before we make any decisions. I don't see an urgent need to be turning around right this second." The first officer agreed.

The report said that the pilots initially were confused about the nature of the hydraulic system problem and whether they were using the correct checklists. "The right hydraulic system pressure was indicating zero, but the hydraulic low pressure light ('R HYD PRESS LOW') on the annunciator panel was not illuminated," the report said. In addition, the pilots observed indicated fluid quantity in the right hydraulic system gradually increase from zero to 8 qt (8.9 l), a normal level.

The captain checked the annunciator panel and found that the light bulbs for the hydraulic low pressure light were inoperative. "When he attempted to change the bulbs, the entire housing came apart," the report said. "He stated that he basically slammed the door closed, and the light came on, but it was so broken up that he was not certain if the light came on because the housing was broken or … because it was actually indicating low pressure."

A company maintenance technician contacted by radio told the captain that there apparently was a problem with the hydraulic fluid reservoir. "The captain interpreted that to mean that … there was a problem with the fluid quantity transmitter on the

DC-9 Right Hydraulic System



Source: U.S. National Transportation Safety Board

Figure 1

reservoir," the report said. The flight crew decided to continue the flight to Minneapolis, to reduce fuel load, and to conduct the checklist procedures related to low pressure and normal fluid quantity in the right hydraulic system.

'Lost Our Quantity'

Weather conditions at Minneapolis included a 5,000-ft broken ceiling and 10 mi (16 km) visibility, with light rain. The captain briefed the flight attendants, and the crew planned for a visual approach to the longest runway: Runway 22, which is 11,006 ft (3,355 m) long.

The airplane was nearing the airport when indicated right system fluid quantity dropped to zero. The first officer said, "We just lost our quantity." The captain declared an emergency and told air traffic control (ATC) that they had a "hydraulic problem."

The report said, however, that the landing gear extended normally, which reinforced the captain's belief that the right hydraulic system indicators were malfunctioning and that there was no problem with the system itself. A flaps 40 setting was selected, and the crew used the localizer and visual approach slope indicator as supplemental guidance for the visual approach. After a normal touchdown, the first officer applied the wheel brakes earlier than normal to ensure that they were functioning. During rollout, the thrust reversers also functioned normally.

Control was transferred to the captain, and, as the airplane was being taxied off the runway, the first officer told ATC that "[we] no longer need any assistance for the emergency response." The flaps and spoilers retracted normally. The low-pressure light remained illuminated, but the captain believed that the light was broken. "He was thinking that everything was normal," the report said.

'Dead in the Water'

About eight minutes before the collision, the flight data recorder recorded a decrease in engine pressure ratio consistent with a shutdown of the left engine. Company procedure encourages pilots to shut down an engine during taxi to save fuel and reduce brake wear. However, the captain told investigators that he did not remember shutting down the left engine; the first officer said he was unaware of the shutdown.

The captain was turning off a taxiway into the gate area when the nosewheel steering system failed. "We just lost our left system pressure," he said. "Look at that … there's no pressure at all."

The first officer told ATC that they were experiencing steering problems and likely would have to be towed to the gate; they had been assigned Gate 7. He then asked the captain if he had brakes; the captain said no and asked the first officer to try his wheel brakes. "The brake pedals went right down to the floor," the report said.

The captain deployed the right engine thrust reverser, and the airplane came to a stop. "We're dead in the water," he said. The first officer recommended shutting down the engine, but

McDonnell Douglas DC-9-50

© Cary Liao/Airliners.net

The DC-9 made its first flight in 1965, two years before Douglas Aircraft Co. merged with McDonnell Aircraft Corp. The initial production version, the DC-9-10, has 12,250-lb-thrust (54.5-kilonewton [kN]) Pratt & Whitney JT8D-5 turbofan engines and can carry 90 passengers. Several versions followed before the DC-9-50 was introduced in 1975 with 16,000-lb-thrust (71.2-kN) JT8D-17 engines, a longer fuselage and a redesigned interior with accommodations for 139 passengers.

The 172-passenger Super 80 was introduced in 1979 and was the basis for the subsequent MD-80 and MD-90 versions. McDonnell Douglas merged with The Boeing Co. in 1997, and production of the series was terminated in 2000.

Source: *Jane's All the World's Aircraft* the captain said that he would keep it running to retain use of the thrust reverser.

'Lost My Reversers'

The first officer informed ATC of the situation. "Our bad day got worse," he said. "We lost all our control over the brakes and steering. … We're having to use thrust reversers to keep from rolling." He said that they would need the wheels chocked or a tug connected before they shut down the right engine. "Otherwise, we won't have any ability to keep the airplane from rolling."

The first officer then radioed the company's maintenance department and requested that they "bring a crew out here with a tug and some chocks, whatever's needed [to] bring us in the rest of the way … probably chock us first to keep us from rolling into something."

"It's going to be a few minutes," the maintenance technician said. "We need an escort out there. He's on his way, so just hang tight." The first officer said that they were in a "very precarious situation" and needed help right away.

A few seconds later, the airplane began to roll forward slowly, either because of engine thrust or a slight slope to the ramp. The captain selected reverse thrust, but the thrust reverser did not deploy. "Lost my reversers," he said. "You can't steer or anything?" the first officer asked. The captain said no.

The DC-9 was rolling at about 16 mph (26 kph) when it struck the A319, which had just been pushed back from Gate 10 and was being prepared to be taxied under its own power. The captain said that the force of the collision was greater than he had expected. His injuries included broken ribs. The first officer said that he struck his head and ribs when he ducked before the "cockpit imploded and glass came flying in." Fuel also began pouring into the DC-9's flight deck from a ruptured wing tank in the Airbus. There was no fire. Both pilots initially were trapped in their seats by debris, but they managed to extricate themselves and exit through the flight deck and cabin doors.

Fuel began pouring into the DC-9's flight deck from a ruptured wing tank in the Airbus.

The captain of the A319, which also was operated by Northwest Airlines, recalled that he was conducting the "Before Taxi" checklist when he felt a tremendous jolt and the airplane began moving forward and to the left. "He 'stood' on the brakes, but he could not stop the airplane from moving," the report said. "He estimated that the airplane was pushed 20 or 30 ft [6 to 9 m]."

Fatigue Crack

After the accident, the right hydraulic system was filled and pressurized. Investigators found hydraulic fluid leaking from a 0.4-in (10-mm) crack in the threaded area of the pressure port in the rudder hydraulic shutoff valve housing, which had accumulated 62,436 service hours. The NTSB materials laboratory determined that the crack was caused by fatigue.

On May 6, 2005, four days before the accident, Boeing had issued a service letter that cited a "failure history" of the cast rudder shutoff valve housing and encouraged operators of DC-8, DC-9, MD-80 and MD-90 series airplanes to replace cast housings with machined housings. The service letter said that 29 housing failures had been reported and that most were caused by fatigue related to porosity of cast housings with 30,000 to 65,000 service hours.

Northwest's records showed that the airline received the service letter on May 19, 2005. However, the report said that the airline previously was aware of the problem, had studied it and had determined that it was a reliability issue rather than a safety of flight issue. "The benefit for enhancing the reliability of the valve did not exceed the financial consequences of the continued failures," the report said.●

This article is based on U.S. National Transportation Safety Board accident briefs nos. CHI05MA11A and CHI05MA11B, and public docket no. 39833.

Note

1. When pressure in the DC-9's right hydraulic system decreases below a specific level, rudder control reverts from hydraulic to manual. "During manual rudder operation, rudder/brake pedal movement operates the rudder control tab," the report said. "Aerodynamic forces move the rudder." A minimum airspeed of 135 kt is required on approach until landing is assured.

BY ROBERT L. SUMWALT

Do You Have a Safety Culture?

A major responsibility of management is to establish and maintain a safety culture. It must start at the top and permeate the entire organization. If the leaders do not truly believe in safety, then why would others in the organization be expected to embrace it?

Do you have a safety culture in your organization?

Think carefully before answering. For those who immediately answer that they do, Dr. James Reason has some words to keep us on our toes: "[I]f you are convinced that your organization has a good safety culture, you are almost certainly mistaken — A safety culture is something that is strived for but rarely attained — [T]he process is more important than the product."

What is safety culture? I define safety culture simply as doing the right thing, even when no one is watching.

The U.S. National Transportation Safety Board (NTSB) has long believed in the importance of such a culture. After questioning an organization's safety focus in a number of accidents, NTSB in 1997 hosted the Symposium on Corporate Culture and Transportation Safety. Jim Hall, chairman of NTSB at the time, said: "We've found through 30 years of accident investigation that sometimes the most common link is the attitude of corporate leadership toward safety. The safest carriers have more effectively committed themselves to controlling the risks that may arise from mechanical or organizational failures, environmental conditions and human error."

Although that symposium was a decade ago, we continue to see accidents in which an operator's safety culture is questioned.

The safety board recently investigated an accident involving a regional jet nighttime positioning flight. The pilots had no passengers and decided, as they told air traffic control, they would "have a little fun." Post accident analysis reveals that the crew performed a number of unauthorized actions, including intentionally causing the stall warning system to activate on three occasions, imposing dangerous sideloads on the aircraft's tail structure by intentionally mishandling the rudder, allowing the first officer to occupy the captain's seat while the captain sat in the first officer's seat and a series of other deviations from standard operating procedures (SOPs).

Once level at flight level 410, the crew allowed airspeed to bleed off, leading to a stall and loss of control. The high-altitude upset disrupted airflow through the engines, and both flamed out. Unfortunately, the crew was unable to restart either engine and they paid for this behavior with their lives.

These were not rogue pilots. In fact, both were generally described as being good pilots. One first officer described the captain as "the best stick-and-rudder pilot" he had ever flown with. Another pilot who flew with the captain a week before the accident said that the captain operated in a standard manner with no deviations from SOPs.

Clearly, however, on the accident flight they were not doing the right

Vice Chairman Robert Sumwalt, U.S. National Transportation Safety Board things when no one was watching. Why did this crew think that they could do what they did?

Dr. Reason states that a safety culture consists of an "informed culture," a "reporting culture" and a "just culture." During the board meeting for this accident, I asked questions concerning two of these elements — informed and reporting cultures.

In an informed culture, an organization collects and analyzes the data to stay informed of its safety health. Examples of such programs are internal and external audits, flight operational quality assurance (FOQA), line operations safety audits (LOSA) and confidential incident reporting systems such as Aviation Safety Action Programs (ASAP).

Interestingly, at the time of the accident, the airline had no effective programs to collect and analyze safety data; it did not have a FOQA or ASAP program; and it had never conducted a LOSA.

Remarkably, when asked how they ensured that crews adhered to SOPs during positioning flights, the company's chief pilot stated, "Same way I do any flight being conducted to SOP. We look at the reports. We look at the numbers, you know: Did they leave on time, did they not leave on time, and if anyone is on the jump seat doing a check. That's the only way I know if any flight I have is being conducted per SOP."

In other words, we don't know.

Reporting cultures are receptive to employee safety-problem reports. The employees know they will not be punished or ridiculed for their reports. The Flight Safety Foundation Icarus Committee stated several years ago that if you expect employees to provide safety information, then you must have a printed policy signed by the CEO that assures employees that the organization will not initiate disciplinary proceedings against an employee who, in good faith, discloses a hazard or safety incident due to conduct that was unintentional. Employees must be confident that confidentiality will be maintained.

The airline involved in the previously mentioned accident had a safety hotline crewmembers could use to report safety concerns. However, investigators discovered that no one used the hotline.

In other words, whatever we have is not working.

One board member at the hearing stated, "Based on what you've told me today, I would say that … [the airline] lacked at least two elements of a successful safety culture — an informed culture and a reporting culture."

I believe the absence of these elements, while not *causing* the accident, may have *enabled* the accident. It enabled a culture in which crewmembers felt they could do whatever they wanted when no one was watching.

A just culture is essential but it is often misunderstood. In a just culture, employees are confident that while they will be held accountable for their actions, they will be treated fairly. They also know that those who act recklessly or deliberately take unjustifiable risks will be punished.

Dr. Reason emphasizes that we must not confuse "just culture" with "no-blame culture" (*FSD*, 3/05, p. 2). He explains that a "no-blame" culture does not address how to deal with "individuals who willfully (and often repeatedly) engaged in dangerous behaviors that … increase the risk of a bad outcome. Secondly, [no-blame culture does] not properly address the crucial business of distinguishing between culpable and nonculpable unsafe acts.

"In my view, a safety culture depends critically upon first negotiating where the line should be drawn between unacceptable behavior and blameless acts," he says.

"In my view, a safety culture depends critically upon first negotiating where the line should be drawn between unacceptable behavior and blameless acts."

The three elements of a safety culture are like gears, turning together to propel an organization towards a safety culture. If one or more are missing, the intended movement doesn't happen.

So, again, the question arises: Do you have a safety culture? Perhaps a more telling question is: Do you have these elements, and are they effective?

Be careful how you answer that one. ●

Geneva Sizzles

BY J.A. DONOGHUE

Photo: J.A. Donoghue

Another record-breaking year at EBACE reflects European business aviation growth.

Geneva — While Europe's rapid business aviation expansion was highlighted at the 7th annual European Business Aviation Convention & Exhibition (EBACE) in Geneva, concerns were voiced that the infrastructure can't handle the hundreds of airplanes ordered by the region's operators. Also, some discussion at EBACE2007 in mid-May pointed to signs that European business aviation might need to address some safety issues, but insufficient data exist to know the full extent of the problem.

Richard Schofield, NATS safety division chief, speaking during a panel session critiquing the sector's safety standing, said that in a three-year period through December 2006, business jets accounted for just 3.5 percent of U.K. traffic, yet were responsible for 10 percent of the gross navigation errors and 16 percent of level busts. Further, business jet flights were 33 percent of all operations that failed to follow standard departure routes, made 12 percent of altimeter-setting errors, and were involved in 10 percent of all events in which pilots did not fly according to their clearance despite a correct readback.

Schofield was especially concerned about the business jet level-bust trend, saying, "It is getting worse."

Schofield was unable to provide any information on business-flown turboprop or piston-powered airplanes, saying that data for that group are not gathered.

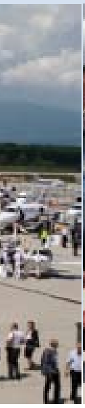
The rates of these errors for U.K.-based aircraft were much lower than those for aircraft coming into NATS airspace from the outside, Schofield said, but he added that it could not be determined if the source of the problem was language or an unfamiliar environment.

David Chapman, U.K. Civil Aviation Authority head of flight operations, also voiced concerns about data. He said that the rate of business aviation fatal accidents is 8.5 times that for large public transport aircraft, a rate he deemed unacceptable. Pointing out the need to gather information on incidents and low-severity safety events in order to direct safety efforts to head off the next accident, he said, "The ratio of low-level events to fatal accidents is 600-to-1." Airlines have accepted the value of reporting incidents and other safety events and are reaping the benefits of the process with lower accident rates. However, "We are not getting reporting on low-level events from business jet operators," he said.

Another area of concern is the high accident rate in ferry or positioning flights, Chapman said, with that category accounting for 18 out of 43 business jet accidents in the U.K.

Both Chapman and Schofield pointed out the lack of data for many aspects of the business aviation community's operations. Another speaker on the safety panel, consultant Robert Breiling of Robert E. Breiling Associates, had to extrapolate figures from U.S. data to comment on the relative safety of European aviation in several categories, including the long-sought European approval for commercial single-engine operations under instrument meteorological conditions.

Jointly sponsored by the European Business Aviation Association and the National Business Aviation Association, the EBACE meeting has produced spectacular growth in its seven years of existence that reflects the vigor of the European market. This year, 11,267 people, up 15 percent from last year, attended the event, eager to see the wares offered by 354 exhibitors, up 21 percent from the 292 exhibitors in 2006. There were 56 airplanes and four helicopters on display on the Geneva Airport ramp just outside the exhibit hall doors.



Photos: J.A. Donoghue

Business was hot even before the show began, with orders for 63 aircraft valued at more than US$1.8 billion announced by numerous exhibitors the day before the show opened. During the show the orders continued to mount.

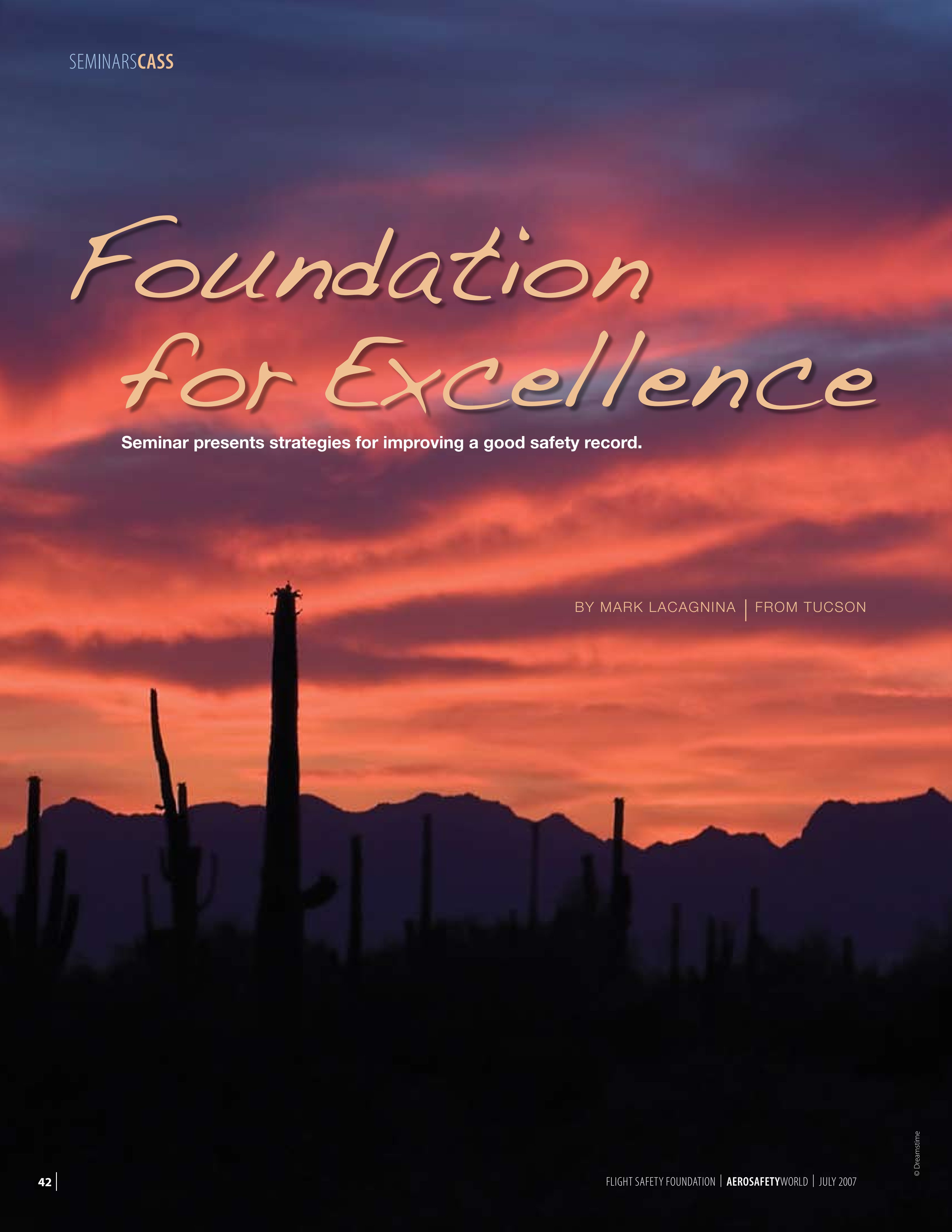
Cessna, for example, counted 40 Citations ordered, including an order for 25 Citations from JetAlliance, plus several piston-engine aircraft. NetJets Europe bought 32 Hawker 4000s, with deliveries to start next year and run through 2016. Eclipse Aviation counted 120 firm orders for Eclipse 500s, plus 60 options, from Etirc Aviation Europe; Eclipse now counts 2,700 orders in its book. Gulfstream sold 20 G450 large-cabin aircraft, plus 17 options, to National Air Services of Saudi Arabia, a company that already ordered 20 Hawker 750s earlier this year and is considering an order for 20 Falcon 2000EXs. Boeing Business Jets lodged two 787-8 VVIP orders, while Airbus on the opening of the show counted five A318 Elites ordered by Petters Group Worldwide.

All this ordering raises the question of where all these airplanes are going to fly given Europe's already-congested airport system and generally poor weather for much of the year. Ironically, host airport Geneva has seen strong growth in low cost carrier (LCC) airline traffic, especially from easyJet, that is pressuring business aircraft operating slots. Likewise, Berlin's Schoenfeld will be pressured, even more so when the downtown Tempelhof closes, and Luton, a London airport, this spring started requiring that business aircraft advance reserve takeoff and landing slots.

Training and simulator companies also found rich rewards by providing the means by which the surge of new pilots will be trained to fly the incoming fleets of business aircraft, opening up new European training centers and selling a wider range of simulators.

And Cessna used the event to accept the European Aviation Safety Agency airworthiness certificate for its new Citation Mustang entry into the very light jet market.●

Sixty aircraft were on display during EBACE 2007 in Geneva.



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Foundation for Excellence

Seminar presents strategies for improving a good safety record.

BY MARK LACAGNINA | FROM TUCSON

Speakers from left, Matthews, Agur and Rohr

Photos: J.A. Donoghue

"Corporate aviation has a good story to tell, and the story will continue to get even better." This was the safety message shared with aviation professionals at this year's Corporate Aviation Safety Seminar (CASS) by Robert Matthews, Ph.D., lead safety analyst at the U.S. Federal Aviation Administration (FAA) Office of Accident Investigation.

More than 425 attendees, hailing from 10 countries, gathered in Tucson, Arizona, U.S., May 8–10 for the 52nd annual CASS, whose theme was "Safety: The Foundation for Excellence." The seminar was presented by Flight Safety Foundation (FSF) and the National Business Aviation Association (NBAA).

Detailing recent safety records, Matthews said, "The story is not so strong in business aviation, but the trends are going in the right direction." According to FAA definitions, the primary difference between corporate and business aviation is that corporate aircraft are flown by "professional" pilots — paid employees of the company; business aircraft are flown by "non-professionals" for transportation required by the businesses in which the pilots are engaged.

Corporate and business aviation activity in the United States is nearly equal, with about 3 million flight hours logged per year by each segment. Matthews pointed out, however, that in the five-year period from 2002 to 2006, corporate aviation had seven fatal accidents while business aviation had 85 fatal accidents.

Among possible factors accounting for business aviation's "less-positive" safety record are the nonprofessional pilots, less organizational support and the greater fleet mix. Matthews noted that 75 of the 85 aircraft involved in the fatal accidents had reciprocating engines — 50 singles and 25 twins. "If we are going to improve the accident rate in this industry, the focus should be on business aviation," he said.

Improvement of the corporate aviation safety record, meanwhile, will continue to be driven by fleet changes — mainly, the replacement of older aircraft — installation of modern avionics equipment and by "continuing to address the issues that don't go away," Matthews said.

Counterpoint

"There's no doubt that corporate aviation has a good safety record, but is it as good as it could be?" The question was posed by Peter v. Agur Jr., founder and managing director of The VanAllen Group. The answer, obviously, is no, and Agur provided some targets for improvement.

The targets arose from his study of 675 accidents involving turbine aircraft flown by airline and charter pilots, as well as corporate pilots. "What got my attention was that 23 percent of the accidents — nearly one-quarter — involved the pilots' technical deficiencies,"

Speakers from left, Healing, Heinrich, Stein, Sands, and Solan.

Outgoing FSF CAC chairman Edward Williams and incoming chairman Patricia Andrews

Photos: J.A. Donoghue

he said. "This is a piece of the safety puzzle that we do not often talk about, but it is one of the biggest pieces."

More than 80 percent of the accidents involved nonadherence to standard operating procedures (SOPs), which Agur classified as PINCs, procedural intentional noncompliance, and PUNCs, procedural unintentional noncompliance.

"The data show that corporate aviation is not as good as the airlines in preventing PINCs and PUNCs," he said. "We can do better. This is a piece of the puzzle that we can do something about and need to keep focusing on."

Safeguards

Ray Rohr, standards manager for the International Business Aviation Council, discussed tools included in the International Standard for Business Aircraft Operations (IS-BAO) for designing a safety management system (SMS).

An SMS, he said, is a proactive process that includes identifying hazards, assessing and measuring safety risks, developing measures to eliminate the hazards and/or reduce the risks to acceptable levels, tracking to ensure that the measures are appropriate and effective, and modifying the measures when necessary. He said that gap analysis — "determining what you have and what you need, and what you do and what you need to do, to meet the goals of an SMS — is a very powerful tool for implementation."

In summary, Rohr said, "Your SMS will cost you money to implement but will save you money in the long run."

A critical element of an SMS, threat and error management (TEM), was discussed by Peter Stein, base manager and chief pilot for Johnson Controls, and Durwood Heinrich, Ph.D., director of aviation and chief pilot for PetSmart.

They described TEM as involving a mindset that humans make mistakes and that error cannot be eliminated but must be managed before it leads to an "undesired state" — for example, an unstabilized approach. Heinrich said that TEM is a reactive process involving the identification of threats and errors, assessment of the risks they pose and development of strategies to avoid or "trap" — detect and manage — them.

Stein noted that the FSF Corporate Advisory Committee and the NBAA Safety Committee recently launched a project to educate corporate/business aircraft operators about TEM. An initial objective is to develop a portable, interactive classroom course for business aviation professionals. "Our ultimate goal is to weave threat and error management principles into the very fabric of business aviation operations," he



said. "Keep your eye on the Foundation's TEM Web page."[1]

Data Mining

An emerging tool for corporate aviation accident prevention, flight operational quality assurance (FOQA), was discussed by Richard Healing, senior partner with R[3] Consulting, and Jeffrey Sands, director of flight operations, finance and administration for Altria Corporate Services.

"Data are the foundation for preventing accidents," Healing said. "We are not taking full advantage of the information that is out there." He noted that FOQA data can help to identify precursors to human error, as well as reveal operational, maintenance, training and organizational problems.

Healing provided several examples of safety improvements, as well as economic and efficiency enhancements, that the airlines and the U.S. military have achieved from FOQA. A challenge to corporate operators, which have relatively small fleets, is to collect sufficient data for useful analysis and trend identification. "Corporate and business aircraft operators need to work together, to share data," he said.

Sands shared firsthand experience as a participant in the FSF/NBAA corporate FOQA (C-FOQA) demonstration program. His company is in its third year of collecting and analyzing data from two airplanes, and had been surprised by some initial revelations, such as a greater-than-expected incidence of bank angle exceedances. These were traced, in part, to a departure procedure at one airport that requires a steep turn soon after takeoff. Following discussions with pilots about the situation, bank angle exceedances dropped from 33 the first year to two the second year.

Sands said that the company's C-FOQA experience has reduced its risk of an accident by about 25 percent. "That is a conservative estimate," he added.

Chris Solan, manager of flight safety for Eclipse Aviation, said that FOQA is among the safety programs that the manufacturer will provide for its customers. He noted that Eclipse is studying technologies that would enable the transfer of data directly from the airplanes to the manufacturer, with no required intervention by the operator.

Among other topics discussed at CASS were in-flight fires, engine failures, maintenance human factors, ground accident prevention, deep vein thrombosis and medical certification issues. Next year's CASS is scheduled to be presented in Palm Harbor, Florida, April 29 through May 1.●

Sands said that the company's C-FOQA experience has reduced its risk of an accident by about 25 percent. "That is a conservative estimate," he added.

Note

1. The information can be found at <www.flightsafety.org/tem_home.html>.

Just

Infrastructure upgrades vary as airports anticipate the Airbus A380's entry into airline service.

BY WAYNE ROSENKRANS

The world's 29 or so airports aiming to create safe conditions for Airbus A380 operations and Boeing 747-8 service later on have plenty to consider, but nothing that is impossible through the use of existing standards, modified standards or waivers. But some are holding off infrastructure upgrades until final criteria have been set for them.

By late summer 2007, the U.S. Federal Aviation Administration (FAA) is expected to announce decisions that will affect A380 operations on U.S. airport runways and taxiways narrower than those prescribed for new large aircraft 20 years ago by the International Civil Aviation Organization (ICAO), says an April 2007 report by the U.S. Government Accountability Office (GAO).[1] In addition to safety-related airport readiness, the report assesses the A380's potential impact on the capacity of 18 U.S. airports and how 11 non-U.S. airports have prepared so far to address issues raised by the first airliner to fit the category of the largest aircraft, called Airplane Design Group VI.

"According to FAA officials, [the Airplane Design Group VI] standard helps ensure that pilots can safely operate large aircraft like the A380," the report said. "Although the design standards do not govern aircraft operations, aircraft operators must seek FAA's approval for certain aircraft to use facilities and infrastructure that do not meet standards and demonstrate to FAA that an acceptable level of safety is maintained."

The only other Airplane Design Group VI aircraft that some airports will have to accommodate in the near future is the 747-8 — the passenger model is expected to enter service in late 2010, the report said. "The A380 falls under ICAO's [airport] design standards for the largest aircraft (Code F), which require at least 60-m wide runways (about 200 ft)[2] and 25-m wide taxiways (about 82 ft)," the report said. The FAA's counterparts in several countries already have

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approved A380 operations on some 150-ft (46-m) wide runways at their airports, however, after determining that the airports will be able to provide a level of safety equivalent to ICAO standards and recommended practices (SARPs).

Airports have had three options for safely accommodating the A380 and other new large aircraft:

- Adhering to civil aviation authorities' regulations and guidance derived directly from ICAO SARPs for accommodating the largest commercial jets with Code F–level airport infrastructure;
- Requesting and obtaining approval for modifications of civil aviation authority standards — for example, by using interim guidance issued by FAA in 2003[3] for a five-year period or by following consensus-based recommendations[4] adopted specifically for the A380 since 2002 by the European Aviation Safety Agency (EASA), several European civil aviation authorities and Australia to provide an equivalent level of safety; or,
- Postponing infrastructure upgrades until the relevant civil aviation authority issues its final requirements.

Typically, the U.S. airports plan infrastructure changes to handle scheduled service and/or to accommodate diversions by new large aircraft based, in part, on whether A380 service likely will affect them in 2007/2008, 2009/2010 or after 2010. "The [FAA's interim] guidance allows the conversion of existing 150-ft wide runways to 200 ft by adding 25 ft [8 m] of [lesser] strength pavement to each side and extending the shoulders [typically for structural reasons or erosion control], and allows use of 75-ft [23-m] taxiways by widening shoulders … adding center lights [and imposing operating restrictions]," the GAO said in a 2006 report.[5] The 2007 report, however, said that among the 11 non-U.S. airports studied, "seven of the eight Asian and Canadian airports will not have to impose operating restrictions on the A380 to the extent of U.S. airports."

Infrastructure Upgrade Scope

According to Airbus, the A380 was designed to minimize airports' need to upgrade infrastructure. "The A380 is the first new large aircraft that has been designed to be compatible with existing airports, as the result of a 16-year-long dialogue with regulators, customer airlines, airport operators, pilot and trade associations and ground handlers," the company told the GAO.[6]

Nevertheless, some airports that want to accommodate Airplane Design Group VI aircraft have planned or completed upgrades to a wide range of infrastructure components, including runway and taxiway pavement and/or shoulders, fillets,[7] jet-blast pads, taxiway bridges, ground vehicle tunnels, signs, lights, pavement markings and safety areas, aircraft rescue and fire fighting (ARFF) capability, gates, fuel pits, airbridges, passenger lounges, drainage, utilities and/or aircraft maintenance hangars.

The broader context of the A380 introduction includes numerous actions by the FAA, Airbus, airports and other organizations to mitigate safety challenges, the report said. For example, minimum distances for wake-vortex avoidance to be applied by air traffic control (ATC) to crews of any aircraft trailing an A380 during flight are greater than for other aircraft types (Figure 1, page 48), although ICAO and Airbus expect that civil aviation authorities in time will reduce these distances — as occurred after the introduction of the 747-400.

Decisions about changes to accommodate new large aircraft have been relatively complicated for airports. "Of the 18 U.S. airports [that GAO] visited, 11 have applied for modifications to standards that would allow [airlines] to operate the A380," the report said. "Of the remaining seven airports, officials indicated they were unsure if such modifications will be needed and will decide whether to request modifications to standards after FAA decides whether an A380 can safely operate on a 150-ft wide runway or whether a 200-ft wide runway will be required."

Among reasons that EASA in December 2006 approved A380 operations

WIDE ENOUGH

on 150-ft wide runways and 75-ft wide taxiways as a general rule are the specific aircraft equipment and runway-to-taxiway centerline-deviation studies that showed that large aircraft do not deviate significantly from the centerline. "The A380 … is equipped with an external taxiing camera system to assist flight crews in keeping the aircraft in the center of taxiways when moving on the airfield," the 2007 GAO report said. "The cockpit was also designed to be much lower to the ground than other large aircraft to provide the flight crew better visibility."

ARFF Concerns

An unresolved safety challenge for some of the airports is providing sufficient ARFF capacity for new large aircraft. "Some fire and rescue officials at the airports [GAO] visited were confident in their ability to respond to an A380 incident," the 2007 GAO report said. "However, several of them identified additional equipment, personnel or training needs that would improve their ability to respond to emergencies involving large aircraft, such as the A380."

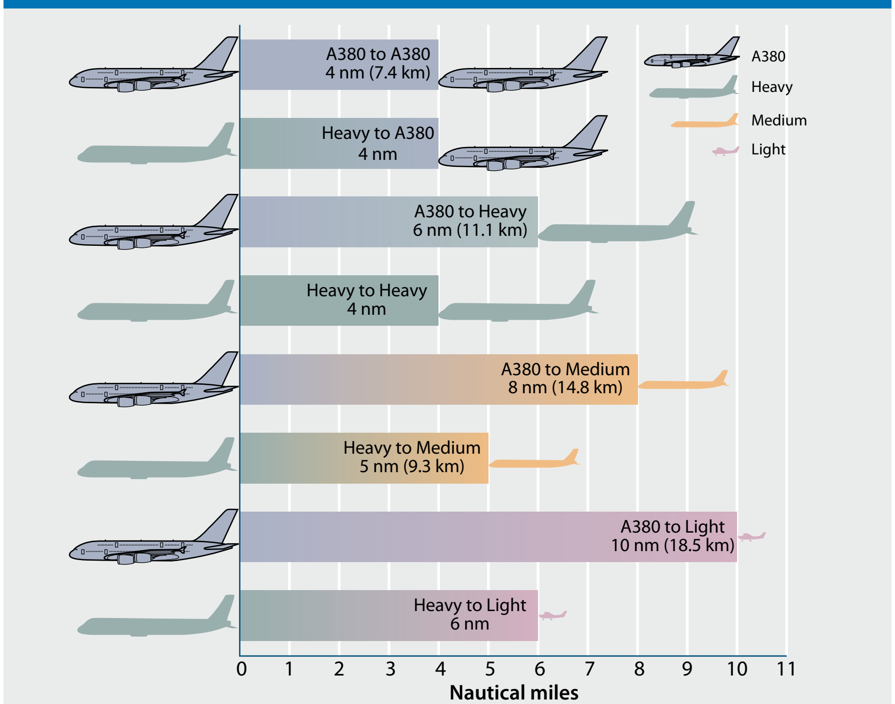
The report said that in the case of the A380, fire-related technical advances in external and internal materials could improve the time available for occupants to evacuate. "A new material called Glare that is highly resistant to fatigue, is used in the external panels for the upper fuselage and provides a longer period of time preventing fire from penetrating into the passenger cabin — about 15 minutes compared to about a minute for standard aircraft aluminum," the report said. "In addition, thermal acoustic insulation blankets, designed to extend the time before an external fire penetrates the fuselage, will be used inside the A380. Combined, these materials could provide additional time for evacuation by delaying the entry of fire into the cabin. The interior materials used in the A380 will also have decreased flammability properties and the aircraft will be equipped with enhanced fire and smoke detection systems."

Airport and ARFF officials also have recognized that the advent of A380 service has implications for quantities of water and fire-extinguishing agents. "The A380 can hold almost 82,000 gal [310,404 l] of fuel, compared to about 57,300 gal [216,904 l] carried by the Boeing 747-400," the report said. "Although the A380 will have Glare material … it will not be installed on the underside of the aircraft where a fire caused by leaking fuel is most likely to occur, according to an FAA official."

The FAA currently is evaluating the need to update its ARFF guidance for new large aircraft, including the amount of water and extinguishing agent needed to respond to fires involving specific types, but FAA officials told the GAO that, generally, airports planning for A380 service already exceed minimum requirements. Some officials also expressed their concern that "the number and position of the A380's [emergency evacuation] slides could also impede the fire and rescue vehicles' access to the aircraft."

Methods for accessing the upper deck of an A380 also have to be considered by ARFF officials. "Most fire and rescue officials at the airports [GAO] visited indicated that they do not have the equipment to access the upper deck of the A380 for fire fighting or evacuation purposes," the GAO report said. "Although the height to the upper deck door of the A380 is essentially the same as that of the 747, according to an FAA official, the

Minimum Radar Wake-Turbulence Separation for Approach/Departure



Source: U.S. Government Accountability Office

Figure 1

need to invest in such equipment now becomes more critical for the A380 because more passengers are seated on the upper deck of the A380. … Some airports … are planning to add a vehicle with a penetrating nozzle with a higher reach that can inject fire extinguishing agent into the upper deck of the A380 [such as a 65-ft (20-m) boom being researched by the FAA]."

The GAO said that airports should have plans for the post-evacuation safety of an unprecedented large number of evacuees. "A related concern of FAA officials [and] airport fire and rescue officials … [is] their ability to control the crowd and how to treat injured people on site prior to being moved to nearby hospitals," the report said. "In most cases, airport fire and rescue officials said that they plan for reasonable worst-case scenarios in which about 50 percent of the passengers can be treated for injuries on the largest aircraft operated at the airport."

Non-U.S. Airport Readiness

The GAO researchers found that some non-U.S. airports will require safety-related restrictions for A380 operations while others will be virtually unrestricted. Examples of plans/improvements include:

- A new 3,800-m (about 12,500-ft) runway that is 200 ft wide and meets ICAO A380 ARFF requirements at Beijing Capital International Airport;
- Tokyo Narita International Airport's ICAO Code F and A380 ARFF compliance, designation of one runway for A380 operations and a restriction prohibiting simultaneous operation of two A380s on parallel taxiways;
- Amsterdam Schiphol Airport's ICAO A380 ARFF compliance, one new Code F–compliant runway and two Code E 45-m (150-ft) wide runways with 23-m wide taxiways to be used for A380s under EASA waivers, and possible limitation on use of a taxiway bridge; and,
- ICAO A380 ARFF compliance, upgraded runway lighting, widening and strengthening of shoulders of two 50-m (164-ft) wide runways for A380 use under waivers plus designation/reconfiguration of A380 taxi routes and runway hold positions at London Heathrow Airport.

Responding to the latest GAO report, Airbus said that these safety challenges sooner or later will apply to the other new large aircraft, noting that the 747-8 "has dimensions and characteristics that should require the same assessment as the A380: runway and taxiway widths; airfield horizontal separations; gate availability and compatibility; increased number of passengers over the current larger aircraft; [ARFF] categorization and requirements; [and] wake vortex characterization and classification … in particular at U.S. airports that will have 747-8 flights before [A380 flights]."

Among its safety-related responses, Airbus also noted that A380 slides provide "two re-entry lines, which provide direct access for fire fighters or emergency responders into both main deck and upper deck"; that wake-vortex separation standards implemented in November 2006 by ICAO already provide "the same level — or an increased level — of safety, compared to separation standards for other aircraft flying today"; and that the aviation industry should recognize the value of wake-vortex characterization of all future commercial aircraft and possibly reclassification of existing aircraft. ●

Notes

1. U.S. Government Accountability Office (GAO). "Commercial Aviation: Potential Safety and Capacity Issues Associated With the Introduction of the New A380 Aircraft." Report no. GAO-07-483. April 2007.
2. The 200-ft width alone does not mean that the runway is suitable for new large aircraft. For example, Paris Charles de Gaulle Airport and San Francisco International Airport have some 200-ft wide runways that are unsuitable for takeoffs/landings or have insufficient length for takeoffs by the A380 under all or some conditions.
3. GAO. "Costs and Major Factors Influencing Infrastructure Changes at U.S. Airports to Accommodate the New A380 Aircraft." Report no. GAO-06-571. May 2006. This report said, "As of March 1, 2006, 11 airports had submitted 68 requests for modifications of standards to U.S. Federal Aviation Administration, of which 47 were approved, 10 disapproved and 11 were under consideration." Examples of results included requiring relocation of a taxiway 13.5 ft (4.1 m) farther from a parallel taxiway; requiring a subset of runways, taxiways and taxi routes for A380 operations; restricting/prohibiting simultaneous operation or reducing maximum taxi speeds on parallel taxiways occupied by an A380 and other aircraft; A380 taxiing speed limited to 15 kt; informing A380 pilots to apply oversteer; and adding signage showing A380 crews restricted taxiing sections of taxiways.
4. According to the "Common Agreement Document of the A380 Airport Compatibility Group," Version 2.1, December 2002, European civil aviation authorities, representatives of European airports and others in the aviation industry informally agreed on common recommendations to authorities.
5. GAO. "Costs and Major Factors Influencing Infrastructure Changes at U.S. Airports to Accommodate the New A380 Aircraft." Report no. GAO-06-571. May 2006.
6. Cohen-Nir, Dan. Letter to Gerald Dillingham, director of civil aviation issues, GAO, April 11, 2007.
7. A fillet is a paved area installed at runway or taxiway intersections for safely turning a large aircraft.

Safety on Demand

U.S. Part 135 on-demand operations in 2006 had fewer accidents and fatalities, and lower accident rates, than in any previous year going back to 1997.

BY RICK DARBY

In 2006, U.S. air carriers and other companies operating under Federal Aviation Regulations (FARs) Part 135, *Operating Requirements: Commuter and On Demand Operations*, had, as usual, higher accident rates than those operating scheduled service under Part 121, *Operating Requirements: Domestic, Flag, and Supplemental Operations.* However, the on-demand (air taxi) segment — based on accidents per 100,000 flight hours — showed its lowest rate in the 1997–2006 period. The data, preliminary for 2006, were published by the U.S. National Transportation Safety Board.[1]

Scheduled air carriers operating under FARs Part 121 had an accident rate of 0.223 per 100,000 departures, compared with 0.599 for scheduled (commuter) air carriers operating under FARs Part 135 (Table 1). There was a similar difference in fatal accident rates, 0.018 versus 0.200 respectively. Departure information was not available for on-demand Part 135 operations, but in accidents per 100,000 flight hours, rates were higher than for scheduled Part 121 operations for all accidents and fatal accidents.

The Part 121 measure of million enplanements per passenger fatality was

Accidents, Fatalities and Rates, U.S. Air Carriers, 2006

	Accidents		Fatalities		Accidents per 100,000 Flight Hours		Accidents per 100,000 Departures	
	All	Fatal	Total	Aboard	All	Fatal	All	Fatal
U.S. Air Carriers Operating Under FARs Part 121								
Scheduled	25	2	50	49	0.132	0.011	0.223	0.018
Nonscheduled	6	0	0	0	0.909	—	2.857	—
U.S. Air Carriers Operating Under FARs Part 135								
Commuter	3	1	2	2	1.071	0.357	0.599	0.200
On-Demand	54	10	16	16	1.500	0.280	—	—
Other Accidents in the United States								
Non-U.S.-Registered Aircraft	9	3	5	5				
U.S.-Registered Aircraft Operated by Non-U.S. Air Carriers	—	—	—	—				
U.S.-Registered Aircraft Operated Abroad by Non-U.S. Air Carriers	1	0	0	0				

FARs = U.S. Federal Aviation Regulations

Notes: All data are preliminary.

Departure information for on-demand Part 135 operations is not available.

U.S. air carriers operating under FARs Part 135 were previously called scheduled and nonscheduled services. The table identifies them as commuter operations and on-demand operations, respectively, to be consistent with definitions in FARs Part 119.3 and terminology in Part 135.1. On-demand Part 135 operations encompass charters, air taxis, air tours or medical service when a patient is aboard.

Source: U.S. National Transportation Safety Board

Table 1

16.0 million in 2006, compared with 41.3 million in 2005 (Table 2; the lower the number, the worse the rate). Passenger fatalities more than doubled, and passenger serious injuries doubled, between 2005 and 2006.

Nevertheless, the rate of Part 121 accidents defined by the NTSB as major[2] decreased in terms of accidents per million flight hours, to 0.051, versus 0.103 in 2005. The major accident rate was the lowest since 1998. Serious,[3] injury[4] and damage[5] accident rates also improved year-over-year.

Scheduled operations, which include a large majority of flights conducted under Part 121, resulted in fewer accidents but more fatalities in 2006 (Table 3). The rates for all accidents and fatal accidents, whether measured by accidents per 100,000 flight hours, per million miles flown or per 100,000 departures, all registered improvement in 2006. The fatal accident rate, 0.018 per 100,000 departures, was virtually the same as the 1997–2005 average of 0.017. The rate for all accidents per 100,000 departures, 0.223, was tied with 2004 as the best in any year of the period and was lower than the 1997–2005 average of 0.374.

The fatal accident rate of 0.200 per 100,000 departures for commuter operations under Part 135 (Table 4, p. 52) matched the 1997–2005 average, although the average included a large degree of variation. The rate for all accidents, 0.599 per 100,000 departures, was lower than any year of the period except 2003.

Part 135 on-demand operations involved 0.28 fatal accidents per 100,000 flight hours (Table 5, p. 52; departure information was not available). That compared with 0.29 in 2005 and was the lowest rate

Passenger Injuries and Injury Rates, U.S. Air Carriers Operating Under FARs Part 121, 1997–2006

Year	Passenger Fatalities	Passenger Serious Injuries	Million Passenger Enplanements per Passenger Fatality
1997	2	21	324.0
1998	0	12	No Fatalities
1999	10	46	67.6
2000	83	11	8.4
2001	483	7	1.3
2002	0	11	No Fatalities
2003	19	10	34.4
2004	11	3	64.6
2005	18	2	41.3
2006	47	4	16.0

FARs = U.S. Federal Aviation Regulations

Notes: The 2006 data are preliminary.

Injuries exclude flight crew and cabin crew.

Since March 20, 1997, aircraft with 10 or more seats used in scheduled passenger service have been operated under FARs Part 121.

Source: U.S. National Transportation Safety Board

Table 2

Accidents, Fatalities and Rates, U.S. Air Carriers Operating Under FARs Part 121, Scheduled Operations, 1997–2006

	Accidents		Fatalities		Accidents per 100,000 Flight Hours		Accidents per 1,000,000 Miles Flown		Accidents per 100,000 Departures	
Year	All	Fatal	Total	Aboard	All	Fatal	All	Fatal	All	Fatal
1997	43	3	3	2	0.285	0.020	0.0068	0.0005	0.433	0.030
1998	42	1	1	0	0.264	0.006	0.0066	0.0002	0.399	0.009
1999	40	2	12	11	0.240	0.012	0.0060	0.0003	0.368	0.018
2000	49	2	89	89	0.280	0.011	0.0069	0.0003	0.443	0.018
2001*	41	6	531	525	0.216	0.012	0.0053	0.0003	0.348	0.019
2002	35	0	0	0	0.209	—	0.0051	—	0.341	—
2003	51	2	22	21	0.302	0.012	0.0073	0.0003	0.499	0.020
2004	24	1	13	13	0.132	0.005	0.0032	0.0001	0.223	0.009
2005	34	3	22	20	0.182	0.016	0.0043	0.0004	0.312	0.027
2006	25	2	50	49	0.132	0.011	0.0031	0.0003	0.223	0.018

FARS = U.S. Federal Aviation Regulations

Notes: The 2006 data are preliminary.

Since March 20, 1997, aircraft with 10 or more seats used in scheduled passenger service have been operated under FARs Part 121.

In years marked with an asterisk (*), an illegal act was responsible for an occurrence in this category. These acts, such as suicide and sabotage, are included in the totals for accidents and fatalities but are excluded for accident rate computation. Other than the people aboard aircraft who were killed, fatalities resulting from the Sept. 11, 2001, terrorist acts are excluded.

Source: U.S. National Transportation Safety Board

Table 3

Accidents, Fatalities and Rates, U.S. Air Carriers Operating Under FARs Part 135, Commuter Operations, 1997–2006

	Accidents		Fatalities		Accidents per 100,000 Flight Hours		Accidents per 1,000,000 Miles Flown		Accidents per 100,000 Departures	
Year	All	Fatal	Total	Aboard	All	Fatal	All	Fatal	All	Fatal
1997	16	5	46	46	1.628	0.509	0.0650	0.0203	1.148	0.359
1998	8	0	0	0	2.262	—	0.1576	—	1.131	—
1999	13	5	12	12	3.793	1.459	0.2481	0.0954	1.934	0.744
2000	12	1	5	5	3.247	0.271	0.2670	0.0223	1.988	0.166
2001	7	2	13	13	2.330	0.666	0.1624	0.0464	1.254	0.358
2002	7	0	0	0	2.559	—	0.1681	—	1.363	—
2003	2	1	2	2	0.627	0.313	0.0422	0.0211	0.349	0.175
2004	4	0	0	0	1.324	—	0.0855	—	0.743	—
2005	6	0	0	0	2.034	—	0.1312	—	1.138	—
2006	3	1	2	2	1.071	0.357	0.0668	0.0223	0.599	0.200

FARs = U.S. Federal Aviation Regulations

Notes: The 2006 data are preliminary.

Since March 20, 1997, aircraft with 10 or more seats used in scheduled passenger service have been operated under FARs Part 121.

Based on a February 2002 U.S. Federal Aviation Administration legal interpretation provided to the National Transportation Safety Board, any FARs Part 135 operation conducted with no revenue passengers aboard is considered a nonscheduled flight operation. This interpretation has been applied to accidents beginning in the year 2002. It has not been retroactively applied to accidents during the period 1997–2001.

U.S. air carriers operating under FARs Part 135 were previously called scheduled and nonscheduled services. Table 4 and Table 5 identify them as commuter operations and on-demand operations, respectively, to be consistent with definitions in FARs Part 119.3 and terminology in Part 135.1.

Source: U.S. National Transportation Safety Board

Table 4

Accidents, Fatalities and Rates, U.S. Air Carriers Operating Under FARs Part 135, On-Demand Operations, 1997–2006

	Accidents		Fatalities		Accidents per 100,000 Flight Hours	
Year	All	Fatal	Total	Aboard	All	Fatal
1997	82	15	39	39	2.65	0.48
1998	77	17	45	41	2.03	0.45
1999	74	12	38	38	2.31	0.37
2000	80	22	71	68	2.04	0.56
2001	72	18	60	59	2.40	0.60
2002	60	18	35	35	2.06	0.62
2003	73	18	42	40	2.49	0.61
2004	66	23	64	63	2.04	0.71
2005	66	11	18	16	1.73	0.29
2006	54	10	16	16	1.50	0.28

FARs = U.S. Federal Aviation Regulations

Notes: The 2006 data are preliminary.

Miles flown and departure information for Part 135 on-demand operations are not available.

In 2002, the U.S. Federal Aviation Administration (FAA) changed its estimate of on-demand activity. The revision was retroactively applied to the years 1992 to present. In 2003, the FAA again revised flight activity estimates for 1999–2002.

U.S. air carriers operating under FARs Part 135 were previously called scheduled and nonscheduled services. Table 4 and Table 5 identify them as commuter operations and on-demand operations, respectively, to be consistent with definitions in FARs Part 119.3 and terminology in Part 135.1. On-demand Part 135 operations encompass charters, air taxis, air tours or medical service when a patient is aboard.

Source: U.S. National Transportation Safety Board

Table 5

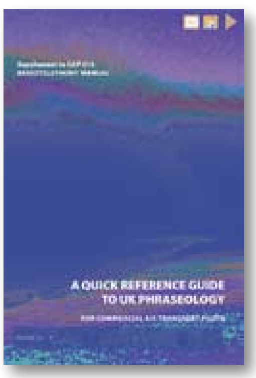
in the 1997–2005 period, in which the average was 0.52 per 100,000 flight hours. The rate for all accidents, 1.50 per 100,000 flight hours, was also lower than the 1997–2005 average of 2.19.●

Notes

1. The data can be accessed via the Internet at <www.ntsb.gov/aviation/Stats.htm>.
2. According to U.S. National Transportation Safety Board (NTSB) classifications, a *major* accident is one meeting any of three conditions: A Part 121 aircraft was destroyed, or there were multiple fatalities, or there was one fatality and a Part 121 aircraft was substantially damaged.
3. A *serious* accident is one meeting at least one of two conditions: There was one fatality without substantial damage to a Part 121 aircraft, or there was at least one serious injury and a Part 121 aircraft was substantially damaged.
4. An *injury* accident is a nonfatal accident with at least one serious injury and without substantial damage to a Part 121 aircraft.
5. A *damage* accident is one in which no one was killed or seriously injured, but in which any aircraft was substantially damaged.

It’s How You Say It

An online “booklet” and a DVD reinforce the importance of clear and standardized phraseology in radio communication between pilots and controllers.



ELECTRONIC MEDIA

CAP 413 Supplement: A Quick Reference Guide to UK Phraseology for Commercial Air Transport Pilots

U.K. Civil Aviation Authority, with support from NATS, the UK Flight Safety Committee and Thordis. 1st edition. 32 pp. May 2007. Available via the Internet at <www.caa.co.uk/docs/33/CAP413Supplement.pdf>.

The supplement offers a condensed version of CAP 413, *Radiotelephony Manual*, for commercial pilots. The online PDF version is designed to give a sense of familiarity by mimicking a booklet, complete with simulated ring binding. Clicking an icon “turns” the “pages.”

Examples of correct U.K. terminology are given in sections titled “Push and Start,” “Taxi and Takeoff,” “Climb–Cruise–Descent,” “Approach and Landing,” and “Emergency Communications.” Color coding clearly distinguishes pilot speech from controller speech in the examples, and the pages contain buttons for audio links.

Concise and standard phraseology is “especially important when operating within busy sectors with congested frequencies, where any time wasted with verbosity and non-standard, ambiguous phrases could lead to flight safety incidents,” the guide says.

Communication Error

NATS. Digital Versatile Disc (DVD). Available from <karen.skinner@nats.co.uk>.

NATS provides air traffic control services to aircraft flying in U.K. airspace and over the eastern part of the North Atlantic. It has produced the DVD, with support from the British Air Line Pilots’ Association, aimed at promoting clear and unambiguous communication between pilots and air traffic controllers.

According to the introductory module, one-third of safety incidents involve communication error; 25 percent of pilot acknowledgements fail to include a call sign; and 48 percent of pilot readbacks are incomplete. Forty percent of runway incursions and 25 percent of level busts — unauthorized departures from assigned altitudes or flight levels — have a communication error component, the narrator says.

The second, third and fourth modules illustrate examples of communication error in the airport, approach and en route environments respectively. Controllers, their radar screens and pilots are seen and heard in re-enactments of actual incidents. The modules analyze the communication errors that led to misunderstandings. Each module ends with a quiz asking the viewer to select the correct phraseology from multiple choices.

The fifth module summarizes the key points made on the disc and offers the "Top 10 Tips" for avoiding communication error or making it more likely to be detected before loss of required separation results.

BOOKS

Supervisory Best Practices for Operational Error Prevention

Booz Allen Hamilton. Prepared for U.S. Federal Aviation Administration (FAA) Air Traffic Organization. DOT/FAA/AR-06/39. 158 pp. Sept. 15, 2006. Available via the Internet from <www.hf.faa.gov/Portal/techrptdetails.aspx?id=1994>.

Operations supervisors (OSs) at FAA air traffic control facilities are uniquely positioned to observe and influence controllers — and, it is hoped, to prevent or minimize operational error. But highly experienced OSs retire, and the organization that produced this study, Booz Allen Hamilton, "could not identify any effort currently under way to capture their knowledge and experience for the benefit of future supervisors."

The study used a "proven and effective" human performance model that addressed two critical factors:

- "Accomplishment. This is what OSs *produce*, not simply what they *do*; [and,]
- "Exemplary performance. This is OS performance in which accomplishments exceed standards."

Interviewing 12 OSs considered "high performing" in six air route traffic control centers, the researchers identified seven major accomplishments and 24 tasks of OSs. Using the methodology based on the human performance model, they analyzed the techniques of the high-performing controllers to develop performance intervention techniques. Those techniques included selection and assignment, skills and knowledge, motivation and incentives, and environmental interventions.

"Selection and assignment" includes choosing the most appropriate candidates for a job. For an OS position, that means both administrative ability and effective interaction with controllers, the study says.

"OSs are often selected based on their success as a controller; however, the technical skills that define controller success do not necessarily indicate supervisor success," the study says. "Supervisory 'soft skills' are as important to safe and effective OS performance as technical proficiency."

The learning and understanding that go with the OS position come under the heading of "skills and knowledge," but there is currently no formal program to groom high-performing controllers for OS work, the study says. It concludes that "most new OSs could benefit from initial supervisor orientation/indoctrination training to give them the skills and knowledge to succeed. Recurrent and supplemental training is necessary to improve and reinforce abilities to execute complex procedures and ensure standardization."

Booz Allen Hamilton used the findings to develop the guide *Air Traffic Operations Supervisor Quick Reference Guide*, which is bundled with the description of the study's methodology and findings.

"The guide contains 'best practices' that OSs can refer to for guidance when dealing with situations for which they have not received formal training," the study says. "The guide serves as a job aid that addresses the gap between existing OS training resources that deal with administrative functions but overlook the people skills that are critical for effectively avoiding operational errors." (See also "Keys to Safety," p. 12.)

REPORTS

Improved Data Collection Needed for Effective Oversight of Air Ambulance Industry

U.S. Government Accountability Office (GAO). GAO-07-353. February 2007. 66 pp. Figures, tables, appendixes. Available via the Internet at <www.gao.gov/cgi-bin/getrpt?GAO-07-353> or from GAO.*

Air ambulance service — also known as emergency medical services — can be crucial for the survival of victims of severe injury, trauma or shock. Air ambulance helicopter flying must be performed under time pressure, sometimes in adverse weather and unfamiliar patient pick-up locations, possibly in difficult terrain. In recent years, the number of air ambulance accidents has led to government and industry concern, as well as media scrutiny. The U.S. National Transportation Safety Board (NTSB) has urged the Federal Aviation Administration (FAA) to issue stricter safety requirements for the industry.

Researchers for the report analyzed FAA, NTSB and industry data, interviewed federal and industry officials, and conducted five site visits, the report says.

"FAA's main challenge in providing safety oversight for air ambulances is that its oversight approach is not geared toward air ambulance operations," says the report. "For example, FAA uses the same set of regulations to oversee air ambulance operations as it uses to oversee other air taxi services. … The broad nature of the applicable regulations further inhibits FAA oversight because they may not fully address the potential risks air ambulance operations face."

The report recommends that FAA:

- "Identify the data necessary to better understand the air ambulance industry and develop a systematic approach for gathering and using this data. At a minimum, this data should include the number of flights and flight hours, the number and locations of air ambulance helicopters, and the number and types of FAA violations and enforcement actions related to the air ambulance fleet; [and,]
- "Collect information on the implementation of voluntary FAA guidance by air ambulance operators and evaluate the effectiveness of that guidance."

WEB SITES

FAA Wildlife Hazard Mitigation, <wildlife-mitigation.tc.faa.gov/public_html/index.html>

The U.S. Federal Aviation Administration (FAA) airport wildlife-hazard abatement Web site is managed by its Airport Technology Research and Development Branch.

In recent years, the branch says, for a number of reasons "the probability of wildlife strikes has increased dramatically." The branch is "undertaking an aggressive research program … to mitigate wildlife strikes with aircraft by providing practical solutions as well as real-time critical information to pilots and airport managers." Results of some of the research and development work and related educational and informational materials appear on this Web site.

"The purpose of this [wildlife hazard mitigation] site is to provide users with information that will allow them to better understand and practice wildlife hazard mitigation at airports through wildlife control," the site says. Along with photographs and news accounts of international wildlife-aircraft encounters, contents include:

- "FAA Wildlife Hazard Management Manual" in English, Spanish and French;
- Transport Canada's aviation industry guide to wildlife hazards management;
- FAA report of wildlife strikes to U.S. civil aviation, 1990–2005;
- FAA regulatory and guidance materials;
- Review of current hazard assessment systems;
- Embry-Riddle Aeronautical University (ERAU) "Airport Wildlife Mitigation" newsletters;
- Bird identification resources;
- Transport Canada's "Control Procedures Manual";
- International bird strike information with Web links to additional resources and

committees in Australia, Canada, Germany, Israel, and Italy; and,

- Public access to the FAA's wildlife aircraft-strike database, which includes a strike summary by species and state; maps showing strikes by species, state and specific location; and other pertinent data.

Much of the information pertains primarily to the United States, but given the nature of the subject, some will be of interest internationally.

This primary Web site and its mirror site at <wildlife.pr.erau.edu> are maintained by ERAU, Prescott, Arizona, U.S., on behalf of the FAA.

Cabin Operations Safety Toolkit, <www.iata.org/ps/services/toolkit/>

The International Air Transport Association (IATA) says its cabin operations safety task force has developed a tool kit to help "safety officers, training instructors and airline managers develop strategies to prevent incidents" in two key areas considered priorities in cabin safety and costs — cabin crew turbulence-related injuries and inadvertent slide deployments. The modules about inadvertent slide deployments are discussed more fully in "A Slip of the Wrist," p. 22.

The tool kit is divided into four sections: turbulence management, cabin safety management system (CSMS), cabin safety quality system (CSQS) and inadvertent slide deployment prevention. Each section contains numerous files that may be downloaded, read online, printed or saved at no charge. Each section deals with issues related to safety, training and airline management. Files contain presentation slides, guidance materials, statistics, images, graphics and survey forms.

According to IATA, "Turbulence is the leading cause of injury in nonfatal accidents. Turbulence-related injuries to cabin crew cost the airline industry over [US]$60 million per year." The turbulence management section addresses safety challenges and remedies, terminology, causal factors, procedures, crew communication, and training.

The CSMS section discusses safety and quality management, organizational and safety culture, and application of safety management system (SMS) components — safety, accident prevention, risk management, audits and emergency response. IATA's SMS implementation guide for senior airline managers is included in this section.

CSQS "involves measuring, correcting and improving cabin crew performance on the line and informing crews of the outcomes/actions taken to improve safety." Using this part of the tool kit, "airlines [are able] to assess their current processes and improve them without the involvement of a third party."

Inadvertent slide deployment prevention covers door design and operations, human factors, checklists, technology, training, and threat and error management analysis.

With one tool kit, IATA is giving safety managers the tools and information to diagnose and correct specific issues; materials to integrate into training programs; and cost analysis templates and action plans to aid in management discussions. ●

Source

* U.S. Government Accountability Office
441 G St. NW, Room LM
Washington, DC 20548 USA

— Rick Darby and Patricia Setze

Nose Gear Jammed

Landing conducted on mains.

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

Problem Traced to Broken Spray Deflector

McDonnell Douglas MD-90-30. Substantial damage. No injuries.

The airplane was on final approach in visual meteorological conditions (VMC) to Denver International Airport the evening of Oct. 11, 2006, when the flight crew observed a nose landing gear "UNSAFE" warning light while trying to extend the gear.

The crew flew the airplane near the airport traffic control tower, and tower personnel told the crew that the nose gear did not appear to be extended, said the U.S. National Transportation Safety Board (NTSB) report.

After consulting with airline maintenance personnel, the crew attempted unsuccessfully to lower the nose gear once more. They decided to land the airplane on Runway 16R, which is 16,000 ft (4,877 m) long and 200 ft (61 m) wide. The flight attendants briefed the passengers for the landing.

The airplane touched down on the main landing gear about 1,000 ft (305 m) beyond the runway threshold. The nose section contacted the runway 5,200 ft (1,585 m) beyond the threshold.

"As the nose section skidded on the runway, a small fire erupted in the nosewheel well area and self-extinguished," the report said. "The nose gear doors were scraped, and the aluminum skin just aft of the nosewheel well was scraped through, exposing five longerons and six stringers [and] compromising the pressure vessel. Two antennas and one drain mast were also broken off."

The crew stopped the airplane with 8,800 ft (2,682 m) of runway remaining and decided not to order an emergency evacuation. None of the 155 occupants of the airplane was injured. The passengers exited through the cabin door and were transported by bus to the terminal. The airplane was towed off the runway to a secure area.

"Postaccident examination [by airline maintenance personnel] revealed that the nose landing gear center spray deflector had fractured and rotated, preventing gear extension," the report said. "The spray deflector is designed to deflect water and other runway material kicked up by the nosewheel away from the rear-mounted engines. [Otherwise, ingestion of debris] could cause flameouts and engine damage."

The spray deflector assembly on the MD-90 is attached to the nose gear and consists of seven main components: the center deflector, two rear deflectors, two side deflectors and two supports.

Examination of the failed assembly at the NTSB Materials Laboratory revealed that the

The airline discovered that the assembly can be damaged during turns when the airplane is towed by a "supertug," which does not use a towbar.

center deflector had fractured around the two bolts that attach it to the left side deflector. The laboratory report said, "Magnified optical examinations of both fractures uncovered uniformly rough, gray fracture features typical of overstress separations in aluminum castings. Fracture features and fracture orientations were consistent with downward bending loads on the left deflector."

The accident airplane was built in 1995 and had accumulated 31,747 hours and 16,739 cycles. The airline inspected other MD-90s and MD-88s in its fleet, and found a cracked spray deflector assembly on one MD-90. The airline discovered that the assembly can be damaged during turns when the airplane is towed by a "supertug," which does not use a towbar.

"Boeing has advised operators not to use the supertug for towing MD-80, MD-90 and 717 airplanes, and has revised the flight operations manual and aircraft maintenance manual, mandating inspection of the spray deflectors during every 'A' check," the report said.

APU Fails, Ejects Hot Debris Onto Ramp

Boeing 737-500. Substantial damage. No injuries.

The aircraft was parked at a stand and was being prepared for departure from London Gatwick Airport the morning of Sept. 3, 2005, when the commander told the copilot to start the auxiliary power unit (APU). "The passengers had been called for boarding but had yet to reach the aircraft," the U.K. Air Accidents Investigation Branch (AAIB) report said.

The commander then vacated the flight deck to inspect the cabin and found that the cabin lights were not illuminated. The copilot told him that the APU had automatically shut down. "The flight crew then became aware of a commotion at the rear of the aircraft," the report said. The aft portion of the aircraft had lurched, and cabin crewmembers believed that it had been struck by a catering truck. However, the commander found that the APU had failed and ejected debris onto the ramp. The commander and the copilot conducted the APU failure checklist.

"Debris was observed extending over some 90 m (295 ft) aft of the aircraft, completely crossing the taxiway behind the aircraft," the report said. "Larger items were collected by flight and ground crew and placed below the rear of the aircraft." The area then was swept clear of debris. No one was injured, and damage was confined to the APU.

The APU's cast-alloy inflow turbine had failed. "This resulted in vanes separating from the casting as its two liberated halves came into rapid contact with the containment structure," the report said. "The hot vane debris was ejected through the jet pipe. … The containment ring was severely deformed … but had successfully prevented any in-plane departure of turbine debris."

The report said that nine "broadly similar events" involving APS 2000/2001 APUs occurred between 1999 and 2006. None of the events involved uncontained turbine failures, and no one was injured.

"Efforts have been made to improve the [turbine] manufacturing process, without proven success, and no reliable method has been found to detect the defect in new or existing turbines," the report said. "No method of establishing a safe in-service life has been determined for this component."

Baggage Loader Locked in Cargo Hold

Airbus A330-300. No damage. No injuries.

The flight crew had just begun to taxi from the gate for a flight from Dublin (Ireland) Airport to New York the morning of Dec. 28, 2005, when they were told by an airport tower controller that a baggage loader had been accidentally locked in a cargo hold. The crew returned to the gate, and the baggage loader was removed from the airplane.

The Irish Air Accident Investigation Unit (AAIU) report said that while the airplane was being prepared for departure, the baggage loaders were told that one passenger might not be allowed to travel on the flight because of security concerns. The ramp agent asked the loading shift leader to locate the passenger's baggage, so that it could be unloaded if necessary. While checking the loading cards, the leader noticed that a bag intended for another flight had inadvertently been loaded into the incident aircraft. The leader told the ramp agent and a member of the loading crew, "Loader 2," that he was going to retrieve the bag.

While the leader was in the cargo hold, the ramp agent told Loader 2 that the questionable passenger had been cleared by airport security personnel to travel on the flight. Loader 2 relayed the information to two other loading crewmembers but did not tell them that the leader had re-entered the cargo hold. One of the crewmembers gave the "thumbs-up" signal to a colleague, who secured and locked the cargo hold door.

"By this time, the leader had located the [misplaced] bag," the report said. "However, as the lights remained on in the hold, he did not notice that pushback had commenced. When the engines powered up, he realized that he was locked in. … He phoned the base supervisors' office and told them of the situation."

The incident was classified by AAIU as serious. "[Other] cases have occurred where loaders have been inadvertently locked in a hold," the report said. "Some years ago, a loader was locked in a hold on a two-hour flight from Philadelphia to Chicago. This was a traumatic event for this person." Among AAIU recommendations generated by the incident investigation was for the development of standard operating procedures for the late removal of items from cargo holds.

Wind Shifts During Rotation for Takeoff

Boeing 747-400. Substantial damage. No injuries.

Winds were from 180 degrees at 16 kt, gusting to 22 kt, when takeoff was initiated on Runway 10L at San Francisco International Airport for a flight to Hong Kong on Nov. 14, 2003. "The wind shifted during the takeoff roll, resulting in a decreasing headwind, an increasing crosswind and, finally, an average 8-kt tail wind during rotation," the NTSB report said.

The first officer, the pilot flying, used a significant amount of aileron control to counter the increasing crosswind, which resulted in the right spoiler extending 12 degrees and a corresponding loss of lift. "The combination of the tail wind gust and spoiler movement resulted in the airplane's pitch attitude exceeding 12.6 degrees while the landing gear was still on the ground," the report said.

A few seconds after rotation, the stick shaker activated, and the first officer relieved back pressure on the control wheel. The airport tower controller, who had observed smoke from the airplane when it rotated, told the flight crew that a tail strike might have occurred. The crew returned to the airport and landed the airplane without further incident. None of the 356 occupants was injured. The report said that two of the airplane's structural members required repair.

Wing Strikes Runway in Freezing Fog

Bombardier CRJ200. Minor damage. No injuries.

The airplane was on initial descent to Rapid City (South Dakota, U.S.) Regional Airport the night of Jan. 17, 2004, when weather conditions were reported as 1.5 mi (2,400 m) visibility, a broken ceiling at 100 ft and an overcast at 500 ft. The flight crew prepared for the instrument landing system (ILS) approach to Runway 32.

The approach controller told the crew that visibility had decreased to 1/4 mi (400 m) in freezing fog, the NTSB report said. The crew requested and received instructions to hold at the outer marker. While holding, the crew was told that visibility had increased to 1/2 mi (800 m); they requested and received clearance to conduct the approach.

"The captain stated that they turned on the [APU] and configured the bleed air system in anticipation of encountering icing conditions when they descended through the fog layer," the report said. When the airplane entered the fog layer, the crew received an "ICE" warning and activated the wing and engine inlet anti-ice systems. The captain said that he became concerned about the rapid buildup of ice on the windshield wipers. "He stated that he looked out the side window and, although he was unable to tell the quantity, he saw ice accumulating on the winglet," the report said.

The captain saw the approach lights soon before the airplane reached decision height, and

The captain said that he became concerned about the rapid buildup of ice on the windshield wipers.

the runway came into sight when the airplane was about 140 ft above ground level (AGL). The first officer, the pilot flying, disconnected the autopilot, and the airplane pitched nose-up slightly. The captain told the first officer to keep the nose down and increase thrust. The captain then noticed a decreasing airspeed trend and that the airplane was drifting right of the runway centerline. He took control of the airplane, which he described as feeling "heavy and sluggish" and responding "poorly" to control inputs.

The captain said the left wing dropped and scraped the runway about the same time the left main landing gear touched down. The airplane bounced into the air and landed hard on the runway. None of the 35 occupants was injured. After the airplane was taxied to the gate, the left wing tip was found to have a scrape measuring 3 in by 10 in (8 cm by 25 cm). A portion of the damaged area was abraded to the underlying aluminum structure.

The first officer said that the examination of the airplane also revealed "large amounts of 1/2 to 1 inch [24 to 25 mm] thick, jagged mixed ice all along the vertical and horizontal stabilizers, as well as up the leading edge of the wing tips, and several silver-dollar-size [about 1.6 in (41 mm) in diameter] balls of ice on the static wicks."

TURBOPROPS

Crew Missed Turn During Approach

Beech C99. Destroyed. Two fatalities.

VMC prevailed at the airport, but instrument meteorological conditions with low visibility in heavy, blowing snow were reported in the area the afternoon of March 18, 2006, when the flight crew of the cargo aircraft began the VOR (VHF omnidirectional radio) approach to Bert Mooney Airport in Butte, Montana, U.S.

The second-in-command (SIC), recently hired by the company, was flying the aircraft from the left seat under the supervision of the pilot-in-command (PIC), the company's training and check captain, the NTSB report said.

The VOR, the final approach fix, is about 12 nm (22 km) northwest of the airport. The approach procedure requires a flight to track 127 degrees inbound to the VOR no lower than 7,700 ft, then turn left and track the 097-degree radial to the airport. The minimum descent altitude for the circling approach is 6,900 ft.

The aircraft was in controlled flight at 6,880 ft when it struck mountainous terrain about 9 nm (17 km) southeast of the VOR. The report said that the location of the wreckage indicated that the crew "failed to follow the approach procedure and turn to a heading of 097 degrees after crossing the [VOR]." The course selector in the SIC's horizontal situation indicator was found set to 127 degrees.

Smoke Prompts Return to Departure Airport

de Havilland Canada Dash 8-200. No damage. No injuries.

The aircraft departed from Melbourne (Victoria, Australia) Airport about 0635 local time on Oct. 19, 2006, for a scheduled flight to Wollongong, New South Wales. The aircraft was climbing through Flight Level 140 about 10 minutes later when the PIC smelled smoke in the cockpit, the Australian Transport Safety Bureau report said.

"Soon afterwards, a smoke detector warning sounded in the aircraft toilet, and the flight and cabin crew observed smoke haze," the report said. The flight crew reported the situation to ATC (air traffic control) and turned back toward Melbourne. The smoke dissipated after power was reduced for descent. The aircraft was landed without further incident at 0658.

Examination of the Pratt & Whitney Canada PW123D engines disclosed an oil leak in the left engine. "Oil had leaked from several compressor bearings into the low-pressure compressor of the engine," the report said. "The high temperature of the compressed air and the engine components caused the oil to vaporize, contaminating the air extracted from that engine section to [pressurize and ventilate] the aircraft cabin."

The engine manufacturer had issued three service bulletins that recommended modifications to prevent this problem. "The operator had already modified about 90 percent [45] of the affected engines in its fleet at the time of the incident," the report said. "The operator had planned to modify the remaining engines [including those on the accident aircraft] at the next period of scheduled or unscheduled maintenance."

Rotating Prop Strikes Runaway Stroller

Saab 340B. Substantial damage. No injuries.

The airplane's engines had been started in preparation for departure from Alpena (Michigan, U.S.) County Regional Airport for a scheduled flight the night of March 13, 2006, when station agents told the captain that a baby stroller had not been unloaded from the cargo compartment.

The captain shut down the left engine, and a station agent opened and entered the cargo compartment, which is in the left rear fuselage. "While he was exiting the compartment, the station agent lost his balance and dropped the stroller onto the ramp," the NTSB report said. "The stroller landed on its wheels and was blown under the fuselage by the wind and into the right main landing gear. The stroller was subsequently blown forward into the right propeller arc. … Fragments from the stroller impacted the airplane's fuselage, puncturing three holes and causing several dents in the pressurized fuselage."

There were no injuries to the 14 airplane occupants or the station agent. The report noted that wind velocity was 20 kt, with gusts to 31 kt, when the accident occurred.

Stall Occurs During Practice Engine-Out

Pilatus PC-12/47. Destroyed. Two fatalities.

A local weather-observing station was reporting surface winds from 060 degrees at 17 kt, gusting to 23 kt, when the private pilot and his flight instructor departed from Runway 06 at Big Timber (Montana, U.S.) Airport for a training flight the afternoon of June 24, 2006. Airport elevation is 4,492 ft; temperature was about 73 degrees F (23 degrees C).

The pilot had 725 flight hours, including 140 flight hours in the single-engine PC-12. The flight instructor, a U.S. Air Force pilot, had 3,200 flight hours and previously was employed as a pilot by Pilatus Aircraft.

A witness said that before departing from the 5,287-ft (1,611-m) runway, the pilot announced on the common traffic advisory frequency that he would practice a loss of engine power after takeoff and conduct a 180-degree turn back to the airport.

"Another witness said that [after liftoff,] the airplane pitched up 30 degrees while simultaneously banking hard to the right in an uncoordinated manner," the report said. The airplane stalled, rolled right and pitched nose-down. The witnesses said that the wings then were leveled and the pilot appeared to be recovering from the dive and flaring the airplane to land in an open field near the runway. However, the left wing tip struck a large rock and a fence post, and the airplane crashed and was consumed by fire.

"No preimpact engine or airframe anomalies which might have affected the airplane's performance were identified," the report said.

PISTON AIRPLANES

Fuel Exhaustion Leads to Ditching

Beech 18. Substantial damage. No injuries.

The pilot, who had 34,450 flight hours, including 14,150 flight hours in Beech 18s, was hired by the new owner of the airplane to fly it from Antigua to Puerto Rico on Aug. 8, 2006. The airplane had not been flown in 12 years.

"The initial test flight [by the pilot on Aug. 5] revealed some discrepancies, including high fuel pressure on the right engine and a strong smell of gasoline fumes inside the airplane," the NTSB report said. The pilot said that when he returned to conduct the delivery flight, he was told that repairs had been made and that the airplane had received an annual inspection.

The pilot said that he departed with three hours of fuel for the 253-nm (469-km) flight. About 1.5 hours after departure, the airplane was in cruise flight at 6,500 ft, about 40 nm (74 km) from Puerto Rico, when the pilot noticed a strong odor of fuel. Both engines lost power soon thereafter. The pilot turned toward the island of Culebra, Puerto Rico.

"He kept the propellers windmilling while he performed emergency procedures by switching fuel tanks and attempting to restart the engines," the report said. "The pilot noted that he was unable to cross-feed fuel because the valve handle would turn 360 degrees without operating properly. He also noted that there was no fuel pressure, and the fuel gauges indicated empty."

The pilot feathered the propellers and ditched the airplane near the shoreline. Both occupants exited with a life raft before the airplane sank in about 50 ft (15 m) of water.

NTSB said that the probable cause of the accident was "a loss of engine power due to fuel starvation/exhaustion in all engines for an undetermined reason."

Thunderstorm Triggers Control Loss

Piper Aztec. Substantial damage. Three fatalities.

Soon after departing from Abaco Island, Bahamas, the afternoon of June 20, 2005, the commercial pilot obtained an ATC clearance to proceed under instrument flight rules (IFR) to Fort Pierce, Florida, U.S.

The airplane was in cruise flight at 10,000 ft when information about convective activity along the pilot's route of flight was broadcast on the ATC radio frequency. "However, both controllers [who communicated with the pilot] stated that they observed precipitation returns in the vicinity of the airplane's route but never advised the pilot of those observations."

About an hour after obtaining the IFR clearance, the pilot told ATC that the airplane was in severe turbulence and requested help in navigating out of the weather. The controller told him that the airplane was in an area of heavy precipitation and "should be exiting at any moment," the report said. Investigators believe that soon thereafter, the pilot lost control of the airplane, which then struck the water. The airplane and the three occupants were not found. "The pilot and two passengers are presumed dead, and the airplane is presumed to have sustained substantial damage," the report said.

NTSB said that the probable cause of the accident was "the pilot's continued flight into known thunderstorm activity" and that a factor was "the controllers' failure to provide the pilot with [information about] convective intensity."

Loose Fuel Fitting Cited in Engine Fire

Piper Chieftain. Substantial damage. No injuries.

One of the six passengers on the commuter flight noticed the odor of gasoline and smoke as the airplane was being turned onto final approach to land at Elim, Alaska, U.S., the afternoon of May 9, 2005. During the landing roll, the pilot saw a fire in the right engine compartment.

"He pulled the firewall fuel shutoff for the right engine and stopped the airplane," the NTSB report said. The passengers were evacuated, and the pilot and airport personnel extinguished the fire. Examination of the engine revealed that the fire was concentrated around the hydraulic pump, fuel pump and turbocharger. A B-nut fitting on the fuel pump was found loose.

The report noted that the hydraulic pump had been replaced about 31 hours before the accident flight. Maintenance personnel had removed the fuel pump to gain access to the hydraulic pump. "Due to the confined area during the reinstallation of the feeder line to the fuel pump, one mechanic held the line in place and another turned the fitting with a wrench," the report said. "A leak check revealed that the fitting was cross-threaded and leaking. The fitting was retightened and signed off."

NTSB said that the probable cause of the accident was improper installation of the fuel line fitting.

HELICOPTERS

Carburetor Ice Suspected in Power Loss

Robinson R22 Beta. Substantial damage. One serious injury.

The pilot was preparing to return to his home base after providing sightseeing flights for interns at an avian rescue organization near Courtenay, British Columbia, Canada, on June 24, 2005. After starting the engine and re-engaging the clutch, he operated the power plant for about two minutes before takeoff, said the report by the Transportation Safety Board of Canada.

"The pilot lifted off, turned the helicopter 180 degrees to point toward his departure path and raised collective to perform a confined-space takeoff," the report said. About 60 ft AGL, abnormal engine sounds and "an apparent detonation" were heard. The helicopter descended rapidly while turning 270 degrees left and struck the ground.

"The Robinson R22B helicopter's low-inertia rotor design is susceptible to rapid loss of rotor rpm if mishandled, and quick recovery action is required by the pilot," the report said. "In this occurrence, when the engine stopped, there was little airspeed or altitude to be traded for energy to the rotor system."

The report said that the weather conditions, which included a temperature of 19 degrees C (66 degrees F) and a dew point of 12 degrees C (54 degrees F), were conducive to the formation of carburetor ice, which typically is detected by a decrease in manifold pressure and engine rpm. However, the R22B pilot's operating handbook states that these indications might not be noticed because the engine governor automatically adjusts the throttle to maintain constant manifold pressure and rpm.

The helicopter was equipped with a carburetor temperature gauge. The pilot told investigators that he did not recall applying carburetor heat before departure or during the takeoff.

Whiteout Encountered During Air Tour

Bell 206L-1. Substantial damage. Three minor injuries.

The pilot was conducting an air tour on May 31, 2006, over glaciers and mountainous terrain in an area near Juneau, Alaska, U.S., that had fog, whiteout conditions and flat light conditions, the NTSB report said.

The pilot told investigators that he could not see the ground while maneuvering over a glacier. A passenger said that it was "all white" outside when the helicopter struck terrain. The pilot and two passengers received minor injuries; four passengers were not injured.

NTSB said that following a series of similar helicopter accidents, it recommended in 2002 that the U.S. Federal Aviation Administration (FAA) require radio altimeters aboard all commercial, passenger-carrying helicopters operated in areas conducive to flat light and whiteout conditions. The FAA replied that a radio altimeter would be ineffective in preventing such accidents unless it was accompanied by all the other instruments required for IFR flight. NTSB said that the FAA's response was unacceptable and that the recommendation, A-032-35, remained open.

Student Pilot Makes Premature Solo Flight

Robinson R44. Substantial damage. No injuries.

During a training exercise at Denham (England) Airfield on Oct. 16, 2006, the flight instructor briefed the student on engine-start procedures and allowed the student to start the engine while alone at the controls. "The instructor had intended to board the helicopter after the engine was started, and with the rotors running," the AAIB report said.

The student, who had received seven hours of flight instruction in the R44, started the engine without difficulty but continued the "Starting Engine and Run-Up" checklist beyond the point briefed by the instructor. "The final item in the checklist was to set the rotor rpm to between 101 and 102 percent, then lift the collective lever and reduce the rpm in order to check operation of the low-rotor-rpm warning light and horn at 97 percent," the report said. "As the student lifted the collective lever, the helicopter began to move, and the student's response resulted in violent control inputs which led to the tail boom being severed by the main rotor."

The report said that as a result of this accident and a similar accident that occurred in October 2003, the U.K. Civil Aviation Authority added the following requirement, article 50(4), to the Air Navigation Order: "An operator shall not permit a helicopter rotor to be turned under power for the purpose of making a flight unless there is a person at the controls entitled in accordance with article 26 of this Order to act as pilot-in-command of the helicopter." ●

Preliminary Reports

Date	Location	Aircraft Type	Aircraft Damage	Injuries
May 1, 2007	Peterborough, England	Eurocopter AS 355F2	substantial	4 fatal
The helicopter was en route from Liverpool to a private landing area near Peterborough when it struck terrain at 2330 local time.				
May 2, 2007	Atlanta, Georgia, U.S.	McDonnell Douglas DC-10-30	none	306 none
During a flight from Ireland, the airplane was descending to land when the flight crew declared an emergency because of a malfunction of the horizontal stabilizer trim system. The crew had received an out-of-trim warning before the autopilot disengaged and the airplane pitched nose-down. The crew said that a "demanding amount" of elevator back-pressure was required to maintain level flight, but they were able to land the airplane without further incident. Initial examination disclosed a fractured shear pin in the stabilizer chain drive unit.				
May 3, 2007	Dillon, Montana, U.S.	Cessna Citation S550	destroyed	2 fatal
Visual meteorological conditions prevailed when the airplane struck terrain about 1/4 mi (402 m) from the runway during a VOR (VHF omnidirectional radio) approach at 1040. Witnesses heard abnormal engine noises and saw the airplane make several turns of decreasing radius before the accident occurred.				
May 5, 2007	Douala, Cameroon	Boeing 737-800	destroyed	114 fatal
The airplane struck terrain soon after departing from Douala at 0050 for a flight to Nairobi, Kenya. Adverse weather conditions were reported in the area.				
May 9, 2007	London, England	Dassault Falcon 20	none	7 none
En route from Gander, Newfoundland, Canada, the airplane was on approach to London Stansted Airport at 2205 when the crew declared an emergency and reported that the flight controls were locked. The airplane was landed without further incident about 20 minutes later.				
May 10, 2007	Pointe Noire, Congo	Ilyushin IL-76TD	destroyed	none
A fire erupted in the cargo airplane as it was being loaded in preparation for a flight to Brazzaville.				
May 11, 2007	Gulf of Mexico	Bell 206B	substantial	2 minor, 2 none
The pilot said that the helicopter entered an uncommanded descent and began rotating right when he attempted to transition from a hover to forward flight on departure from an offshore platform. He deployed the emergency floats before the aircraft struck the water.				
May 13, 2007	London, England	Boeing 737-800	none	176 none
A partial, temporary loss of flight displays occurred soon after the airplane departed for a flight to Stockholm, Sweden, at 1129. The crew declared an urgency, returned to London Stansted Airport and landed the airplane without further incident.				
May 17, 2007	Walikale, Democratic Republic of Congo	LET 410	destroyed	3 fatal
A fire erupted in an engine soon after departure for a cargo flight to Goma. The crew was attempting to return to the airstrip when the airplane crashed in a forest.				
May 18, 2007	Syracuse, New York, U.S.	Douglas DC-9-31	substantial	99 none
The cabin depressurized as the airplane was climbing through 19,000 ft after departing from Syracuse. The crew diverted to Buffalo and landed without further incident. A 12-in by 5-in (30-cm by 13-cm) tear in the fuselage skin was found forward of the forward cargo door. The preliminary report indicated that the damage may have been caused by a baggage-cart tug.				
May 23, 2007	Warraber Island, Queensland, Australia	Piper PA-32-260	destroyed	4 NA
During a charter flight from Horn Island to Warraber Island, the pilot reported engine problems and subsequently ditched the airplane. The four occupants were rescued by a helicopter crew.				
May 24, 2007	Pampa Hermosa, Peru	de Havilland Canada DHC-6	destroyed	13 fatal, 7 serious
The Twin Otter struck mountainous terrain during a charter flight from Orellana to Pampa Hermosa.				
May 30, 2007	McGrath, Alaska, U.S.	Carvair ATL-98	substantial	2 none
The cargo airplane, a modified Douglas DC-4, crashed while landing with a tail wind on a 4,200-ft (1,280-m) gravel runway.				

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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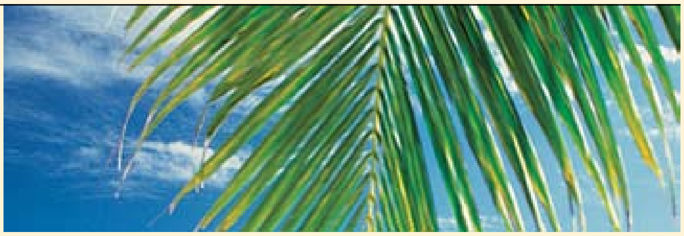

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