AeroSafety WORLD

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THE JOURNAL OF FLIGHT SAFETY FOUNDATION

JUNE 2012

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COMPANY AUTHORITY Gradient

At Flight Safety Foundation, we try to allocate our time to areas where the risk is the greatest, which means that we are spending an increasing amount of our time with smaller operators in high-growth areas around the world. Of course, they have a lot of the challenges you would expect, but a disturbing number of them have a challenge that nobody really wants to talk about. So I guess it is up to me to start the conversation.

The problem is similar to one the industry faced during the 1990s, known as the "cockpit authority gradient." We carefully acknowledged the fact that this had a cultural component that varied in the different regions of the world. We talked about it because it was a big deal and had to be dealt with. Twenty-plus years later, the message has been heard, and to a great extent, that problem is being seriously addressed.

The new and unspoken problem is similar — let's call it the "*company* authority gradient" — and it also has a bit of a cultural component. Here is what it looks like in the real world: A small operator staffed with good people works hard to put the right safety systems in place. But that airline or flight department is run by a new-generation owner, who really has no insight into, or respect for, the integrity of the operation. The airline or corporate jet is just another possession. The owner routinely jumps into the middle of the operation, overrides the operations director, ignores standard operating procedures and regulations, and orders something to happen. To be clear, we are talking about owners who order pilots to overload aircraft, fly with expired licenses, ignore duty-time limits and so on. If a pilot or operations officer disagrees, he or she is fired on the spot and replaced. I hear this story often in Asia, Africa, the Commonwealth of Independent States and elsewhere. It happens every day, and it is getting people killed.

Clearly, this is a tough problem. Manufacturers have a great track record for identifying risk and taking corrective action, but in this case, the risk is the person who signs the checks and buys the airplanes, so it is not realistic to expect manufacturers to use a heavy hand. It would be reasonable to expect the regulator to limit this sort of behavior, but to be honest, these sorts of owners also tend to have massive political influence, and so regulators have plenty of incentive to pursue other priorities. In big airlines, there are corporate governance structures that would limit such transgressions, but those don't apply in some parts of the world or in small, privately held operations.

That leaves us in a pretty tough place. It took decades to convince some captains that they did not have to be all-powerful to be effective, and that seeking advice was not the same as losing face. Now we are faced with the challenge of communicating this same sort of message to some powerful people who don't want advice. Somehow we have to get the message through that the integrity of the operation is a more precious asset than the pretty airplanes that sit on the ramp. This isn't an easy conversation, but it is a conversation that can no longer wait.

William R. Voss
President and CEO
Flight Safety Foundation

AeroSafetyWORLD

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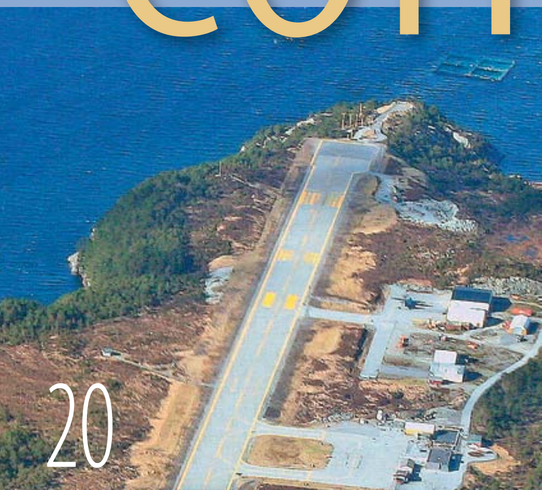

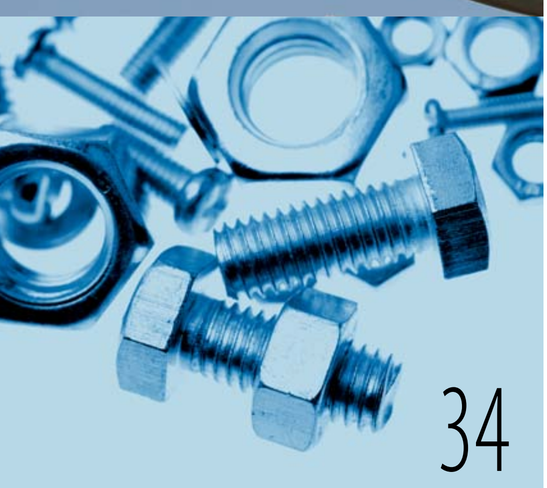

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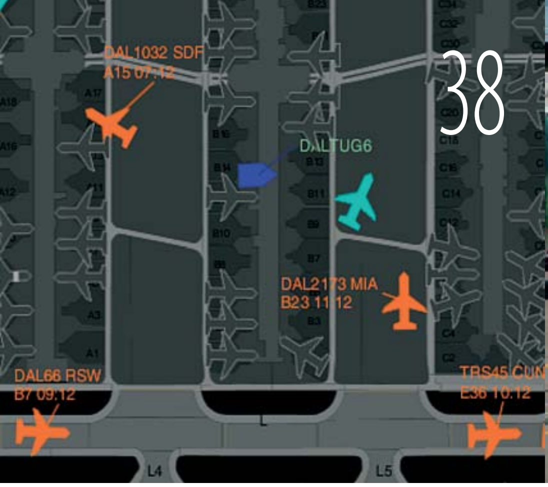

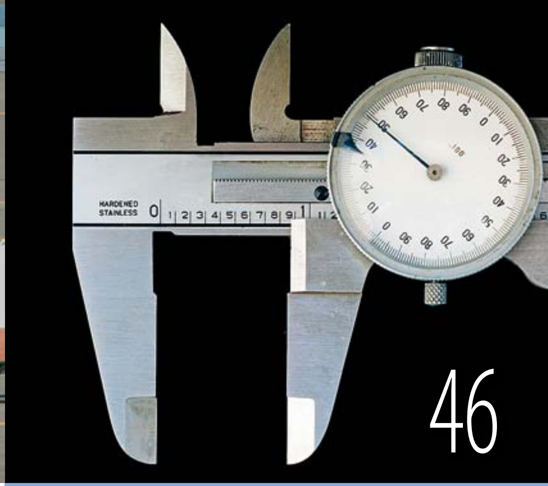

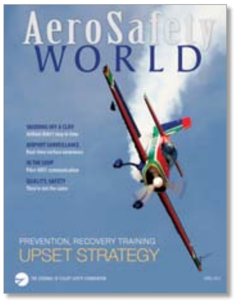

About the Cover
The Extra 300 is among airplanes used in upset prevention and recovery training.
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If you have an article proposal, manuscript or technical paper that you believe would make a useful contribution to the ongoing dialogue about aviation safety, we will be glad to consider it. Send it to Director of Publications Frank Jackman, 801 N. Fairfax St., Suite 400, Alexandria, VA 22314-1774 USA or jackman@flightsafety.org.

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Tragedy in Africa

In the May *AeroSafety World*, we reported on International Air Transport Association (IATA) statistics showing an improved safety picture in Africa. The rate of Western-built hull losses in Africa fell to 3.27 per million flights in 2011 from 7.41 per million in 2010, and the number of accidents for all aircraft types declined from 18 in 2010 to eight last year. Still too many, but a positive move nonetheless. "Good News About Africa," said the headline on p. 49.

Fast forward just a few weeks, and last year's "good news" was pushed aside by two tragedies that occurred in rapid succession. On June 2, a Boeing 727-200 freighter operated by Allied Air ran off the end of the runway after landing at Accra-Kotoka International Airport in Ghana and slammed into a minivan. Twelve people on the ground were killed, including 10 in the minivan, which was being used as a taxi.

One day later, a Dana Air McDonnell Douglas MD-83 with 153 passengers and crew crashed into a residential area near Lagos-Murtala Muhammed International Airport in Nigeria after the pilot declared an emergency during the short flight from Abuja to Lagos. Everyone aboard was killed, as were a number of people on the ground. Video of the smoldering wreckage dominated television news programming for at least 24 hours after the crash.

It's much too early to know the cause of either accident, but there are some important factors to be considered. First of all, as IATA CEO Tony Tyler said in remarks prepared for delivery at the IATA Annual General Meeting in Beijing, "As the two tragic accidents earlier this month in Africa reminded us, safety is a constant challenge."

Tyler went on to say that the industry's safety achievements are not distributed evenly across all regions and that "it is our duty as an industry to ensure that flying is safe everywhere." We at Flight Safety Foundation are trying to do our part by spending our time and resources in areas of the world where the Foundation is needed the most, and numerous other organizations are taking the same approach. It is incumbent upon the companies and countries with the most expertise and experience to see that their knowledge is spread around the world.

Also important is the recognition that, despite recent events, real progress is being made in Africa in terms of safety, albeit perhaps not uniformly across the continent. Despite the tragedy in Lagos, Nigeria is one of those countries where progress is apparent. Within days of the accident, the Foundation and President and CEO Bill Voss, along with IATA's Tyler, released a statement in support of the Nigerian Civil Aviation Authority and its director general, Harold Demuren, who recently was named by the International Civil Aviation Organization as chairman of the Regional Aviation Safety Group for Africa.

Of Nigeria's CAA and Demuren, a member of the Foundation's Board of Governors, Voss said: "Since 2006, we have seen the creation of an autonomous civil authority that has been immune from political interference in Nigeria. Aggressive steps have been taken to build a capable and competent civil aviation authority."

Here's hoping the Nigerian Accident Investigation Bureau can get to the bottom of this month's tragedy professionally and accurately, that its findings help advance the industry's safety record and that the country's CAA is allowed to continue to develop, free from political interference.

Frank Jackman
Editor-in-Chief
AeroSafety World

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

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FSF Board of Governors

Continuing with the theme of change at the Foundation, which I have covered in the last few issues of *ASW*, the size of the Board of Governors has been undergoing a thorough review since May 2011. Our Board comprises 44 positions with authorization for up to 50. The original intent was to have global representation that would bring an international viewpoint and opinions to Board meetings. However, it became evident to Board members that the Board was too large and a more manageable number would move the Foundation forward.

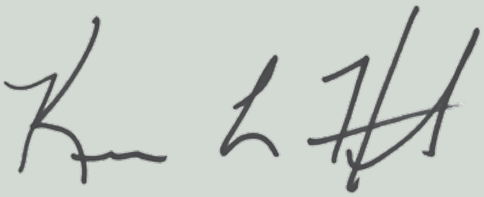
The chairman of the Nominating and Governance Committee, William (Bill) McCabe, was tasked by the chairman of the Board, Lynn Brubaker, to come up with a transition plan to scale down the size of the Board. Bill, with other members' input, launched a plan last May to "right size" our Board. Now this was no easy task! It was determined that: (a) the Board structure would represent the global community that the Foundation serves, with a particular focus on areas of greatest need; (b) it would enable the Foundation leadership to pursue its mission with clear supportive guidance, knowledgeable oversight and the room for initiative; and (c) the structure would afford each Board member the opportunity and accountability to meaningfully contribute to the Foundation's success.

One year and many telephone calls and emails later, the authorized size of the Board was set at 30. Ten regions — Africa, Australia-New Zealand, the Commonwealth of Independent States, Europe, Latin America, Middle East, North America, North Asia, South Asia, and Southwest Asia — will be represented, and several Board members graciously agreed to step down so that Board representation could be more evenly distributed across the regions.

Within the Board will be a smaller contingent known as the Foundation Governance Council. Its 11 members will include the chairman, chair-elect, past chair, FSF president/CEO, treasurer and chair of the Audit-Finance Committee, lead governor of initiatives oversight, lead governor of inter-regional affairs, lead governor of business segments, chair of the Compensation Committee, chair of the Nominations/Governance Committee, and general counsel/secretary. They will provide oversight governance of Foundation business matters and staff.

I would like to recognize those Board members who have stepped down. All of them have been dedicated and have contributed to the work of the Foundation. They are Bob Aaronson, Victor Aguado, Mohammed Berenji, Jens Bjarnson, Ed Bolen, Manfred Brennwald, Carol Carmody, Jim Coyne, Don Gunther, John Johnson, Gen. Abdel Kato, John O'Brien, Nick Sabatini, Lou Seno, Ken Smart, Don Spruston, Mike Sweeney, Ray Valeika, Bob Weatherly, Michel Wachenheim, and Henk Wolleswinkel. I want to express on behalf of the staff our gratitude for their help and insight on the many projects and ideas they have provided to us along the way.

One final note: Foundation Governance Council positions are not paid. All of the past and current members deserve recognition for their support in the past and their vision for the future — particularly Bill McCabe.



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

Objections to Accident Report

This refers to the article "Spiral Dive," written by Mark Lacagnina, in the March 2012 issue of *AeroSafety World*. Ethiopian Airlines would like to express its deepest disappointment with the misconception and fallacies presented in the article based on a very controversial and one-sided report published by the Lebanese Ministry of Public Works and Transport in relation to the Ethiopian Airlines Flight 409 accident.

It is our firm belief, and we hope you will agree, that balance and accuracy are of paramount importance in the preparations leading to the dissemination of such a sensitive matter to the public. We are greatly saddened with the inaccuracies and the lack of fairness and balance reflected in this particular article.

The so-called investigation report contained numerous factual inaccuracies, internal contradictions and hypothetical statements that are not supported by relevant evidence. It didn't include the crucial evidence for investigation such as the recovery of the wreckage, security footage, autopsy and toxicological records, baggage screening X-ray records, terminal CCTV [closed-circuit television] records, and examination of the victims' bodies before burial. Accordingly, Ethiopian Airlines had already expressed its strong opposition to the investigation report released by the Lebanese Ministry of Public Works and Transport. We have enclosed comments made by the Ethiopian Civil Aviation Authority on the investigation report for your review.

The purpose of this letter is to provide you with vital information related to the ET 409 accident and, most importantly, to enable the truth to emerge about the probable cause of the accident. By doing so, our objective is to contribute to the enhancement of international aviation safety.

Therefore, we kindly request that you reflect our objection regarding the investigation process of ET 409. It is information of profound importance which our customers throughout the world have an inalienable right to know, and its release will unquestionably acknowledge the professional act of honesty and integrity of *AeroSafety World* magazine.

Tewolde Gebremariam
CEO, Ethiopian Airlines

The editor replies: *Standard procedure here is to base articles about accidents/incidents on the official final reports — in this case, the final report published by the Lebanese Ministry of Public Works and Transport. The report did not include the comments submitted by the Ethiopian Civil Aviation Authority (CAA), a party to the investigation, which said that the accident investigation was "guided and monitored to prove and justify" speculative public statements by government officials about the causes of the accident before the investigation was begun. Rejecting the Lebanese report's conclusion that "inconsistent flight control inputs" by the flight crew led to a loss of control of the Boeing 737 on departure from Beirut, the CAA said that recorded flight data, air traffic control data and witness accounts show that "the most probable cause of the accident … was the breaking-up or disintegration of the aircraft as a result of an explosion in the air at 1,300 ft because of a possible shoot-down, sabotage or lightning strike." An executive summary of the CAA's comments is available at <www.mfa.gov.et/Press_Section/ExecutiveSummary.pdf>.*

Who Makes SMS Difficult?

I would like to share with you my perspective on William Voss's article, "SMS Reconsidered" (*ASW*, 5/12, p. 1).

I have great respect for Flight Safety Foundation and Mr. Voss. I agree in principle with the comments made by Mr. Voss in this article, but would like to elaborate on a couple of key points.

In the opening paragraph, the following two comments are exactly on target but there is more here than is evident on the surface.

> *"We also knew that all these consultants couldn't possibly know much about the subject and would be forced to regurgitate the ICAO guidance material that was being put out."*

Our industry does not have a requirement for certification of safety personnel. In the absence of organizational guidance or certification, it's not hard to understand that anybody can, and will, slap their logo on the same old "me too" acceptable means of compliance published by regulators and industry organizations.

> *"It was obvious that the process people dealing with ISO and QMS would embrace the concept of SMS and treat it as another process exercise."*

Business processes are both important and useful. The problem with the aviation SMS process is twofold:

1. Business aviation, in particular, is relegated to applying business processes designed for other industries due to the lack of a solid aviation process framework.

2. Many operators start out with the "me too" templates and skip the most important part of designing a proper SMS — defining their system, identifying their hazards, and setting quantifiable goals.

I discuss this problem in my blog post titled: "I have an SMS, now what do I do with it" <airsafetygroup.com/i-have-an-sms-now-what-do-i-do-with-it>.

In the second paragraph, the comment, "They are reassured by the fact that all they really have to do is fill out the right form and show up at the weekly meeting" is correct in its assessment of what's happening, and is so very wrong, with regard to SMS process.

Most operators have a stack of useless reports that don't measure anything of value. These operators skipped the step of identifying their actual issues, setting quantifiable goals, developing mitigation, measuring and tracking.

In the third paragraph, the comment, "Before SMS was made complex by the consultants and process people, it was meant to do one simple thing — allocate resources against risk" is a little misdirected. Have a look at FAA Advisory Circular 120.92A, "Safety Management Systems for Aviation Service Providers," and tell me again who makes the process difficult. Without picking on the consulting industry, I will give you this: The lack of useful or understandable information from the civil regulatory agencies and aviation organizations allowed operators to be frightened into doing something, even if it was wrong. That being said, again, anybody can sell SMS, and they do. It is not necessary to understand either the SMS or ISO process to sell "me too" templates to unsuspecting operators who are trying to do the right thing.

The closing questions posed by Mr. Voss are exactly correct, but let me put the SMS process spin on them:

- "What is most likely to be the cause of your next accident or serious incident?" (Have you identified your hazards and developed a risk profile?)

- "How do you know that?" (Are you collecting hazard information and are you analyzing it for potential outcomes and severity?)

- "What are you doing about it?" (First, what do you want to do about it [goals], then have you developed mitigations/corrective actions?)

- "Is it working?" (Are you tracking your results?)

Answering these questions requires factual information, which can only be obtained through a structured, repeatable process.

In closing, there are two obstacles standing in the way of effective implementation of an aviation SMS:

1. Translating the academic hypothesis and terminology into easily understandable requirements and breaking the risk analysis process into steps that make sense to our everyday operations.

2. Making the paradigm shift from "check this — done," to "what do I need to do to solve my problem?"

Thank you.

Jeff Whitman
Air Safety Group
Manchester, Michigan

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

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

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

JULY 10–12 ➤ Basic Introduction to SMS. CAA International. London Gatwick. <training@caainternational.com>, <bit.ly/KK8chm>, +44 (0)1293 768700.

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

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

JULY 9–20 ➤ Aircraft Accident Investigation. Southern California Safety Institute. San Pedro, California, U.S. <registrar@scsi-inc.com>, <www.scsi-inc.com/registration.php>, 800.545.3766, +1 310.517.8844, ext. 104.

JULY 12 ➤ Evolution of Safety Through Pilot Training. Air Line Pilots Association, International. Washington. <pilottrainingconference.alpa.org>, +1 703.689.2270.

JULY 16–18 ➤ SMS Principles and Evaluation. Continuous Safety. Zurich. <sms@mycs.it>, <www.mycs.it>, +41(0)81 826 51 52.

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

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

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

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

Safety News

Lightning Strike Data

Pilots and air traffic controllers should have access to more up-to-date information on lightning strikes, the U.S. National Transportation Safety Board (NTSB) says in a safety recommendation that calls on the U.S. Federal Aviation Administration (FAA) to study the technical feasibility of accomplishing that goal.

The NTSB cited several recent accidents and incidents, noting that "total lightning" detection networks — those that detect both cloud-to-cloud lightning and cloud-to-ground lightning — can help predict areas where lightning may exist along planned flight paths.

"Because lightning detection networks operate independently of weather radar systems, their coverage areas complement each other and lightning information may indicate the presence of thunderstorms outside the range of ground-based weather radar systems," the NTSB said. "Therefore, lightning information may be critical for thunderstorm identification in regions of the National Airspace System where weather radar data are unavailable."

In its safety recommendation letter to the FAA, the NTSB cited several lightning-related events, including an American Eagle Embraer ERJ-145LR's encounter with severe turbulence on June 28, 2010, while at 38,000 ft over Pioneer, Louisiana, U.S. A flight attendant and one of the 42 passengers were seriously injured, and three other passengers received minor injuries.

The NTSB investigation revealed that air traffic controllers had not told the pilots that they were about to fly into an area of heavy precipitation, which appeared on the airplane's weather radar display about 20 seconds before the encounter. The controllers said that their weather display showed no precipitation.

Data from a total lightning detection network, however, showed "substantial lightning activity" at the accident site; the lightning was "a strong indication of the presence of a thunderstorm immediately in front of the airplane," the NTSB said.

© Дмитрий Буянский/iStockphoto

The captain said that, if he had known about the thunderstorm, he would have asked controllers for a course change.

The NTSB recommended that the FAA "study the technical feasibility of presenting, through the use of the weather and radar processor system or other means, real-time total lightning data on controller displays."

Another recommendation called for incorporating "real-time total lightning data into the products supplied to pilots through the flight information services–broadcast data link."

TSB Complains of Safety Delays

Significant delays in action on aviation safety recommendations are hindering the strengthening of safety in Canada, the Transportation Safety Board of Canada (TSB) says.

The TSB, in its annual assessment of responses to its safety recommendations, said that only one recommendation dealing with aviation safety received a "fully satisfactory" response.

In the cases of 32 other active recommendations, there is "significant room for improvement," the TSB said.

Bill Fawcett/Wikimedia

The TSB noted, however, that "since 2000, the board has made five recommendations aimed at enhancing crew resource management, which have just recently received TC's [Transport Canada's] priority status."

In addition, the TSB said it was pleased by a TC project to take quick action on four recommendations made in 2011.

"Every year, we take stock of whether improvements have been made and what still needs to be done to address important safety issues," said TSB head Wendy Tadros. "This year, there is some progress, and that is encouraging, but in many areas, we still see safety risks, risks that will persist until concrete action is taken."

Dennis Fitch

Dennis E. Fitch, who, as an off-duty United Airlines captain, helped land a crippled McDonnell Douglas DC-10 in Sioux City, Iowa, U.S., after a catastrophic engine failure and loss of hydraulic flight control systems, died May 6. He was 69.

A DC-10 instructor pilot, he was aboard the airplane as a passenger on the July 19, 1989, flight. He operated the throttles of the nearly uncontrollable DC-10 throughout much of the makeshift approach.

The crash landing killed 111 of the 296 people aboard, and 47 people were seriously injured. Afterward, many in the industry said the fact that anyone survived was a tribute to the crew's extraordinary airmanship.

Fatigue Warnings

The U.K. Parliament's Transport Committee is criticizing flight time regulations proposed by the European Aviation Safety Agency (EASA) as a "lowest-common-denominator approach to safety" that does not measure up to existing U.K. requirements.

The EASA proposal must be improved, "or safety could be at risk," the committee said in documents issued in late May.

The EASA proposal, introduced in December 2010 and revised earlier this year, was intended to introduce new flight and duty time limits and to harmonize those limits throughout the European Union. Current limits in the U.K. are generally more stringent than those being considered by EASA, the Transport Committee said.

"MPs [members of Parliament] accept that common European flight time limitations could improve aviation safety for U.K. passengers travelling on non-U.K. airlines," the committee added. "However, for these benefits to be realized, the European standards must be uniformly high."

Committee Chairwoman Louise Ellman said members of Parliament were especially concerned about several items, including the proposed 11-hour maximum nighttime duty period, which "flies in the face of scientific evidence" and should be reduced to no more than 10 hours.

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In addition, under some circumstances, the proposed rules would allow pilots to work very long duty periods and, for example, would not preclude a pilot from landing an airplane after being awake for as long as 22 hours, Ellman said.

"The Civil Aviation Authority must do more to monitor pilots so that long duty periods are the exception, not the rule," she added. "And we are also concerned about a culture of underreporting of pilot fatigue."

Ellman said the EASA proposals should be revised before the British government commits itself to their adoption.

Proposed Penalties

The U.S. Federal Aviation Administration (FAA) has proposed $445,125 in civil penalties against Horizon Air for its alleged operation of a Bombardier Dash 8-400 on 45 flights while it was not in compliance with an airworthiness directive requiring inspections of engine nacelle fittings.

The flights occurred in March 2011.

The FAA also proposed $395,850 in civil penalties against US Airways for allegations that it violated hazardous materials regulations in 2010 by accepting an undeclared shipment of 10 disposable cigarette lighters filled with flammable gas and an improperly packaged shipment of alkali-filled wet cell batteries.

The agency proposed a $210,000 civil penalty against Alaska Airlines for an alleged failure to comply with deactivation procedures during maintenance on 10 dates in 2010 and 2011.

Each airline was given 30 days to respond to the allegations.

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STC Compatibility

Citing the fatal crashes of two small twin-engine airplanes, the U.S. National Transportation Safety Board (NTSB) is calling for the development of guidelines to ensure that every time an aircraft is equipped with a supplemental type certificate (STC) modification, it is compatible with others that may have been installed before it.

"The installation of multiple STCs is becoming more prevalent in general aviation aircraft," the NTSB said. "There are likely many aircraft that are flying with multiple STCs for which the interrelationship may not have been properly evaluated by the installer."

The agency's safety recommendation letter noted two fatal accidents in 2010 — involving a Cessna T337G Skymaster and a Beech 58 Baron — that killed a total of seven people. In each case, the NTSB cited multiple STCs and a "lack of guidance by the [U.S.] Federal Aviation Administration for multiple STC interaction evaluation."


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Crisis Management

Representatives of the European aviation industry attended a Eurocontrol crisis management workshop aimed at enhancing the industry's response to situations such as ash-spewing volcanic eruptions, nuclear emergencies and the uncontrolled re-entry into earth's atmosphere of space satellites.

Representatives of more than 30 nations and expert organizations attended the May session in Brussels, Belgium.

"Delegates discussed lessons learned from the ash crises in 2010–2011 and how these could be applied to other events with a network-wide impact," Eurocontrol said. "They talked about the responsibilities of various actors involved, in particular that of the [air traffic control] network manager and [European Aviation Crisis Coordination Cell, which supports the network manager], which they agreed is a strategic and political layer to help in coordinating a response to a major crisis."

Fatigue Proposal in Australia

The Australian Civil Aviation Safety Authority (CASA) has proposed new rules to manage pilot fatigue.

CASA's graduated approach would allow operators engaged in aerial work to choose basic flight and duty time limitations of no more than seven hours of flight time and eight hours of duty time a day, while those engaged in more complex operations could operate under more detailed rules that consider time zone changes, split duty periods, augmented crew and overnight operations.

"These operators would have the flexibility needed for the demands of daily operations, such as passenger transport, while safely managing fatigue," CASA said.

The largest airlines would be required to adopt a fatigue risk management system, which uses scientific principles to identify fatigue hazards and provides for continuous monitoring.

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"Under the proposed new rules, the shared responsibilities of both air operators and flight crew in the management of fatigue risk are clearly defined," CASA said. "Flight crew would be required to use off-duty periods to obtain enough sleep, to use in-flight rest appropriately and to disclose anything that may prevent them from meeting applicable fatigue risk management policies and limitations. Operators would be required to provide flight crewmembers with sufficient time away from work to enable restorative rest and sleep."

CASA is accepting comments on the proposals through June 12.

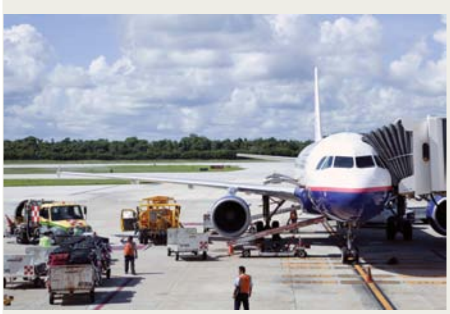
Cooperation on the Ground

The International Air Transport Association (IATA) has endorsed the creation of a ground handling council to encourage cooperation in a variety of areas in ground operations, including safety initiatives.

The council will consist of 20 representatives of airlines and ground services providers and will report to the IATA Operations Committee.

Related initiatives will involve the linking of several key data sources "to facilitate data-driven decisions to improve safety performance and reduce ground damage," IATA said.

In addition, IATA said it will promote "greater regulatory acceptance and utilization" of the IATA Safety Audit for Ground Operations and the *IATA Ground Operations Manual.*



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"Through renewed commitment to working together, taking a risk-based and data-driven approach, aviation stakeholders and regulators can improve safety and reduce the cost of ground damage, which is estimated in the billions of dollars annually," said Guenther Matschnigg, IATA senior vice president for safety, operations and infrastructure.

In Other News …

The U.S. Federal Aviation Administration (FAA) says it plans to reexamine its recently announced rule on **pilot fatigue**, especially the exclusion of cargo pilots from flight and duty time limits and rest requirements. … The U.K. Civil Aviation Authority (CAA) has delayed until September the introduction of new European Aviation Safety Agency **pilot licenses** for U.K. pilots. The delay from the planned July date was a result of "the complexity of the transition to the new license format," the CAA said. … The U.S. Federal Aviation Administration has directed its investigators and lawyers to "pursue the stiffest possible sanctions" against people who intentionally point laser devices at aircraft. Some 3,592 **laser strikes** were recorded in 2011, up from 2,836 in 2010.

Compiled and edited by Linda Werfelman.

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In a hard-won consensus, about 80 international specialists from 45 organizations have identified "critical" knowledge, skills and attitudes that professional pilots must have to prevent airplane upsets — their primary goal — and to recover from an inadvertent upset. In laying out a rational plan for pilot training, their evidence-based work and expertise have been a stabilizing influence in the wake of high-profile loss of control–in flight (LOC-I) accidents, several representatives told the World Aviation Training Conference and Tradeshow (WATS 2012) in April in Orlando, Florida, U.S.

This work group — the International Committee for Aviation Training in Extended Envelopes (ICATEE) of the Royal Aeronautical Society — currently is completing the last of several near-term deliverables to the global aviation community, specific civil aviation authorities and the air transport industry, according to Bryan Burks, a captain for Alaska Airlines and ICATEE member. He also is the vice chairman of the National Training Council of Air Line Pilots Association, International (ALPA) and ALPA representative to the Royal Aeronautical Society's Flight Simulation Training Device International Working Group.

"For too long … we [as an industry] assumed that when we hire pilots with an ATP [airline transport pilot] certificate, they will come with the requisite knowledge and skills when it comes to aerodynamics," Burks said. "ICATEE [identified] a training gap; that that is not the case [*ASW,* 10/11, p. 36]. Hopefully, licensing requirements in the future will assure that an ATP license means something more. But in the meantime, the operator should probably [address] that deficit."

ICATEE has developed a strategy for *graduated* — that is, one step at a time in a building

Global strategy envisions training all air carrier pilots in airplane upset prevention and recovery.

Graduated Approach

BY WAYNE ROSENKRANS | FROM ORLANDO

block approach — implementation of enhanced upset prevention and recovery training (UPRT) that can be supported by the existing pilot training infrastructure.

"Enhanced, integrated UPRT contains three primary elements: academics, on-aircraft training at the [commercial pilot] licensing level [and] the appropriate use of flight simulation training devices [FSTDs]," he said. "[On-aircraft training] would be in an all-attitude, all-envelope, aerobatic-capable aircraft with a trained instructor early in a professional license scheme. … ICATEE also has identified opportunities to enhance FSTDs to provide UPRT." The on-aircraft element would be a UPRT endorsement to a commercial pilot certificate.

Current proposals call for upset prevention and recovery training in all-attitude, all-envelope airplanes (left) at the commercial pilot licensing level and in flight simulation training devices (above) at defined intervals throughout the careers of airline transport pilots.

For FSTDs, the work group advocates and recommends enhanced aerodynamic (or *aero*) models beyond the normal envelope, new/improved tools for feedback to instructors and pilots in post-flight briefing, and significantly improved UPRT motion and buffet cues. "These will happen in the future … in a way that the industry can adopt in an organized fashion — and control the quality and, most importantly, the instructor qualifications," Burks said. "We've made some strong recommendations on how instructors should be qualified for the on-aircraft training aspect and for flight simulators. … [We also advocate] a gradual implementation of these requirements."

Exposure of pilots to the actual threat environment helps to develop habitual responses to incipient conditions and confidence in their ability to respond correctly to upset situations, said Sunjoo Advani, chairman of ICATEE. "There is no single tool for providing the optimum solution; we must integrate several tools," he said. "If pilots have the knowledge, if they have the capability, that is one thing. But being put into that threatening environment is very important."

Specifically, ICATEE concluded that the inadequate training environment has been based on several assumptions, which in turn became limitations to how the industry provided training to prevent upsets and respond to LOC-I. "[The industry] had assumed that the aircraft is in a normal operational envelope in a non-agitated flight condition," Advani said. "We also had assumed that situational awareness and information can be accurately correlated by the pilot with respect to the observed flight condition. … And we assumed that the handling skills that are taught during licensing are suitable and adequate to resolve the [potential upset] situation."

In the academic arena, ICATEE members have been updating, augmenting and adapting to current instructional media the *Airplane Upset Recovery Training Aid, Revision 2.* "We wanted to refresh the [training aid in October 2012] by looking at its limitations," Advani said. "Our new training manual, based on the [training aid], will include sections for pilots, instructors, training providers and regulators [that will be] very usable and user-friendly when implemented into training programs."

Notably, the training manual also will furnish examples of negative training to help airlines and other simulator training providers anticipate FSTD limitations as they implement UPRT scenarios. Every UPRT event recommended for initial and recurrent pilot training will have a dedicated instructor manual, the presenters said.

A substantial number of the pilot-track session attendees raised their hands when Advani asked if they were familiar with the current training aid and had used it in their training programs. ICATEE also has concentrated on breaking content into parts that are easier to absorb and is seeking to officially incorporate the manual into standards and recommended

Alaska Airlines Shares Voluntary UPRT Initiatives

Alaska Airlines has developed web-based and prototype Apple iPad-based courseware among other "very viable" ways to help line pilots to internalize academic content for airplane upset prevention and recovery training (UPRT), says Bryan Burks, a captain for the air carrier.

One of the airline's assumptions is that the timing, complexity, rate and amount of training have to be considered against the reality that line pilots sometimes can be "inundated" by academic study assignments. "The whole idea is to have retention of the requisite knowledge that we need to operate safely," Burks said.

Related work has focused on UPRT instructor pilot standardization and qualification. "[We] have the benefit of at least 12 of our check airmen and flight managers [including the director of training] having been through Calspan Corp. [advanced maneuvering and upset recovery program] in their Learjet in-flight simulator or APS Emergency Maneuver Training all-attitude, all-envelope UPRT training in an Extra 300," Burks said.

The flexibility of the airline's advanced qualification program (AQP) for pilots, with oversight by the U.S. Federal Aviation Administration, has enabled the introduction of a 12-month UPRT cycle that includes a one-day "classroom interaction" about aerodynamics and airplane upset. "We're going to tie in the academics, and, more importantly, we are going to have specific targeted training elements for the [flight simulation training device (FSTD)] pre-briefing and post-briefing, in which the instructor will assess the knowledge of the students," he said.

The flight operations training manual developed also details how UPRT is to be conducted in FSTDs. For the 2012 cycle, the manual specifies a nose-high upset event at high altitude.

The airline has focused intently on standardization of UPRT training in FSTDs partly because of the challenge of avoiding negative training. Burks gave an example of abandoning a proposed, internally developed UPRT scenario expected to be compatible with built-in, preselectable functions of its Boeing 737-800 FSTD instructor operating stations. The plan was to show simulated traffic on the traffic-alert and collision avoidance system and enable the flight crew to "envision flying into the wake behind a heavy large aircraft, and getting into a wake vortex," he said. In the scenario, the instructor suddenly slews the airplane to a pitch-up attitude followed by a rolloff.

"Unfortunately, because we did not understand the limitations of the device, we ended up with negative training," Burks said. The FSTD's instant pitch-up to about 25 degrees in reality would cause structural damage to the tail. Moreover, after a roll to about 110 degrees, when the pilot attempted to intervene with aileron and recover from the upset, nothing happened. "The simulator [had a] 'washout' — like an aerodynamic reset or reslew — so for about four seconds, no flight control inputs by the pilots were honored or recognized," he recalled.

— WR

practices endorsed and/or required by the International Civil Aviation Organization (ICAO).

On-Airplane Rationale

The idea of conducting UPRT training for the current population of airline pilots in small all-attitude, all-envelope airplanes has been controversial. In the 2012 update on its work, ICATEE has been more specific and realistic about targeting this element to generations of pilots coming into the profession.

"The airplane is really the place where we can provide the psychological component, the physiological component, g-awareness [actual gravitational acceleration] and an accurate recovery environment," Advani said. "If pilots haven't been exposed to it, and they encounter an upset — even though it may be rare — they may end up applying the wrong control strategies and make the situation worse. … We realize we cannot take a transport category aircraft and start doing training on upsets. On a voluntary basis, [airlines also could provide UPRT flight training in an all-attitude, all-envelope airplane], and I think that improves pilot skills. However, we have to concentrate on the future. … So we need integration of the use of aerobatic-capable aircraft, qualified [UPRT] instruction [and] appropriate [and] better use of today's FSTDs."

The industry can enhance feedback through use of better instructional tools and information in FSTDs. "In the future, we can look toward improving simulation fidelity through better aero models and … feedback tools, such as informing the pilots where they are with respect to the validated envelope," Advani said. "If they exceed the envelope, the instructor should have the ability to tell the pilot, 'We have gone beyond the bounds of what is known.'

"We also want to see if the pilots have exceeded the structural limitations of the [real] aircraft [because] incorrect control inputs can be devastating." Methods tested as effective include displaying color-coded aerodynamic diagrams in the instructor operating station alongside replays of the pilot's control inputs with animation software. The instructional tools described have been designed to provide instructors more accurate situational awareness and a "powerful new way of providing UPRT feedback to pilots while avoiding negative training," he said.

Deliverables Arriving

The list of ICATEE deliverables comprises tasks accomplished, several with 2012 target dates. So far, ICATEE has presented its recommendations to the U.S. Federal Aviation Administration (FAA), the FAA-Industry Stall–Stick Pusher Working Group, the Adverse Weather Working Group and the Loss of Control Aviation Rulemaking Advisory Committee.

Proposed language was delivered in January in an executive level recommendation to ICAO for an amendment stating that UPRT "shall be conducted." "In [ICAO's] *Procedures for Air Navigation–Training* document, there will be references [submitted in October 2011] that refer to our training manual, which is scheduled for delivery to ICAO later this year, as well as the UPRT component for simulator documents such as [ICAO Doc 9625]," Advani said. Anticipated products include a report in mid-2012 from ICATEE's research and technology group to the Royal Aeronautical Society and a revision to the International Air Transport Association's FSTD data document.

Toward FSTD Stall Realism

ICATEE now considers the prospects of expanding the aero model used in simulators to be favorable for several reasons and will continue to pursue that objective, Burks said. He cited recent demonstration by Boeing Commercial Airplanes of a prototype enhanced aero model that would help commercial aviation to conduct aerodynamic stall training.

"[Today's model] is very good up to approach to stall, to the critical angle-of-attack," he said. "After that, there are [not enough] flight test data from the manufacturers that provide a good model to do training in the device. … An aerodynamic stall — for a swept-wing, transport category jet — is a place pilots don't want to be. Unfortunately, if a crew gets to the aerodynamic stall in most simulators today, it is a very benign representation. It does not look very much different than the approach to stall. So if they haven't actually stalled an airplane since they were in a Cessna 152 25 years ago, pilots have this false or benign sense of the aircraft performance. In an approach to stall, the aircraft still has airflow attached to the wings, and it is still somewhat controllable; it is in a decayed state, it has less margin, but it is controllable."

A simulator's stick shaker activates at about 5 nm (9 km) on final approach.

Adapted by Susan Reed from a video presented by Capt. Paul Kolisch, Pinnacle Airlines

Advani noted, "What we have to teach is not the actual flight dynamics in that stall — how to fly in that region — but how to immediately recognize [the situation] and recover. The most important thing [is] how to avoid it and, if [they go] there, to get out as quickly as possible. … We're looking at how we can incorporate today's high-fidelity models that go up to the top of the [lift curve slope] with, perhaps, lower fidelity or representative models that simply teach the skills necessary for the recovery from upsets."

From experience supporting military FSTDs, aircraft manufacturers have a wealth of knowledge and can deliver very accurate engineering data, Burks said. "We are excited because they're going to bring that capability into the civil market now," he said. "The bottom line is we hope to have a good platform to introduce aerodynamic stall training to pilots and show them the marked difference between approach to stall and aerodynamic stall. This is going to enhance pilots' … upset prevention through avoidance, recognition and awareness."

Essential Refreshers

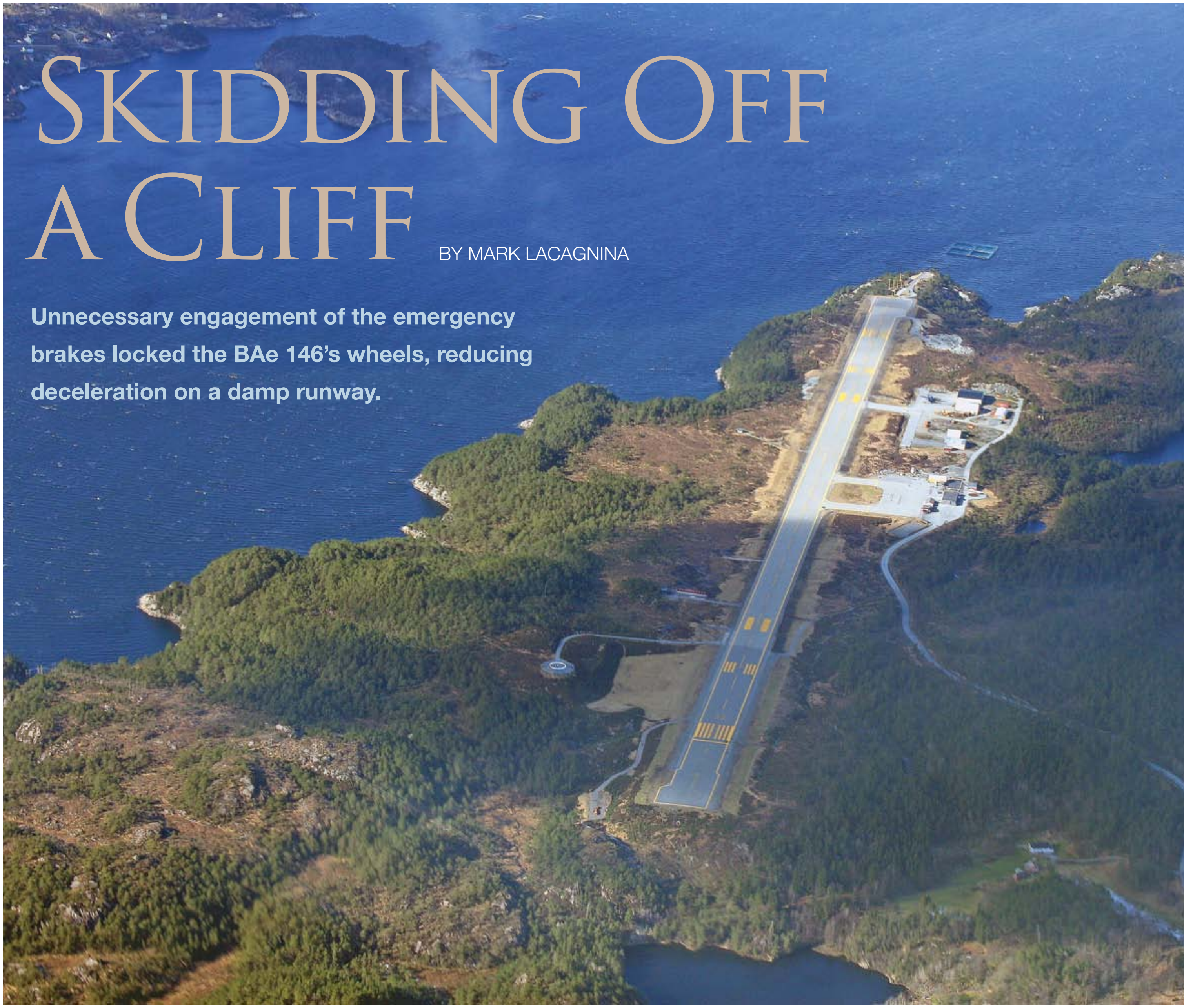
UPRT is not a one-time inoculation. "These are perishable skill sets," Burks said. "[At Alaska Airlines,] we believe that we need to revisit [UPRT] on an annual basis. After the skill sets are developed, we want to measure the effectiveness of the prevention strategies. So, eventually, after we gain exposure and develop the skill sets in the maneuver-based training, we want to validate that training by giving our pilots these events in a true surprise scenario." The objective is to apply prevention skills, not recovery skills, in those events.

To read an enhanced version of this story, go to <flightsafety.org/aerosafety-world-magazine/june-2012/upset-mitigation>.

Skidding Off a Cliff

BY MARK LACAGNINA

Unnecessary engagement of the emergency brakes locked the BAe 146's wheels, reducing deceleration on a damp runway.



An "unacceptable combination" of airport, aircraft and operational factors led to the overrun of a British Aerospace BAe 146-200 at Stord Airport, said the Accident Investigation Board Norway (AIBN). The small, four-engine jet hydroplaned off a damp runway and plunged down a steep cliff, killing three passengers and a cabin crewmember, and seriously injuring three passengers, another cabin crewmember and both pilots. Six other passengers escaped the Oct. 10, 2006, accident with minor or no injuries.

In a final report issued in April, the AIBN said that the aircraft's spoilers failed to deploy after touchdown, and the flight crew misinterpreted the consequent absence of expected deceleration as a fault in the wheel brake system. They responded, according to procedure, by applying the emergency brakes, which, without anti-skid capability, locked the four main wheels. There were no grooves in the runway

Had the runway end safety area been 50 m longer, the overrun might not have occurred, investigators said.

to decrease its surface slickness, and friction between the motionless tires and the pavement heated the thin layer of moisture into steam, melting the rubber in a process called *reverted rubber hydroplaning*. The aircraft skidded sideways off the end of the runway at 15 to 20 kt. The exit speed might have been slow enough to bring the aircraft to a halt *if* the paved safety area between the runway and the precipice had been just 50 m (164 ft) longer — in conformance with new Norwegian standards. The aircraft caught fire when it came to an abrupt stop at the bottom of the cliff. "The fire spread so fast that there was not enough time for everybody to evacuate the aircraft," the report said.

The flight crew had followed their training in responding to the abnormal deceleration as an apparent malfunction of the normal wheel-braking system. "Neither the manufacturer nor the airline had prepared specific procedures stating how the crew should act in a situation where the lift spoilers did not deploy," the report said. "The pilots had not trained for such a situation in a simulator.

"The AIBN considers that the excursion could have been prevented by relevant simulator training, procedures and a better system-understanding related to failures of the lift spoilers and the effect that it has on the aircraft's stopping distance."

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Coastal Run

The BAe 146 was operated by Atlantic Airways, which conducted scheduled and on-demand service with five airplanes and two helicopters to Denmark, Iceland, Norway and the United Kingdom from its main base on the Faroe Islands.[1] The accident occurred during a scheduled round-trip flight from Stavanger with stops in Stord and Molde, all on the west coast of Norway.

The commander, 34, had 5,000 flight hours, including 1,500 hours in type. He had served as a Jetstream 31 pilot in Denmark for three years before being hired by Atlantic Airways in 2004 as a BAe 146 and Avro RJ first officer. He was promoted to commander in May 2006 and "had carried out 21 landings at Stord Airport as a commander, most recently on 17 September 2006," the report said. "Prior to the accident, he had been off duty for two days."

The first officer, 38, had 1,000 flight hours, including 250 hours in type and 231 hours in the preceding 90 days. He was hired by Atlantic Airways in April 2006 and held a Danish airline transport pilot license and a type rating for the Avro RJ/BAe 146.

Both pilots had deadheaded to Stavanger the night before; the captain arrived at 2330 local time, the first officer at 2145. They told investigators that they felt "sufficiently fit and rested" when they reported for duty at 0555. Operating as Flight 1670, the aircraft departed from Stavanger at 0715, with the commander as the pilot flying. "After departure, the aircraft rose to Flight Level 100 [approximately 10,000 ft] and set a direct course for the Stord VOR [VHF omnidirectional radio]," the report said.

At 0723, a Flesland Approach controller cleared the crew to begin a descent and advised that weather conditions at Stord included winds from 110 degrees at 6 kt, visibility greater than 10 km (6 mi), a few clouds at 2,500 ft and a temperature and dew point of 10 degrees C (50 degrees F).

Dry Runway Assumed

The controller did not provide information on runway condition.[2] The airport had received 10 mm (0.4 in) of precipitation in the 24-hour

Left main landing gear tires show damage consistent with reverted rubber hydroplaning.

period ending at 0700, and AIBN investigators who arrived at the airport about 6 1/2 hours after the accident found dark patches of moisture remaining on the runway. Nevertheless, "since the crew were not otherwise informed, the runway was assumed to be dry, and this was the basis for their landing calculations," the report said.

Stord Airport is uncontrolled and has a single runway that is 1,460 m (4,790 ft) long and 30 m (98 ft) wide, with an available landing distance of 1,200 m (3,937 ft). There were paved, 130-m (427-ft) safety areas at both ends of the runway, with steep cliffs beyond. Although the safety areas had met previous Norwegian requirements, the standard had been changed in July 2006 to require that safety areas for such a runway be at least 180 m (591 ft) long. "The short runway, in combination with an inadequate safety area and the steepness of the adjacent terrain, were decisive for the severity of the accident," the report said.

Fire consumed most of the aircraft after it plunged down the rock- and tree-covered slope.

The pilots initially had planned to conduct the VOR approach to Runway 15 but later decided to save time with a visual approach to Runway 33. The report said that this decision was "understandable" because the crew assumed that the runway was dry and considered that the 5-kt tailwind component was well within the aircraft's 10-kt limit.

As the aircraft neared the airport, the Flesland Approach controller cleared the crew to change radio frequencies. They subsequently advised the Stord aerodrome flight information service (AFIS) duty officer of their intentions to conduct a visual approach to Runway 33. The aircraft was 2 nm (4 km) from the threshold when the AFIS duty officer advised "runway free" and reported the winds as from 120 degrees at 6 kt.

"Information on the aircraft cockpit voice recorder (CVR) shows that the pilots communicated strictly regarding official matters and with good cockpit resource management" while conducting a stabilized approach, the report said.

The target landing speed was 112 kt, and groundspeed was between 115 and 125 kt when the aircraft crossed the runway threshold. The commander moved the thrust levers to the flight idle position over the runway threshold and then to ground idle as the aircraft touched down at 0732. "Both pilots stated that the landing took place a few meters beyond the standard landing point and that it was a 'soft' landing," the report said.

'No Spoilers'

The spoilers — six panels on the upper surface of the wing that reduce lift by about 80 percent when extended — did not deploy when the commander moved the air brake/lift spoiler handle from the air brake position to the lift spoiler position immediately after touchdown.[3] Noticing that the annunciator lights indicating spoiler deployment had not illuminated, the first officer called "no spoilers," per standard operating procedure, four seconds after touchdown. However, as mentioned earlier, the crew had not been trained to recognize or to handle non-deployment of the lift spoilers.

"The wings continued to produce lift, so that the weight of the aircraft was not sufficiently transferred to the landing wheels," the report said. "Hence, the main wheels did not get sufficient contact with the runway, and the braking effect was reduced." (The BAe 146 does not have thrust-reverse capability.)

By itself, the failure of the spoilers to deploy likely would not have resulted in an overrun, the report said; the crew probably could have brought the aircraft to a stop on the runway if they had used maximum wheel braking. However, the report noted that the commander received "three disturbing warnings" within the space of five seconds: "first the lack of spoilers, then the apparent failure of the brakes, followed by the end of the runway coming toward [him] at high speed. … The commander did not have time to consider his actions, but acted almost instinctively."

He later told investigators that the less-than-expected braking action became apparent when the aircraft was halfway down the runway, and he felt that it was too late to conduct a go-around at that point. "The commander applied full force on both brake pedals, without achieving normal braking action," the report said. "In an attempt to improve retardation, he moved the brake selector lever from the 'Green' [hydraulic system] position to the 'Yellow' position, but this did not help. He then moved the lever to the 'Emergency Brake' position, whereby the aircraft's anti-skid system was disconnected."

The CVR recorded "the first screeching noises from the tires" about 13 seconds after touchdown, the report said. "The aircraft skidded with locked wheels along the last 520 m [1,706 ft] of the runway length."

British Aerospace BAe 146-200

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Hawker Siddeley Aviation began work in 1973 on a short-range, four-engine transport called the HS 146. The company was acquired four years later by British Aerospace, which brought two versions of the airplane into production in 1983: the BAe 146-100, which was designed for operation on short and unimproved airstrips; and the BAe 146-200, which was designed for operation only on paved runways and has a longer fuselage and a higher maximum takeoff weight.

Powered by Avco Lycoming ALF 502R-5 engines of 31 kN (6,970 lb) thrust, the BAe 146-200 accommodates up to 111 passengers in six-abreast seating. Maximum weights are 42,185 kg (93,000 lb) for takeoff and 36,741 kg (81,000 lb) for landing. Maximum operating speed is 295 kt. Maximum range is 2,734 km (1,476 nm). Stall speed in landing configuration is 92 kt.

British Aerospace also produced the BAe 146-300, which has a longer fuselage that can accommodate a galley and 103 passengers in five-abreast seating, or 128 passengers in six-abreast seating. The Avro RJ (regional jet) versions were launched in 1992 with slightly more powerful Honeywell LF 507 engines and digital avionics equipment. An upgraded RJX model was introduced in 2001 by BAE Systems, formed from the 1999 merger of British Aerospace with Marconi Electronic Systems.

A total of 221 BAe 146s, 170 RJs and three RJXs were built before production was terminated in 2002.

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

Off the End

Because of a steep drop-off to an inlet of the North Sea on the left side of the runway and rocky terrain off the right side, the commander continued steering the aircraft toward the end of the runway. "In a last attempt to stop the aircraft, he steered it toward the right half of the runway and then maneuvered it with the intent to skid sideways to the left," the report said. "The commander hoped that skidding [sideways] would increase friction and help to reduce the speed of the aircraft."

The AFIS duty officer and airport fire and rescue service personnel saw the aircraft pointed 45 degrees left of centerline and banked steeply right when it traveled off the end of the runway about 23 seconds after touchdown. "In accordance with procedure, the fire and rescue service at Stord Airport are on standby beside the fire engines when aircraft take off or land at the airport," the report said, noting that they began spraying water and foam on the wreckage from the end of the runway in less than a minute.

The aircraft had struck approach lights and partially dragged them by their wiring as it plunged nose-first about 100 m (328 ft) down a 30-degree slope inside a bowl-like depression in the cliff leading to the sea. "The slope consisted of uneven rock, partially covered in low vegetation, bushes and small trees," the report said.

"On the way down the slope, the wheel doors and later the outer starboard engine (engine no. 4) were ripped off," the report said. "The starboard wing sustained several cuts as it pulled down trees and the approach lighting. It is probable that the aircraft maintained its speed down the slope and that it was still traveling at a relatively high speed when its nose encountered rising ground."

When the aircraft came to a stop, the commander shut off the fuel supply to the engines and activated the engine fire extinguishers. Because of a broken mechanical connection from the fuel shut-off lever to the no. 2 (left inboard) engine, however, the engine continued running at high speed, and its exhaust flow fanned a post-impact, fuel-fed fire that rapidly intensified.

The engine continued running at high speed, and its exhaust flow fanned a post-impact, fuel-fed fire that rapidly intensified.

The pilots were unable to open the cockpit door and exited through the left window. The right forward cabin door was blocked, and the commander was unable to open the left forward door from outside the aircraft. "There are grounds for supposing that problems with opening the [forward] cabin doors, in combination with the early outbreak of fire at the forward end of the cabin, explains why all those who died were sitting in the forward half of the cabin," the report said. The surviving passengers and cabin crewmembers exited through the left rear door, which required substantial force to open.

Call for Training

Because of the extensive impact and fire damage to the aircraft, investigators were not able to determine conclusively why the spoilers failed to deploy, but the report discussed two possibilities — a mechanical fault in the air brake/lift spoiler lever mechanism and faults in the microswitches in the thrust lever mechanism, which signal that the levers are in the ground idle position, a prerequisite for spoiler deployment. "It cannot be ruled out that there are also other explanations," the report said.

The investigation prompted the AIBN to recommend that the European Aviation Safety Agency in conjunction with BAE Systems "make operators of the BAe 146 aware of the problem associated with inoperative lift spoilers [through] both theoretical and practical training."

The board also recommended that the Norwegian Civil Aviation Authority, upon identifying regulatory "nonconformities," require airports to effect "compensatory measures" — for example, installation of an engineered material arresting system where there is insufficient space to install a standard runway end safety area.

The report noted that Stord Airport made a number of safety-related changes following the accident, including extending the runway end safety areas to 190 m (623 ft) and incorporating grooves while repaving the runway.

This article is based on the English translation of AIBN Report SL 2012/04, "Report on Aircraft Accident on 10 October 2006 at Stord Airport, Sørstokken (ENSO) Norway, Involving a BAE 146-200, OY-CRG, Operated by Atlantic Airways." The report is available at <www.aibn.no/aviation/reports>.

Notes

1. The Faroe Islands are a self-governing dependency of Denmark.
2. Norwegian civil aviation regulations require controllers to advise pilots when runways are wet or contaminated by ice, slush or standing water.
3. The airbrakes consist of two hinged panels at the rear of the fuselage that create substantial drag when deployed.

Takeout Menu

BY MARK LACAGNINA

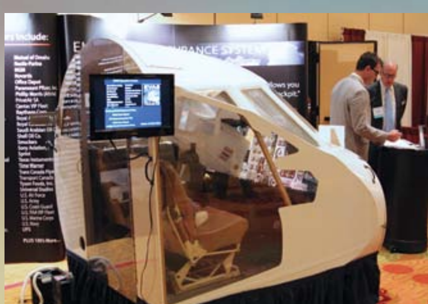
Corporate aviation safety specialists shared information and ideas to be taken home and used.

The Corporate Aviation Safety Seminar (CASS) essentially is a "deep dive, an opportunity to dig deeply into safety issues and take back information and ideas that you can apply to your own individual organization," said Steve Brown, senior vice president of operations for the National Business Aviation Association (NBAA), joining Bill Voss, president and CEO of Flight Safety Foundation (FSF), and Kevin Hiatt, the Foundation's COO, in welcoming the more than 325 aviation professionals who attended the 57th annual CASS, presented by FSF and NBAA April 18–19 in San Antonio, Texas, U.S.

"What is presented here is only information … until it is taken back to your department and used to mitigate risk," added George Ferito, director of rotorcraft business development for FlightSafety International and chairman of the FSF Corporate Advisory Committee.

The seminar featured two panel discussions — one focusing on fatigue, the other on general safety priorities — and 13 individual presentations on a variety of cutting-edge topics.

Roger Lee, director of corporate safety and quality for Hong Kong–based Metrojet, recipient of this year's Business Aviation Meritorious Service Award, led off with a presentation of "the young dragons" — business aircraft operators in China, whose current



Frank Jackman

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Snyder (left);
Stein, Ferito and Grace

fleet of 870 aircraft, 6 percent of the world fleet, is expected to grow by 20 percent a year, or 10 times the U.S. rate. "Growth is exciting, but growth comes with risks and problems," not the least of which are limited airport access and a "disastrous shortage" of fixed base operations, Lee said.

The ingredients of an effective safety management system (SMS) were included in several presentations. Flight risk assessment tools (FRATs), critical SMS elements, were examined by Peter v. Agur Jr., founder and director of The VanAllen Group. He outlined a six-month study of the use of "second-generation," or software-based, FRATs by 10 aviation departments. The study showed that the tools are highly beneficial in highlighting known risks and identifying unknown risks, but need to be made easier to use and more effective.

In a presentation developed with John Sheehan, a colleague at the International Business Aviation Council, Jim Cannon, director of the International Standard for Business Aircraft Operations (IS-BAO), outlined the fundamentals of SMS implementation, including the prerequisite of management commitment to safety as a core value. Cannon also stressed that the results of safety management must be "fast-tracked" and readily apparent: "There can be no delay in assessment and dissemination of safety information."

Rick Boyer, aviation manager for SCANA Corp., detailed how his department developed the "centerpiece" of its SMS, a hazard reporting and tracking system that progressed from a hot line message system ("no one used it"), to hard-copy reporting forms, to an automated, PC-based system with Internet access. "While it isn't easy to implement a hazard reporting and tracking system, it isn't all that hard, either," Boyer noted.

SMS implementation today is being impeded by the same types of skepticism and suspicion that fomented resistance to the concept of crew resource management (CRM) decades ago, said Chris Broyhill, chief pilot for Sprint, in a presentation co-authored by fellow Embry-Riddle doctoral candidate David Freiwald. "What CRM did for the cockpit, SMS does for an organization," Broyhill said, noting that before the advantages of safety management can be realized, senior managers must direct the evolution of a safety culture in which SMS will be embraced.

The safety management theme also was addressed by Thomas Anthony, director of the Aviation Safety and Security Program at the University of Southern California. Anthony probed the physiological and psychological aspects of hazard detection, focusing on the need to *notice*, which, unlike *seeing*, is "a form of recognition that involves subconscious processing."

Fighting Fatigue

Panelists Curt Graeber, president of The Graeber Group and an FSF fellow; Doug Carr, NBAA vice president for safety, security and regulation; and Leigh White, president of Alertness Solutions, explored the causes, consequences and prevention of pilot fatigue. Graeber likened fatigue to "subtle incapacitation," which can be mitigated only by sleep. Carr discussed a recent regulatory interpretation by U.S. Federal Aviation Administration (FAA) counsel that disallows controlled rest on the flight deck by a member of an unaugmented corporate flight crew. He called the interpretation "baseless" and contrary to scientific evidence that controlled rest is a proactive safety measure that can prevent fatigue-related hazards, such as microsleep on final approach. White proposed a demonstration project to prove the operational validity of controlled rest on corporate aircraft flight decks.

Fatigue and controlled rest on the flight deck were high on the list of business aviation safety priorities discussed by panelists Ferito; Dan Grace, director of flight operations, safety and security for Cessna Aircraft; Cliff Jenkins, aviation director and chief pilot for Milliken and Company; and Peter Stein, director of flight operations for Johnson Controls. Priorities also included functional check flight safety, erosion of aircrew skills in the global recession and the tendency to concentrate on checking pilots rather than training them. When the microphones were distributed among attendees, several more

Photos: Frank Jackman

Cox (left), White and exhibit area

priorities were suggested. One was "ego management" on the flight deck, which prompted a lively exchange of ideas, as did a question of how to get all aviation department members to buy into and support an SMS.

Robert Sumwalt, a member of the U.S. National Transportation Safety Board, followed up with a presentation on factors that may persuade pilots to disregard standard operating procedures (SOPs), a transgression that has figured in many accidents. He noted, for example, that SOPs themselves often are at fault because they are poorly conceived or poorly written. "If people aren't following a procedure, it may not be the people, it may be the procedure," Sumwalt said. "Change it. Come up with something that will work."

Stuart Cocks, business development manager for Flight Data Services, presented information developed by the company's executive vice president, John Flemming, on how corporate and air carrier operators are using flight operations quality assurance (FOQA) data to improve their training programs and subsequently to gauge the effectiveness of program revisions. Cocks noted that while FOQA data can show the "what, where and when" of an event, such as an unstabilized approach, a follow-up nonpunitive interview of the flight crew often is valuable in determining why it occurred.

An overview of the FAA's Aviation Safety Information Analysis and Sharing (ASIAS) program was presented by Tony Fazio, the agency's director of accident investigation and prevention. The program seeks to identify leading safety hazards requiring further study and mitigation, based on voluntary reports and data collected, de-identified and analyzed by Mitre Corp. Fazio noted that the information currently is supplied mostly by the airlines, and he urged business aviation aircraft operators to participate in ASIAS.

Valuing Safety

John Cox, CEO of Safety Operating Systems, discussed "time-driven, activity-based costing," a proven method of gathering and using financial data to demonstrate the value of safety programs to corporate officers "who don't speak the language of aviation." Cox said the method is "time- and labor-intensive but worth the effort." He gave an example of the painstaking effort involved in demonstrating that investment in a $1 million program to reduce flight diversions would save a company nearly $1 million *each year*.

Quay Snyder, president and CEO of the Aviation Medicine Advisory Service and Virtual Flight Surgeons, discussed how to identify the "failing aviator" — a pilot who no longer can perform proficiently — and how to help him or her. Snyder outlined a number of causal factors, including fatigue-inducing sleep apnea and undiscovered medical problems, and noted that aging, by itself, does not appear to be a critical element in "losing the right stuff." "Most cases, especially when identified early, are treatable and can result in a return to duty," he said.

Tips on managing security and medical risks during travel were provided by MedAire's global director of aviation security, Denio Alvarado. "Security and medical emergencies can affect anyone, anywhere," he said. "Companies must establish and *test* travel risk management programs, and incorporate them in the SMS." Alvarado emphasized the need for emergency response planning by describing a case in which preplanned actions were implemented to protect company employees and evacuate them to a safe haven after a general strike escalated into violence and vandalism that effectively shut down the airport where their aircraft was parked.

David Adams and Camille Khodadad, partners in Hall Prangle and Schoonveld, completed the presentations with an examination of judicial actions following accidents. Outlining six recent cases, they noted that criminal investigations and prosecutions have become a nearly automatic response to aircraft accidents in many countries. Adams and Khodadad discussed how aircraft operators can prepare for and respond to such situations, and recommended that actions and countermeasures be established and incorporated in the company's emergency response plan.

Into Africa

The FSF BARS program manages aviation risk in the resource-rich continent.

BARS
BASIC AVIATION RISK STANDARD
FLIGHT SAFETY FOUNDATION

Broadening the global profile of Flight Safety Foundation's Basic Aviation Risk Standard (BARS) program is one of Larry Swantner's mandates, and his focus in the early weeks of 2012 was Africa. Swantner, manager of program development for BARS, spent much of the first quarter on the continent, primarily in South Africa, working to raise awareness of the Foundation and BARS in what he described as the "first extensive push" of BARS into Africa.

"We want to increase our BARS footprint in Africa," said Swantner, who has had extensive experience in Africa during his 35-year aviation career. His stint in Africa this year included making presentations at four aviation safety-related conferences, one of which he chaired.

BARS was launched less than three years ago in response to a need identified by resource sector companies. Mining, oil exploration and similar interests rely heavily on charter aircraft operators to move personnel and equipment to and from operations in some of the most remote locations on earth, flying aircraft that range from single-engine helicopters to multi-engine, transport category jets.

Many of the BARS member organizations (BMOs) use multiple operators. BARS was developed to establish a common safety audit standard that could be applied to on-shore resource sector aviation support activities. BARS draws on industry best practices and is "a high standard recognized throughout the industry," Swantner said.

The BMOs benefit by having their charter operators audited to a common safety standard by qualified auditors trained specifically in BARS. In addition, all the BMOs have employees who oversee their aviation operations. BARS provides training opportunities for non-technical staff to become more skilled in managing aviation safety risks. The two-day Aviation Coordinator training course covers "things to look for when overseeing air operations," such as controlling animals that may walk across runways, securing fuel supplies and ensuring that center-of-gravity and gross-weight limits are not exceeded during cargo loading. "You don't treat an airplane like a truck," Swantner said. Other training courses are in the pipeline, including one for senior executives on aviation capabilities limits and operations and another on managing remote airstrips.

The audited operators, who pay for the audit and control the release of the results, benefit by working to a single standard and by reducing the burden of multiple audits by multiple customers. Also, audited operators are potentially more attractive to BMOs that are initiating or expanding operations in a particular region.

Swantner is quick to point out that BARS is not a regulatory endeavor. "We are not there to usurp their oversight," he said of local regulatory agencies.

The actual audit is designed to take two auditors two "very full" days to accomplish, with flexibility for a third day, if needed, Swantner said. The process of preparing for the audit, however, can take a few months of manuals, certifications and other data being traded back and forth. "A good audit starts three months before the auditors show up on-site," he said.

The BARS program is directed by Greg Marshall and includes several safety specialists in Australia, which has an extensive mining industry and support structure. Audit findings are tracked by the BARS quality control office, which is based in Melbourne. Of the 79 aircraft operators that already have undergone a BARS audit, 27 are located in Australia, according to Foundation statistics. Another 16 are based in Africa.

Many BMOs that are not directly based in Africa have operations or affiliates in Africa, as does the United Nations–affiliated World Food Programme, which also is a BMO and represents a move by BARS beyond resource companies, according to Swantner. South America and the Caribbean region have 11 audited operators. Ten operators in Asia and the Pacific have been audited. "I see Indonesia and Papua New Guinea as among other areas that could benefit from BARS membership," Swantner said.

Photo: Bresson Thomas/Wikimedia

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North American pilots on overnight flights across the Atlantic are especially at risk for fatigue and related problems.

BY LINDA WERFELMAN

Struggling With Sleep

Inadequate fatigue risk management training and a longer-than-recommended nap during an overnight trans-Atlantic flight contributed to an altitude deviation as a sleepy airline pilot confused the bright light of Venus for an aircraft landing light and then misjudged the location of a military transport aircraft, investigators say.

The Transportation Safety Board of Canada (TSB) said in its final report that the incident occurred in the early morning of Jan. 14, 2011, when the Air Canada Boeing 767 was about halfway across the Atlantic Ocean on a flight from Toronto to Zurich, Switzerland.

The flight left Toronto/Lester B. Pearson International Airport at 2138 local time Jan. 13. At 0040, the first officer (FO), whose sleep the night before had been interrupted by child care responsibilities, said that he needed to rest. The captain agreed to a period of controlled rest (see "Controlled Rest," p. 31).

At 0118, the captain turned on the seat belt sign because of forecast turbulence, and at 0155, he made a mandatory position report to air traffic control. The announcement roused the FO, who had by then had 75 minutes of rest — nearly twice as much as the recommended 40-minute maximum — and "reported not feeling altogether well," the report said.

At the same time, the captain pointed out to the FO a traffic-alert and collision avoidance

© Erez Sirotkin/Jetphotos

system (TCAS) alert involving a U.S. Air Force C-17 traveling the opposite direction at 34,000 ft — 1,000 ft below their 767.

"Over the next minute or so, the captain adjusted the map scale on the ND [navigational display] in order to view the TCAS target and occasionally looked out the forward windscreen to acquire the aircraft visually," the report said. "The FO initially mistook the planet Venus for an aircraft, but the captain advised again that the target was at the 12 o'clock position and 1,000 ft below.

"The captain … and the oncoming aircraft crew flashed their landing lights. The FO continued to scan visually for the aircraft. When the FO saw the oncoming aircraft, the FO interpreted its position as being above and descending towards them. The FO reacted to the perceived imminent collision by pushing forward on the control column. The captain, who was monitoring [the] TCAS target on the ND, observed the control column moving forward and the altimeter beginning to show a decrease in altitude. The captain immediately disconnected the autopilot and pulled back on the control column to regain altitude."

The C-17 then passed below the 767 without conflict.

Sixteen people — 14 passengers and two flight attendants — of the 103 aboard the airplane received minor injuries, including seven passengers who later were treated at hospitals and released.

The investigation revealed that the airplane's pitch attitude during the incident had changed from 2 degrees nose-up during cruise to 6 degrees nose-down and back to 2 degrees nose-up. The airplane's altitude decreased from 35,000 ft to 34,600 ft, and then increased to 35,400 ft before returning to 35,000 ft.

The incident occurred within the first minute or so after the first officer awakened, when he was "most likely suffering from the strong effects of sleep inertia [and] not in a state to effectively assimilate the information from both the instruments and from outside the aircraft or effectively provide an appropriate response," the report said.

Interrupted Sleep

The 14,800-hour captain had been with the airline for more than 30 years and had been a 767 captain since early 2010. The first officer, with 24 years in aviation, including 14 years with the airline, had 12,000 flight hours, including 2,000 in 767s.

The first officer said that he typically slept six to seven hours per

Incident investigators say the first officer on a trans-Atlantic Air Canada flight probably was experiencing "strong effects of sleep inertia" after a nap when he misinterpreted the position of another airplane.

night, but his sleep periods were interrupted if his children needed his care. To compensate for lost sleep, he often napped for an hour in the early afternoon. He said that the night before the incident flight, he had nearly eight hours of rest, "with some child care interruptions before waking at approximately 0600." He said that he took a two-hour afternoon nap and that when he reported for duty at 1935, he felt well-rested.

Even though he felt fine at 1935, the interruptions to his sleep increased the chances of fatigue during the overnight flight, the report said.

Circadian Lows

Fatigue consistently reduces performance levels, and the TSB incident report said that pilots based in North America are especially at risk during night flights to Europe because they experience circadian lows that "magnify performance decrements and increase desire to sleep."

Circadian lows are naturally occurring periods during a 24-hour cycle that are marked by high fatigue and poor performance. These periods occur at times when a person typically would be asleep.

"Most of these pilots fly a small number of nighttime legs per month and revert to sleeping at night when not working," the report said. "The circadian system of pilots who fly only a small number of nighttime legs will not adapt to working at night, and these pilots are likely to display performance decrements during the nighttime legs in spite of any countermeasures."

Although some pilots try to offset anticipated fatigue with a nap before an overnight flight, this is not always effective, and performance decrements persist, the report said.

The report also characterized as "soporific" the "long periods of darkness with few operational demands while [flying over the] mid-Atlantic."

The report added, "It is not until the flight approaches the coast of Europe at dawn that pilots experience reduced sleepiness as the daylight and circadian rhythms start to alleviate some of the fatigue. Nonetheless, the high-workload requirements of approach and landing have to be borne at a time when there is a significant risk of pilot fatigue."

Sleep Inertia

The report said that, after he awakened, the first officer probably experienced sleep inertia

Controlled Rest

Air Canada's *Flight Operations Manual* defines controlled rest as "an operational fatigue countermeasure that improves on-the-job performance and alertness when compared to non-countermeasure conditions," according to the Transportation Safety Board of Canada (TSB).[1]

Procedures outlined by the company describe controlled rest as "strategic napping on the flight deck." Rest periods may last no longer than 40 minutes and must be completed at least 30 minutes before top of descent — the point at which the crew begins the descent from cruise flight. At the end of a period of controlled rest, the pilot should have at least 15 minutes to become fully awake before receiving a briefing by the other pilot and resuming normal flight duties.

Pilots are required to inform flight attendants when a controlled rest period begins, and at the planned end of the rest period, a flight attendant is required to enter the cockpit "to ensure that both pilots are not asleep," the TSB said in its report on the Jan. 14, 2011, pitch excursion incident.

—LW

Note

1. TSB. Accident Investigation Report A11F0012: *Pitch Excursion, Air Canada, Boeing 767-333, C-GHLQ; North Atlantic Ocean,* 55°00'N 029°00'W; *14 January 2011*.

— grogginess that can persist, sometimes for only a minute or two but other times for as long as 35 minutes, after a nap.[1]

"The severity and duration of sleep inertia are more likely to be worse if a person is awakened from slow-wave sleep [also called deep sleep], especially if the rest occurs at a circadian low and when the person is fatigued," the TSB report said. "Given the consistency between the conditions that worsen sleep inertia and the FO's sleep and controlled rest, and the observation that the FO felt unwell when awakened, it is likely that the FO was suffering from high levels of sleep inertia."

One problem associated with sleep inertia is slower cognitive processing speed — which means that a person with sleep inertia takes more time to "filter out incongruous visual information," the report said.

Slow-wave sleep develops about 30 minutes after a person falls asleep — the reason that Air Canada and other carriers that allow controlled rest say that rest periods must be no longer than 40 minutes.

The 40-minute time limit was cited in a 1994 study by sleep researchers at the U.S. National Aeronautics and Space Administration (NASA), who found that setting aside 40 minutes for rest typically allowed pilots to sleep "efficiently" for an average of 26 minutes and to awaken with "improved physiological alertness and performance," compared with another group of pilots who were not offered the controlled rest option.[2]

Other studies have found that people who took naps of 20 minutes had the best post-sleep reaction times, compared with those who took naps lasting 50 minutes or 80 minutes.

Fatigue Risk Management

Controlled rest has been adopted by 17 air carriers in Canada, including Air Canada, and several other airlines in other countries, the TSB report said. Air Canada's policy also calls for the flight crew to notify the in-charge flight attendant that controlled rest is in progress and to request that the flight attendant call the flight deck at a specified time. The guidelines said that this step is intended to "ensure that both pilots are not asleep."

When the controlled rest is over, the guidelines say the awakened pilot "should be provided at least 15 minutes without any flight duties to become fully awake before resuming normal duties, unless required to do so due to an abnormal or emergency situation. Following the 15-minute wakening period, an operational briefing must be given. This is designed to ensure that the rest is taken in a manner that minimizes risks to the flight."

Transport Canada (TC) included controlled rest as one of the "fatigue-based error mitigation" strategies — along with the use of caffeine and relief pilots — described in its guidelines for developing a fatigue risk management system (FRMS). In addition to mitigation strategies, the guidelines discuss crew scheduling designed to allow for sufficient sleep, actions to be taken by pilots to obtain sufficient sleep, monitoring on-duty fatigue and analysis of fatigue-based occurrences.[3]

Additional recommendations are being developed by the Flight Crew Fatigue Management Working Group of the Canadian Aviation Regulation Advisory Council, which will address flight and duty time limitations and rest period rules to be developed according to "the science that underpins the FRMS," the report says.

Under Canada's Commercial Air Service Standards, all pilots who engage in controlled rest are required to undergo training in the specifics of the program and the general principles of fatigue and fatigue countermeasures. Air Canada's initial training for newly hired pilots includes a discussion of controlled rest; recurrent training also addresses the subject. In 2010, both the captain and the first officer attended fatigue risk management training sessions that discussed the effects of sleep inertia.

In addition, the airline's internal flight safety magazine published an article on sleep inertia in the fall/winter 2010 issue. Neither pilot had read the article before the incident.

Knowledge Gaps

Investigators interviewed several Air Canada pilots, including the incident pilots, about their knowledge of fatigue mitigation, especially controlled rest, and found that "their general knowledge about how to manage their rest for flights was good, but there were specific gaps," the report said.

One of the gaps involved knowledge of how sleep disturbances — including those associated with caring for young children, snoring or waking up at night — can affect sleep quality and increase fatigue risks.

Another gap involved the requirement to notify cabin crew before a controlled rest period. All of the pilots interviewed said they understood the requirement, "but they tended to rely on their own assessment of the sleepiness of the non-resting pilot in order to decide whether the cabin crew needed to be told. …

"Since pilots take controlled rest at times when they are most sleepy, which is likely to be at a similar time to the other pilot due to the circadian rhythm of fatigue, there is a high risk of nighttime controlled rest resulting in both pilots falling asleep."

The report added, "One of the reasons they were reluctant to inform cabin crew was that they knew cabin crew were not entitled to controlled rest themselves. They did not realize that by not informing the cabin crew of the controlled rest they were creating the possibility of the resting pilot being disturbed."

Misunderstanding

The report also noted that the interviews revealed a misunderstanding among pilots about the reason for the 40-minute limit on controlled rest periods.

Some of the pilots told interviewers that they believed 40 minutes was not enough time to obtain adequate rest "and believed that what was really required was a significant sleeping period — 90 to 120 minutes. Some were unaware that by sleeping longer than 40 minutes, there was a high risk of entering slow-wave sleep and increasing the severity of sleep inertia."

The pilots also had little understanding of sleep inertia, the report said, adding that they were "aware of the term but were not aware how significantly impaired a recently awakened pilot could be."

Flight Paths

Even a well-rested pilot can have difficulty determining the relative position of another aircraft, especially in an overwater environment with few external cues for assessing the position and motion of other objects, and especially if cockpit lights are bright, the report said.

Tests in a 767 simulator found that when an oncoming aircraft was far away, an observer could not detect its relative motion. The oncoming aircraft's up or down motion could not be detected until the two aircraft were 15 seconds apart at a closure speed of 900 kt, the report said, adding, "An oncoming higher aircraft then moves up the visual field, and an oncoming lower aircraft moves down the visual field."

After the incident, Air Canada issued several bulletins to crewmembers, including one that emphasized the need for compliance with all components of its standard operating procedure for controlled rest. Another emphasized the importance of notifying cabin crew when a controlled rest period is in progress on the flight deck.

The airline also identified the Toronto–Zurich route as the subject of a data collection exercise to evaluate the alertness of crews on these flights.

This article is based on TSB Accident Investigation Report A11F0012: Pitch Excursion, Air Canada, Boeing 767-333, C-GHLQ; North Atlantic Ocean, 55°00'N 029°00'W; 14 January 2011.

'It is likely that the FO was suffering from high levels of sleep inertia.'

Notes

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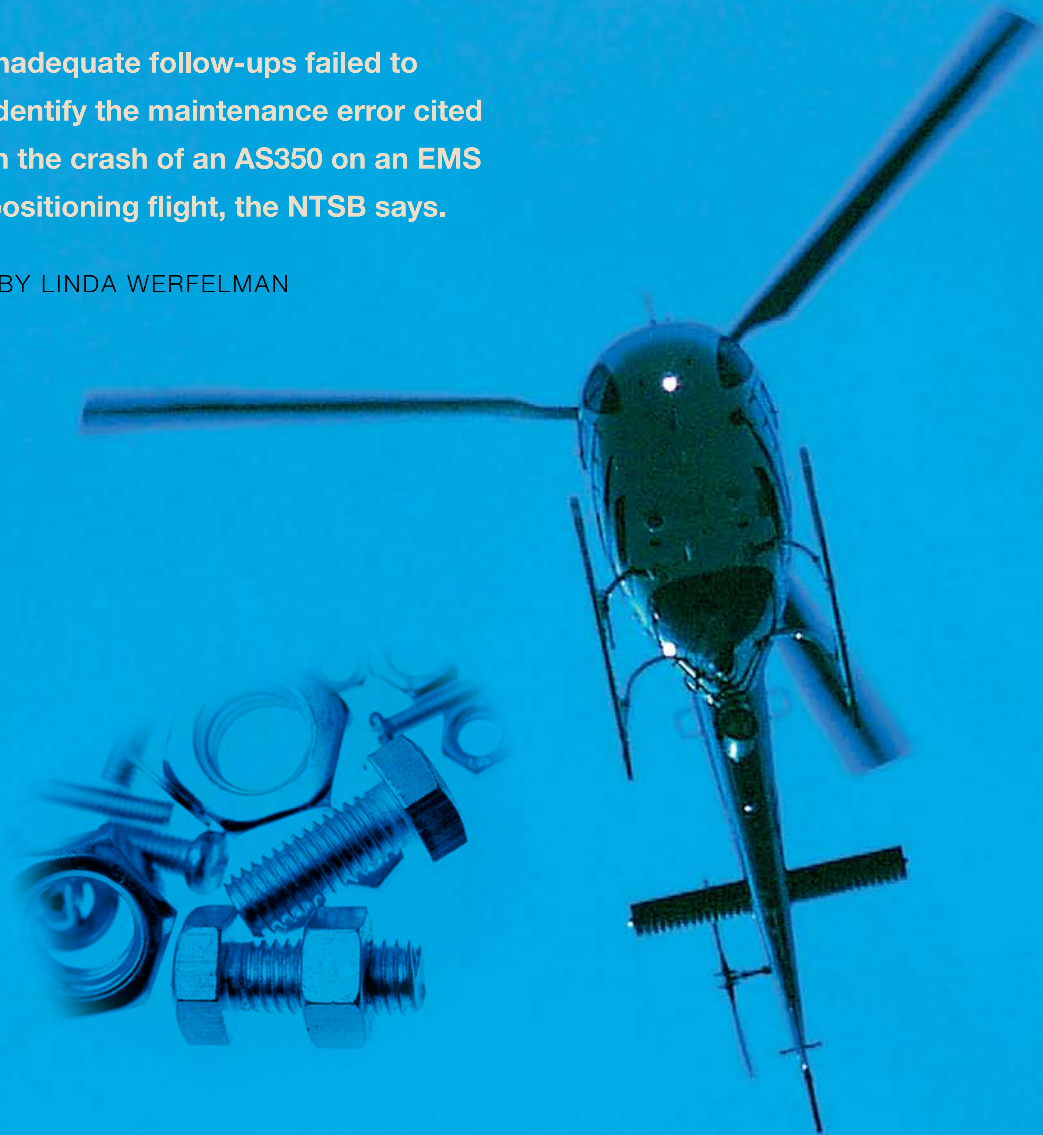
INSTALLATION ERROR

Inadequate follow-ups failed to identify the maintenance error cited in the crash of an AS350 on an EMS positioning flight, the NTSB says.

BY LINDA WERFELMAN



Photos: Jim Kuhn/Wikimedia and © Les Cunliffe/Dreamstime.com

An improperly installed part was to blame for the engine failure and subsequent crash of a Eurocopter AS350 B3 during an emergency medical services (EMS) positioning flight in Tucson, Arizona, U.S., on July 28, 2010, the U.S. National Transportation Safety Board (NTSB) says.

The pilot and two medical personnel were killed when the helicopter, which had been cruising at 800 ft, entered a rapid descent and struck a 5-ft-high (2-m-high) concrete wall. The wall penetrated the fuselage and the fuel tank. The helicopter, operated by Air Methods as a LifeNet flight, was destroyed by the impact and subsequent fire.

In its final report on the accident, the NTSB said the probable causes were that "the repair station technician did not properly install the fuel inlet union[1] during reassembly of the [Turbomeca Arriel 2B1] engine, the operator's maintenance personnel did not adequately inspect the technician's work, and the pilot who performed the post-maintenance check flight did not follow the helicopter manufacturer's procedures."

Other causes were the "lack of requirements by the [U.S.] Federal Aviation Administration [FAA], the operator and the repair station for an independent inspection of the work performed by the technician," the report said.

The report also identified as a contributing factor the FAA's "inadequate oversight of the repair station, … which resulted in the repair station performing recurring maintenance at the operator's facilities without authorization."

The accident flight originated at 1342 local time at Marana Regional Airport in Tucson, where the helicopter had undergone engine maintenance; the planned destination was the Air Methods base in Douglas, about a 55-minute flight to the southeast (Figure 1).

About six minutes after departure, the helicopter began a rapid descent, which became increasingly vertical as it neared the ground. Witnesses said they heard "whump, whump" sounds and "rapid intermittent popping sounds, which were followed by unusual quietness," before the impact.

Accident investigators said that the helicopter's descent rates, calculated by examining the last 10 seconds of radar data, "were consistent with an autorotation," and they theorized that the pilot had tried to conduct an autorotative approach to an open intersection about 300 ft (92 m) beyond the accident site but was stymied by a row of power lines 40 ft (12 m) above the ground; the helicopter's rotor speed decreased as the pilot maneuvered over the power lines, and the helicopter plunged to the ground.

Veteran Pilot

The 61-year-old pilot had more than 13,900 flight hours, including 9,465 hours in helicopters, 4,500 hours in single-engine airplanes and 100 hours of instrument time. He had a commercial pilot certificate, with ratings for single-engine land airplane and rotorcraft-helicopter, along with an instrument rating for both airplanes and helicopters.

He was hired by Rocky Mountain Helicopters, later acquired by Air Methods, in 2002, after he retired as a pilot for the U.S. Border Patrol. He previously had flown for the U.S. Army.

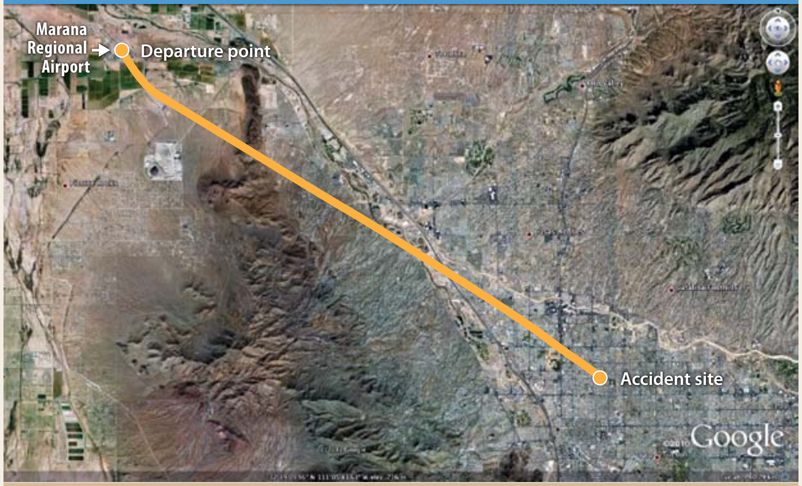
He completed AS350 transition training with Aerospatiale (now Eurocopter) and was qualified as pilot-in-command in 1989. He received training in the AS350 B3 in August 2002. He received satisfactory grades in all portions of his most recent competency/proficiency check, conducted in September 2009. The accident report said that a review of his training records for the previous four years showed 11.3 hours of training and proficiency check flights but no training flights after September 2009 during which he would have practiced autorotation.

"The lack of recent autorotation training/practice, although not required, may have negatively impacted the pilot's ability to maintain proficiency in engine failure emergency procedures and autorotations," the report said. "However, because the engine failed suddenly at low altitude over a congested area, more recent training may not have changed the outcome."

The airframe and powerplant technician who worked on the accident helicopter had worked for Helicopter Services of Nevada (HSN) since September 2009 as director of maintenance for Turbomeca engines, supervising the work of four mechanics. He previously worked at Turbomeca for 23 years and completed initial Level 3[2] Turbomeca training in 1998.

Most of the work performed by the HSN technicians was field work — repairs and Level 3 maintenance — through a contract with Turbomeca.

Track of Accident Flight



Source: U.S. National Transportation Safety Board

Figure 1

A duty pilot performed a 7.5-minute post-maintenance check flight.

Air Methods was founded in 1980 and now conducts helicopter EMS operations in 45 states. It acquired LifeNet in 2002.

The company's pilot training program says that recurrent training should include four hours of ground training for visual flight rules (VFR) operations and another four hours for instrument flight rules (IFR) ground training, and recommends at least two hours of VFR flight training and four hours of IFR flight training.

"However," the report said, "an instructor can recommend a flight test before the completion of the recommended hours."

Company check airmen told accident investigators that around the time of the accident, each pilot underwent a training flight every six months. A training flight typically included standard commercial maneuvers, various approaches and landings, engine failures, simulated hydraulic system failures, instrument flight and an instrument approach, and concluded with "three to five practice autorotations … [which] terminate in a 3- to 5-ft hover power recovery," the report said.

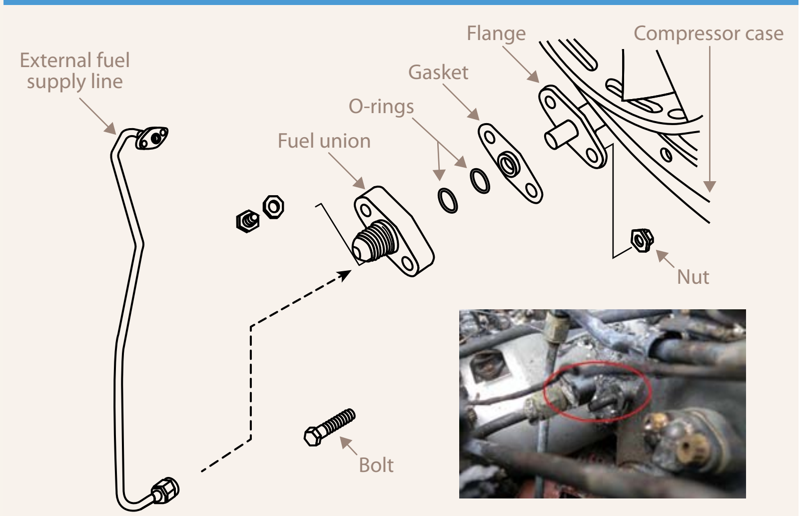
Fuel Coking

The accident helicopter was manufactured in 2009 and purchased by Air Methods the same year. When the accident occurred, it had accumulated 352 hours total time. The most recent maintenance was a 20-hour engine inspection performed the day before the accident.

The inspection followed work that was done on the helicopter because of fuel coking — a problem involving carbon deposits on the injection manifold[3] that does not affect flight performance but can interfere with engine starting, the report said.

Replacement of the injection manifold is categorized as Level 3 maintenance, and because Air Methods maintenance personnel were authorized for only Level 1 and Level 2 maintenance, the replacement was performed by the HSN technician. The HSN technician then reassembled the engine, including the fuel inlet union (Figure 2).

Fuel Supply Routing



Source: U.S. National Transportation Safety Board

Figure 2

Inspections

After the engine was reassembled, Air Methods maintenance personnel installed it in the helicopter. The HSN technician inspected his own work, as he was authorized to do, and Air Methods personnel inspected the engine after it was installed in the helicopter but did not inspect the HSN technician's work.

"In interviews with the Air Methods mechanics and HSN technician, they all reported feeling a sense of pressure to complete the maintenance and return [the accident helicopter and a second Air Methods helicopter with a similar coking problem that required attention at the same time] to service," the report said.

During an initial ground test, a leak from the engine hydromechanical unit was identified, and then repaired. After that, a duty pilot performed a 7.5-minute post-maintenance check flight, which included several flight checks — but not the four post-maintenance checks specified in the AS350 B3 *Flight Manual*. There were no records from the check flight.

The report noted that the American Eurocopter chief pilot said that the four checks specified by the flight manual typically are completed in 30 to 45 minutes.

The duty pilot who conducted the check flight said that he had never received training on how to conduct a post-maintenance check flight and that any company pilot who was qualified in the model was permitted to perform check flights.

Missing Nuts and Bolts

An examination of the engine at the accident site revealed that the fuel inlet union, on the lower right side of the engine, had separated from the boss on the compressor case but was still attached to the fuel supply line and the hydromechanical unit. During a search of the area, there was no sign of two five-point bolts and self-locking nuts used to mount the union to the compressor case flange, the report said.

The accident investigation found no indication of pre-existing airframe failure.

Engine Test Runs

As part of the investigation, a series of engine test runs were performed on another Arriel 2B1 engine at Turbomeca facilities in Bordes, France, under the supervision of the Bureau d'Enquêtes et d'Analyses, to "assess the engine's operating abilities with the fuel inlet union incorrectly affixed to the engine case flange."

During these test runs, the fuel inlet union was partially attached to the compressor case flange in several configurations, with the attachment nuts and bolts either hand-tightened or, in some cases, omitted; the engine was operated at power levels to simulate engine startup and flight.

"The data revealed that, with the [fuel inlet] union installed without its associated mounting nuts and bolts, it was possible to start and run the engine with no observable fuel leak," the report said. "During the test with the union nuts and bolts tightened by hand, the engine ran for three minutes and 32 seconds before the nuts began to unscrew from the bolts.

"The tests further revealed that, with both nuts and bolts removed, the union would ultimately eject … , resulting in an expulsion of about 0.5 L [0.1 gal] of fuel, followed by a subsequent engine shutdown."

The report said it was "likely that the technician did not tighten the bolts and nuts securing the union with a torque wrench and only finger-tightened them."

Missed Opportunities

Any of several procedural requirements might have identified the problem before the accident flight, the NTSB said.

Neither the operator nor the repair station had implemented procedures for an independent inspection of the maintenance technician's work, and no such procedures were required by the FAA.

The report noted that requirements are stricter for Federal Aviation Regulations (FARs) Part 135 ("Commuter and On-Demand Operations") operators with aircraft equipped with at least 10 passenger seats. Regulations say that, for those aircraft, "No person may perform a required inspection if that person performed the item of work required to be inspected."

If an independent inspection had been conducted, the NTSB said, it "may have detected the improperly installed fuel inlet union."

The report also noted that the FAA's principal maintenance inspector (PMI) for HSN had revoked the company's authorization to perform work outside its primary location in 2008.

"However, the *Repair Station Manual* was not updated to reflect this change, and the PMI did not follow up on the change, nor did he log the change in the FAA's tracking system," the report said. "The PMI was unaware that, in the year before the accident, the repair station had performed work for the operator at locations other than the repair station's primary fixed location at least 19 times.

"The FAA's inadequate oversight of the repair station allowed the repair station to routinely perform maintenance at locations other than its primary fixed location even though this practice was not authorized."

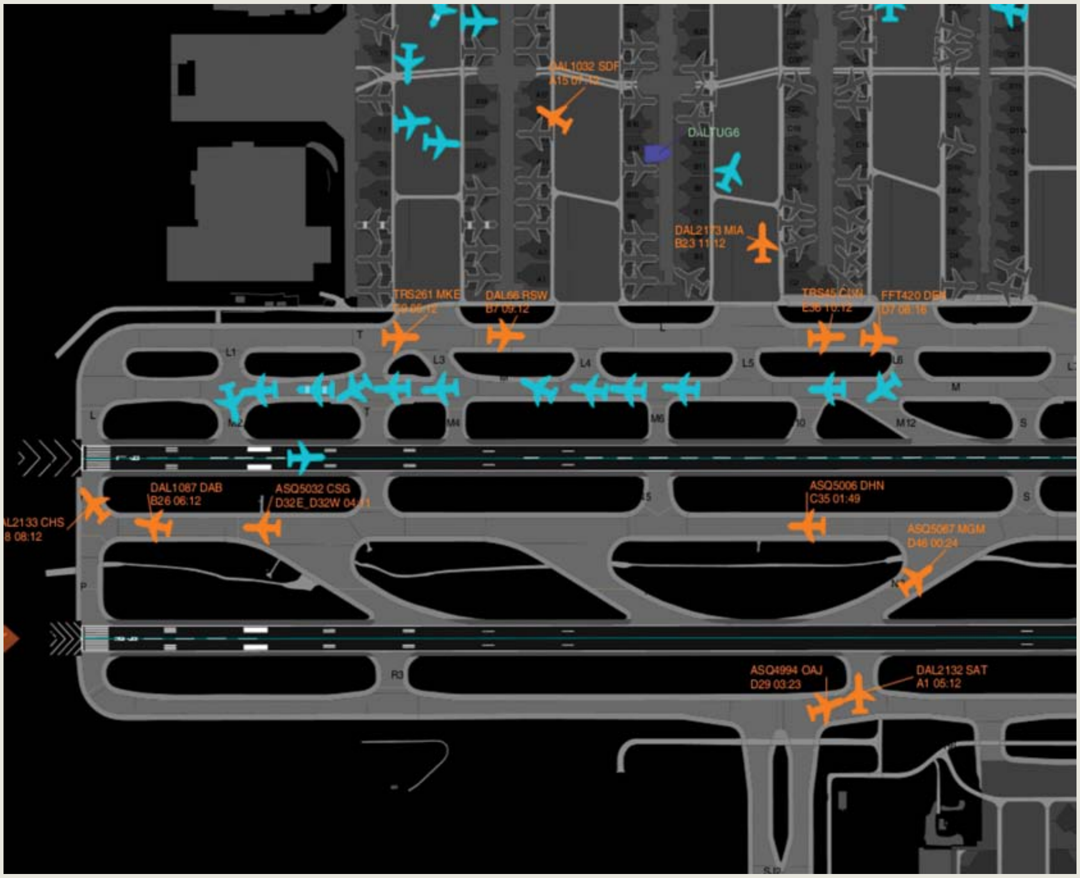
In addition, if — instead of the abbreviated 7.5-minute check flight — a standard full-length post-maintenance check flight had been conducted as specified by the manufacturer's flight manual, the fuel inlet union probably would have separated then, the report said.

"Because the helicopter would not have been operating near its maximum gross weight and the check flight would have been conducted over an open area, the pilot would have had greater opportunities for a successful autorotative landing," the report added.

This article is based on NTSB accident report WPR10FA371 and accompanying documents.

Notes

1. The report described the fuel inlet union as a "body mounting flange and seal [that] provide the interface" between the tip of the internal fuel line and external fuel supply lines.
2. According to information in the NTSB accident docket, Level 3 maintenance, also known as "deep maintenance," is defined as requiring "disassembly of a module and/or maintenance intervention." Level 2 maintenance requires removal of an engine and/or the separation of engine modules. Level 1 maintenance is performed without removing an engine.
3. An injection manifold is sometimes called a fuel manifold.



Real-Time Awareness

Non-ATC users find innovative applications for surface surveillance technologies.

BY WAYNE ROSENKRANS

Evolving ways to leverage airport surface surveillance technologies — building on those already adopted by air traffic control (ATC) — primarily enhance operational efficiency. Yet some non-ATC users also report positive influence on safety, according to a U.S. airport user of the Aerobahn system and Saab Sensis Corp., the system's manufacturer.

Aerobahn, a browser-based surface management system, provides diverse airport stakeholders a common surveillance and communication platform for managing operations, says Dan London, director of airline and airport automation for Saab Sensis. Worldwide, the predominant users are airports, airlines and air navigation service providers.

"We advise people that Aerobahn has been designed as an efficiency system, and that is how it should be used," London said. "However, our customers are finding benefits that go beyond just efficiency. Aerobahn is not a safety tool; however, some of our customers use it for potentially safety-related applications."

Uses of Aerobahn by airports and airlines mainly revolve around operational use and decision making. However, benefits are also derived from capabilities pertaining to data analysis for reducing surface traffic congestion, measured use of specific taxiways and other aspects of facility utilization, he said.

"Almost all core business-case utilizations of Aerobahn and how its procurement is justified are based on cost savings, enabling airports to use their resources more efficiently, and airlines to burn less fuel and improve the customer experience," London said.

Highly Accurate Sources

For an advanced surface movement guidance and control system (A-SMGCS) — such as airport surface detection equipment, model X (ASDE-X) at 35 major airports in the United States — the fusing of multilateration and surface surveillance radar typically becomes the source of the surveillance data for Aerobahn users.

"The same surveillance feed and the bulk of the technology in ASDE-X are also capable of feeding Aerobahn," London said. Under specific data-access policy requirements, the U.S. Federal Aviation Administration (FAA) shares with the industry "highly accurate, reliable information about what is out on the surface, so an Aerobahn system is capable of displaying the same track data used for ATC, similar to that used on ASDE-X," he said.

How the *industry* should use the technology does not compare with how the *FAA* primarily uses the technology for safety. "Make no mistake, in the airport control tower, one of the core safety systems is ASDE-X," London said. "Aerobahn in no way is being used by U.S. air traffic controllers — either directly or as a supplemental advisory — to ASDE-X."

ASDE-X produces one type of surveillance feed — primarily using complementary capabilities of airport surveillance radar, surface movement radar and multilateration — from which the private sector can create secondary benefits for the aviation industry. "The three primary surveillance feeds in ASDE-X are fused together into one comprehensive flight data object track around which we can build safety logic to provide alerts to ATC about a potential collision or incursions," London said. "Saab Sensis, for example, can make use of that same high-quality track output to Aerobahn, providing rich information that can be used for either safety-related analytics or for efficiency purposes."

Perspectives From Atlanta

Providing virtually real-time information for aircraft rescue and firefighting (ARFF) personnel has been one of many uses of Aerobahn at Hartsfield-Jackson Atlanta International Airport (ATL), says Paul Meyer, the airport's director of operations. For the time being, the department has an Aerobahn display at one station, which enables relaying to the firefighters on scene — and to more than 300 other local users — both status notification and awareness of where all vehicles and associated personnel are located.

"Our ultimate goal is to add a laptop display in the fire chief's vehicle so that when he is out on the field responding to an emergency, he can see in real time where all the ARFF trucks are rather than calling them by radio and asking them for their locations," Meyer said.

The department is among airport stakeholders that can replay real events from Aerobahn to develop lessons learned and conduct training based on factors such as how quickly the ARFF vehicles responded and what route they took.

Meyer sees Aerobahn as a supplemental advisory tool, complementing established procedures for ARFF notification by ATC and other emergency networks. "For example, there may be 10 or 15 recently arrived airplanes out on the airfield when the flight crew of one calls ATC to report hot brakes, an engine fire or an emergency," he said. "Sometimes, the ARFF responders find five, six or seven aircraft in the same area, and they don't know exactly which one it is. It could depend on how a good a description they received from the control tower. With Aerobahn, a dispatcher, and possibly in the future, all drivers of ARFF vehicles can look up the flight number and tail number right on the vehicle's moving-map display to see exactly where the airplane is."

All vehicles that operate on the ATL movement area — including those for aircraft towing, airport operations, snow plowing and ARFF — carry proprietary 4.9-GHz transmitters designed for the airport's independent Aerobahn multilateration system, which updates displays at the rate of once per second. Off the airport, airlines, FAA facilities and authorized users can access Atlanta's Aerobahn displays as needed — such as during thunderstorm conditions — from almost any location in the world with a secure connection and login.

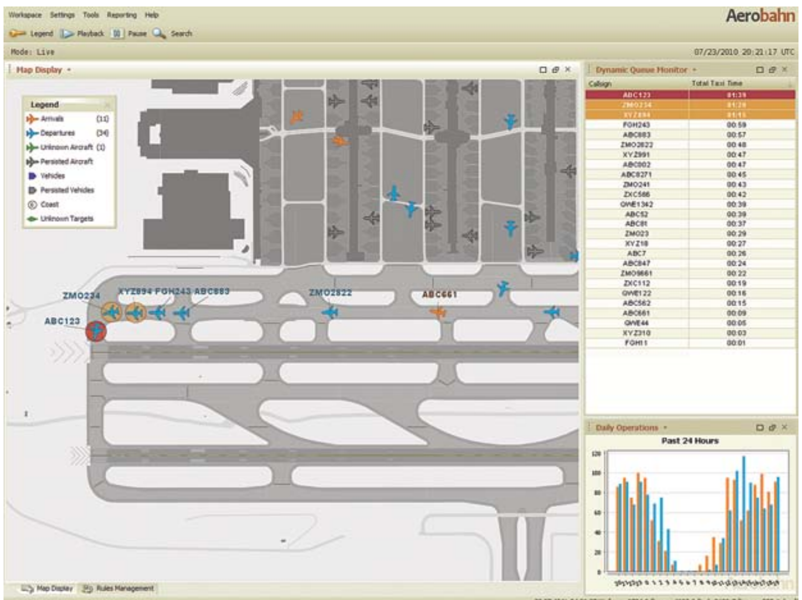
"Our multilateration surveillance system covers 100 percent of the movement area and 100 percent of the nonmovement area, so all the gates and all the parking locations have surveillance coverage," Meyer said. "So non-ATC users see the airplanes and vehicles with unique identification and function icons wherever they go on the airport." The system also already accepts signals from automatic dependent surveillance–broadcast[1] (ADS-B) equipment on a growing number of aircraft, a technology the FAA also anticipates will be adopted voluntarily by U.S. airport vehicle operators for safety enhancement (*ASW*, 4/12, p. 34).

As at the country's other ASDE-X airports, this Aerobahn system receives a feed of the flight data object track from the FAA. "This augments our system as a redundant flow of information, but we don't feed any of the airport's multilateration data into ASDE-X," he said.

Typical Aerobahn displays that Meyer monitors show at a glance how long each aircraft has been taxiing, aircraft waiting to enter an occupied gate and similar metrics. "We can slice and dice the data up any way we want for practically any purpose. This information has become operationally critical to our ramp controllers and the airlines responsible for these flights," he said.

"Surface management has been a game-changer for Atlanta, and Aerobahn is a very popular system. It makes everyone proactive — for example, to find a new gate for an airplane and to reduce the delays — and we know this ahead of time rather than when airplanes are showing up on the ramp. By then, everyone would be in a reactive mode. We had no idea about these things before we had surface management. The people in ramp control towers, with the windows all around them, then only had binoculars to try and find specific aircraft, and they did not have any idea how long they had been taxiing."

Replays of Aerobahn displays (p. 38) and analytical screens (below) have indirect safety uses.



Creative Applications

Saab Sensis has learned from a number of U.S. Aerobahn users — including those in Atlanta — about applications that illustrate how the technology indirectly benefits safety without crossing the line into the safety-of-life applications for which the FAA is responsible. For example, the system assists some users responsible for non-ATC-related taxi route conformance of the Airbus A380, which operates only on taxiways and runways stressed for pavement strength and meeting other requirements.

"Within Aerobahn TaxiView, users can set up some alerting mechanisms to advise when an aircraft, such as an A380, is not on the appropriate taxiway," London said. "To be clear, that is not an FAA-approved use of Aerobahn, but it is an additional way in which a ground handler, a terminal operator and/or an airline would be able to know whether or not its A380 is on a predefined taxi segment."

Airlines and operators of deicing pads, which may be located inside or outside the airport movement area, use Aerobahn as an additional tool for remote awareness of deicing activity, anticipating the expiration of deicing holdover times and receiving automated alerts under defined conditions. "Aerobahn can be used as a very accurate timer," he said. "While designated individuals are responsible for tracking metrics such as elapsed time following application of deicing fluid, Aerobahn can be a supplemental system to recognize and log when the aircraft left the deicing pad, where it is on the surface, how long it has been out there and, potentially, its predicted takeoff time. Saab Sensis is very clear that this is not the primary safety mechanism for determining holdover times, but this can and does add value. We state that Aerobahn is an advisory tool that people can use in a supplemental fashion to approved procedures."

The system's OpsView database allows subsequent analyses of deicing activity. This function supports efficiency reviews and, with caveats, safety reviews. "Users are no longer restricted to who has the best recollection of what happened," he said. "They can actually see where the aircraft and/or vehicles were and, in a fully integrated fashion, perform post-event analyses. The caveat is that Aerobahn is only one data point and cannot be the exclusive source of information. Deductions cannot be made exclusively from an Aerobahn replay of an event."

Alleyway Choreography

At many U.S. airports, the city government handles ramp control and occasionally can share a ramp tower with tenant airlines. "In some cases, topographical issues of various elevations on the airport make aircraft hard for ramp controllers and airline personnel to see," London said. "When they can't see them visually, however, they can look down on their Aerobahn situational awareness display and see where an aircraft is coming into the gate area.

"They also need to know where aircraft are for movement in and out of the alleyways.[2] Congested alleyways impede pushbacks. So, to the extent these personnel can better manage flows in and out of the alleys, they reduce the probability of a pushback into an aircraft waiting in the alley. Aerobahn is not the ramp tower operators' safety system, but they use it in a way that improves the visibility of aircraft."

Augmenting Aerobahn data with proprietary airline data opens the door to further sophisticated applications. "Instead of just knowing that Ship 3235 is out on the surface, this proprietary information can provide the crew on board, number of passengers on board, etc.," London said. Several ways in which elapsed time affects operations also can be tracked.

"Some use Aerobahn to help them make better determinations about crew connections," he added. "For example, an aircraft crew inbound on this flight is connecting to take that flight out. Management can make better decisions about getting a particular aircraft in to the gate and off-boarded so that the airline can move the crew on to its next flight. They can make determinations about aircraft crews that are out on the surface and intending to complete their route, and how that time will affect duty time. Aerobahn is not the safety system but rather a timer or an alerting mechanism that can point an airline to a potential issue."

At New York's John F. Kennedy International Airport (JFK) in 2011, TaxiView highlighted on Aerobahn displays the locations and status of hazards on taxiways and runways under construction. Such temporary annotations continue to be "pushed" simultaneously over the network to the entire user community. Later in 2012, the ability to display and record notices to airmen will be added to Aerobahn, he added.

"During the JFK Runway 31L-13R reconstruction, the Port Authority of New York and New Jersey required a fully integrated response by the community," London said. Aerobahn served as one of the information-integration tools for "situational awareness and coordinated departure movements," he said.

Aerobahn also provides insights into where to spend money on the airfield to get maximum return from pavement inspections and maintenance, London said.

"We take the map representation of the airport surface and 'carve up' all of the runways and taxiways into regions of interest," he said. "Aerobahn monitors aircraft movements in and out those regions, and derives a dwell time for each. When the airport wants to know how frequently a taxiway segment has been used, the system produces a region-occupancy report containing the number of movements with the breakdown by aircraft weight type, four-main-gear versus two-main-gear aircraft, etc."

Aerobahn users can consider their surveillance-based data to calculate the total gross weight that has transited a particular taxiway segment. This supplements estimates of pavement condition based on total gross weight from standard algorithms, taking core samples and other FAA-approved techniques, he added.

For the FAA itself, Saab Sensis researchers currently are studying new methods of analyzing surface surveillance data from ASDE-X to identify anomalous events on an airport that may or may not be precursors to aviation incidents. The aircraft-related data of interest include rapid decelerations, wide turns and route excursions, London said.

Notes

1. In the future, Aerobahn will be "a beneficiary of the ADS-B surveillance feed; it does not take much modification to tune a multilateration system to be ADS-B-compliant," London said.
2. *Alleyways* and *alleys* refer to areas where aircraft parking at gates and pushbacks occur between adjacent concourses of one or more terminal buildings.

In an emergency, pilots should be able to talk directly to ARFF as well as ATC.

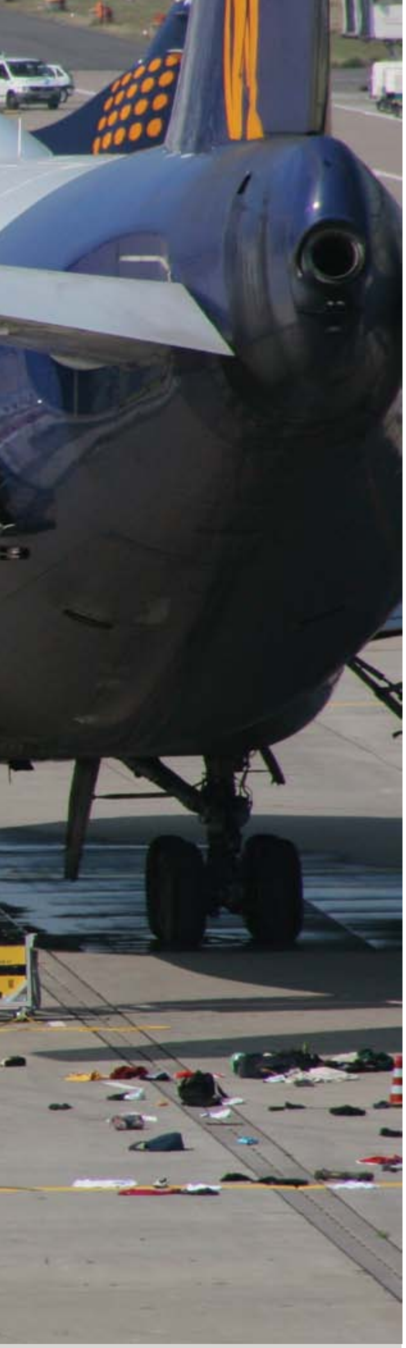
TRIPLE PLAY

BY FLORIAN GROSCH

An incident involving an Airbus A330 at Düsseldorf, Germany, demonstrates the advantages of an advanced emergency communication (ERCOM) system.[1] While the aircraft was in flight, the captain declared an emergency because of a fire at door 2 left. The first officer independently called the aircraft rescue and firefighting (ARFF) unit, which also was alerted by air traffic control (ATC) because of the declared emergency. The ARFF unit prepared accordingly.

Agreements were made about where the aircraft would stop after it landed and the preparations to be made by the flight crew. After the aircraft landed, the ARFF unit was able to immediately approach the affected door from outside with an infrared camera and report directly to the flight crew that there was no longer a fire.

Following the incident, the captain said the information from the ARFF unit contributed to an easing of tension and to his decision not to conduct an evacuation. Also, he recommended that ATC should inform flight crews about the possibility of communicating



with ARFF, which a flight crew might overlook because of the stress level. The first officer said that, because of the presence of ARFF personnel and equipment around the aircraft, it would have been necessary to inform ARFF before performing an evacuation, because of the dangers to firefighters from deploying evacuation slides.

The results of a German test of the introduction of a direct radio communication link between ARFF and flight crews also confirm the advantage of the advanced ERCOM. Five German airports — Frankfurt, Cologne, Düsseldorf, Hamburg and Munich — are participants in the test phase. In the first year of the test, which began in April 2010, 45 contacts were reported between ARFF and flight crews via direct radio communication. The use of an advanced ERCOM proved to be useful in various abnormal situations.

On July 1, 2012, the *Feuerwehrfrequenz* (the German word for emergency communication frequency) will finish its test phase and be introduced officially. The frequency will be 121.550 MHz. The airports will have until 2014 to prepare for English language usage in the system.

Communication management is essential in safe air traffic coordination and ARFF operation. The operation, transmission and receiving of information are based on coordinated standard procedures, phraseology and language, which influence the decision-making processes of the participants.

This also applies to an emergency on the ground, when an advanced ERCOM enlarges the circle of involved parties. No longer is it just from flight crew to ATC. Now the loop consists of flight crew, ATC and ARFF. In this new and dynamic situation, quick and reliable information is an advantage for all participants and improves safety, preserves equipment and reduces costs.

A test of advanced emergency communication demonstrated its advantages, but procedures need more work.

Despite all the safety developments in aviation, there has been no real progress toward widespread adoption of an ERCOM, though several studies and accident reports have recognized its advantages. In 1998, the U.S. National Transportation Safety Board (NTSB) published a safety recommendation that says, "The [U.S.] Federal Aviation Administration (FAA) should establish a designated frequency at all airports certified under [U.S. Federal Aviation Regulations] Part 139 that allows direct communication between ARFF personnel and flight crewmembers."[2]

Even within states, the levels of emergency communication facilities differ. For example, in Switzerland, only Zurich airport, which is used by commercial air traffic, offers the possibility of a direct radio communication link between ARFF and a flight crew, and the service is available in German only. This results in different levels of emergency communication standards and procedures, the majority of which are not as efficient as possible. Only two states — the United Kingdom and Australia — were identified as having a countrywide direct communication link between flight crews and ARFF. Both countries use English as their official language, which facilitates the communication.

The most widely used ERCOM system routes all communication through ATC — a system I call the *communication triangle* (Figure 1, p. 44).

The triangle system fulfills the minimum task of integrating the acting parties. However, the system involves weakness for all participants. The indirect connection between ARFF and flight crew decreases the speed of information flow and increases the possibility of information being misunderstood. Additionally, ATC has to coordinate traffic, besides conveying emergency information. Both tasks take place on the same radio frequency.

However, ATC cannot be excluded from the communication triangle, because it is in contact with all resources. As the airport's traffic coordinator, it needs to be aware of the situation and its development. It has to remain a part of the information exchange without creating additional problems.

The principle of direct communication between ARFF and the flight crew is not new, but there exists no standard for the content or requirement for direct communication in an emergency.

Both ARFF and flight crews have access to first-hand information about the external and internal condition of the aircraft.

Based on analysis of incident reports, the German test of this system proved an advanced ERCOM highly effective in the accomplishment of the rescue mission. It allows a more efficient rescue operation through a faster information exchange between ARFF and the flight crew (Figure 1).

The system keeps ATC in the communication loop but in a passive position. This means that the ATC frequency and involved personnel gain more communication capacity by transferring the ERCOM voice transmissions to a separate radio frequency. The standard airport traffic frequencies remain unaffected. As a backup, it is still possible to return to the communication triangle via ATC if necessary. Technically, the system is easy to integrate and can be used with existing equipment. The biggest investment in training and radio equipment has to be made by the ARFF unit.

Both ARFF and flight crews profit from the improved information exchange, which is more flexible and faster. Both ARFF and flight crews have access to first-hand information about the external and internal condition of the aircraft. This allows them to more quickly get the total picture and coordinate their next steps.

Coordinated measures reduce environmental dangers. Running engines and the unexpected activation of evacuation slides with ARFF personnel nearby pose serious risks for ARFF. Coordination also helps to avoid situations where specific aircraft procedures require completing certain steps, such as engine shutdown and setting flaps, before external arrangements are made.

Similar dangers, involving proximity to ARFF heavy equipment and extinguishing devices, exist for passengers during and after evacuation.[3] Those dangers are reduced by an agreement about evacuation speed.

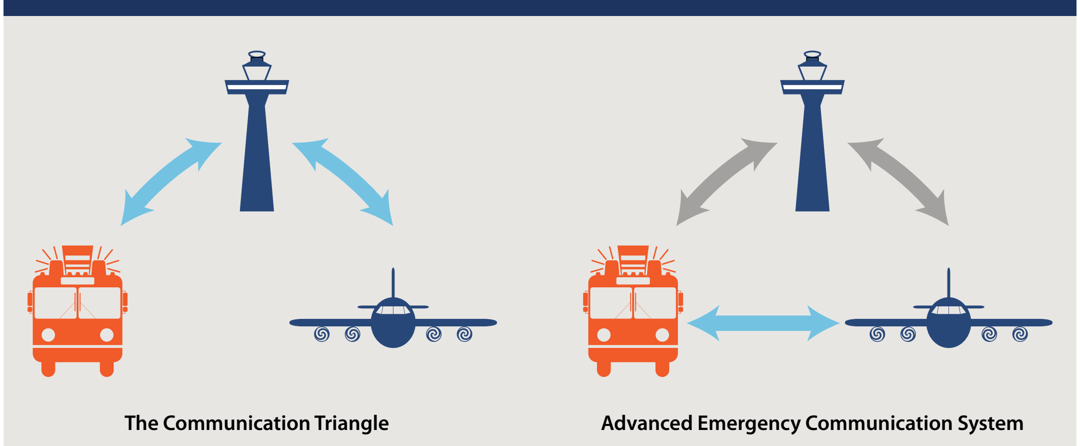
Controlled evacuations, which are conducted less quickly when there is no immediate danger, pose less injury risk than normal evacuations. In the Airport Cooperative Research Program report, *Evaluation and Mitigation of Aircraft Slide Evacuation Injuries*, ARFF personnel noted that when there is no imminent danger, coordination between the flight crew and ARFF personnel is needed to control the flow and speed of passenger evacuation.[4]

The analysis of the 45 communication events through DFS, the German air navigation service provider, highlights the advantages identified under actual emergency conditions for the fast establishment of a direct communication link between ARFF and flight crewmembers (Table 1).[5] Affected flight crews repeatedly said they welcomed the existence of such a system.

A direct information exchange about the situation and the actions taken avoided four evacuations. In two of these cases, a hydraulic failure and a cabin smoke incident, ARFF and flight crews maintained the communication even as an aircraft taxied toward the parking position.

Problems that appeared during the test highlight the need for regular inspection of the ARFF radio equipment, the development and publication of standard

Standard Versus Advanced Emergency Communication



Source: Florian Grosch

Figure 1

procedures and the examination of airport radio coverage characteristics.

During the test phase, radio equipment failure and the inability to select required frequencies sometimes remained unnoticed, which led to a correction of the daily equipment check procedure. Too much noise in the ARFF vehicle hindered the communication and even led to missing a flight crewmember's call. ARFF vehicles were equipped with up to five different radio frequencies, selected by a single switch. As a consequence, a change in the method of activating radio frequencies and a volume control feature are being reviewed.

Being unfamiliar with ERCOM standard procedures led to a delay in ARFF alerting, because the flight crew had used only the ERCOM frequency for an initial call. Unclear rules of responsibility caused frequency congestion, as different ARFF units tried to establish contact with the flight crew on the ERCOM frequency. This highlights the need for clear responsibility and a planned, coordinated procedure at bigger airports that have more than one responding ARFF unit. Frequency overlapping was identified as a problem at Hamburg, which hindered communication there.[6]

During the test, no language problems were reported. Because the test was conducted in German and involved only German airlines, using the local language posed no difficulties to the participants. In the future, the goal is to make ERCOM available to all airlines and expand it to more airports. A sufficient level of English language knowledge and an understanding of multi-language communication principles will then be necessary.

The investment necessary for installation and operation of an advanced ERCOM system is small compared with the benefit. Because the system uses existing radio equipment installed in the cockpit, no investment is necessary for airlines. To comply with International Civil Aviation Organization standards and recommended practices, the necessary technical equipment to record the emergency communication is included in the investment calculation. The recording not only serves as evidence for accident/incident investigations, but also is helpful for ARFF training and analysis. Depending on the equipment already installed as well as technical capabilities, the task of ERCOM recording can be taken over by ATC.

ARFF has the highest proportion of the costs. It has to invest in training and equipment. The head of ARFF Stuttgart calculates costs of €15,000–€20,000 (US$19,000–$25,380) for acquisition, installation of radio and a suitable recording system. A further €5,000 (US$6,345) is estimated for English language training of ARFF personnel.[7]

Although the advantages of an advanced ERCOM system are known and confirmed through accident/incident reports and studies, it must become clear to decision makers that advanced ERCOM, if applied efficiently, can offer greater safety for people, protection for equipment and lower costs.

Florian Grosch is an Airbus captain and a member of the German Pilot Association (Vereinigung Cockpit) Accident Analysis and Prevention Committee. He has an M.Sc. degree in air safety management from City University, London.

Advanced ERCOM System Incidents During Test at Five German Airports

Reason for Communication	Number of Incidents	Percentage of Total
Landing gear	13	28.9%
Fire/fire report	6	13.3%
Smoke in the cockpit	6	13.3%
Hydraulic failure	5	11.2%
Smoke in the cabin	4	9.0%
Engine failure	2	4.4%
Bird strike	2	4.4%
Fuel leak	1	2.2%
Flight control	1	2.2%
Rejected takeoff	1	2.2%
Unknown	4	8.9%
Total	**45**	**100.0%**

ERCOM = emergency communication

Source: Florian Grosch

Table 1

Notes

1. Incident: Air Berlin, A33-3 at Düsseldorf, Aug. 15, 2011, fire on board, <avherald.com/h?article=44528d0c&opt=0>.
2. NTSB, Safety Recommendation A98-41-42, June 25, 1998.
3. ARFF Frankfurt, German Commercial Pilot Forum, Frankfurt am Main, Germany, March 28, 2011.
4. Airport Cooperative Research Program (ACRP), Report 2, *Evaluation and Mitigation of Aircraft Slide Evacuation Injuries*. Washington, D.C., 2008, p. 19.
5. DFS, Presentation Feuerwehrfrequenz, May 2011.
6. Telephone interview with ARFF Hamburg, June 11, 2011.
7. Rudloff, A., head of ARFF Stuttgart, via email, June 9, 2011.

Quality *and* Safety

They are different but complementary business principles.

BY MARIO PIEROBON

Given the evolution of the aviation safety regulatory framework in the European Union (EU), the United States and other aviation markets, in particular with regard to mandating safety management systems (SMSs), it is important to reflect on the principles of *quality* and *safety*, to understand what each has to offer to an aviation operator's bottom line, and to reflect on the future of aviation management systems.

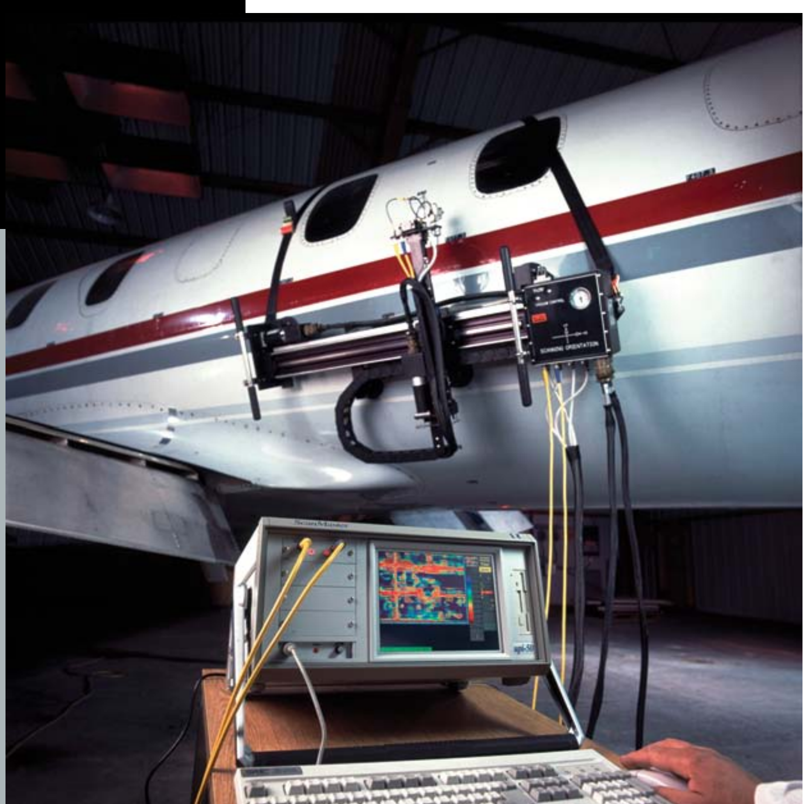
Before beginning, it is best to clarify the terms under consideration. "Quality," as defined by the International Organization for Standardization (ISO) standard 9000:2005,[1] is "the degree to which a set of inherent characteristics fulfils requirements." "Safety," as defined in the International Civil Aviation Organization (ICAO) *Safety Management Manual*,[2] is "the state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management."

The first thing that emerges from the definitions is that quality and safety are not the same. Quality refers to meeting requirements, and safety refers to keeping people and property from harm. The two principles are nevertheless related.

Customers and regulators require certain safety requirements to be met by an air operator; therefore, a quality product is also necessarily safe.

ISO standard 9001:2008 requires the implementation of a quality management system (QMS) oriented to meeting customer requirements, thus improving customer satisfaction. The scope of a QMS as required by ISO goes well beyond the compliance of an air operator with regulatory safety requirements. Many areas related to the customer experience that have little if anything to do with safety fall under the competence of a QMS as required by ISO.

The European Joint Aviation Authorities (JAA), through its Joint Aviation Requirements, first promoted the compulsory introduction of quality management in airline operations in the European Union.[3] Several other countries (for example, in the Gulf regions) have followed the JAA's regulatory efforts with regard to quality management, in many cases adopting the same regulations by simply changing their names. This is a path, however, that many important aviation markets, most notably the United States, have not followed. The European regulation that currently establishes a mandatory QMS is EU Regulation on Air Operations (EU OPS) 1.035, but it prescribes only basic quality requirements, "to monitor compliance with, and adequacy of, procedures required to ensure safe operational practices and airworthy aeroplanes."[4] In airline operations, QMSs are mandatory with only safety in mind and with no consideration for other, more strategic, business areas.



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SMS Quality Principles

In the past decade, ICAO has developed the ICAO *Safety Management Manual*, which accounts for a key innovation: the promotion of SMSs and the provision of guidance on how to implement them. According to ICAO,[2] an SMS shares many commonalities with a QMS, and specific SMS processes are nurtured by quality principles. QMSs and SMSs both need to be planned and managed; both depend on measurement and monitoring; both involve every function, process and person in the organization; and both strive for continuous improvement.[2] In the safety assurance component of an SMS, the application of quality assurance principles helps to ensure that the requisite system-wide safety measures have been taken to support the organization in achieving its safety objectives.[2]

Although QMSs and SMSs share many common features, the peculiarities of SMSs should not be underestimated. SMSs promote the achievement of high safety standards by encouraging a safety culture that considers the human dimension organization-wide and by promoting a hazard identification/risk management–based approach to safety management. In a QMS, two parts can be identified: quality control and quality assurance. Quality control is reactive — that "part of quality management focused on fulfilling requirements."[1]

Quality assurance is proactive — the "part of quality management focused on providing confidence that quality requirements will be fulfilled."[1] Just as the scope of QMS goes well beyond monitoring compliance with safety requirements, its inclusion in SMSs extends the scope of safety management beyond ensuring the conformance of working practices with safety requirements toward thoroughly identifying hazards, some of which are organization-specific. An SMS is therefore considerably more proactive than a QMS; furthermore, the theory that supports SMS has been developed with only safety in mind, while the theory supporting QMS has been developed with customer satisfaction in mind.

Quality and safety are both fundamental for an organization to attain its corporate goals. Air operators have disparate goals, but they almost all attempt to transport passengers and/or cargo by air at a profit. The fundamental importance of safety in allowing an air operator to operate safely and profitably is unquestionable, because an airline with a poor safety record can be banned from flying to some countries and is not likely to attract many customers. As airlines are increasingly operating in commercially unregulated environments, the ability to meet customer requirements and to improve customer satisfaction is increasingly becoming the determinant of airline profitability. It is to improve its business performance that an air operator can benefit from the implementation of a QMS, without necessarily obtaining a certification.

Integrated Aviation Management Systems

Some countries (e.g., Australia and Canada) have already made SMSs mandatory. Many other countries, including the United States and those in the EU, will soon require SMS implementation as mandated by ICAO. Since air operators are or will be mandated to implement another system — the SMS — it would be more efficient to implement an SMS with the intention of adopting also a more comprehensive integrated aviation management system (IAMS). An IAMS is the result of the integration of all management systems within an airline, and "describes the relationship and operational responsibility of each supporting management system within the overall enterprise."[5] Air operators are complex businesses: they require multiple management systems (including several trans-organizational systems), have dispersed operations, have many technical functions requiring skilled employees, and are highly regulated and characterized by overlapping state jurisdictions.[5]

Within this operational complexity, inefficiencies can arise from the overlapping of different systems. If, with the appropriate approach and the appropriate culture, the numerous management systems are integrated, airlines will benefit not only from the contribution each system brings but from a smoother functioning of each system — because of the higher efficiencies generated by the integration. The systems will support one another in optimally achieving the air operator's business objectives.

Total Quality Management

Although air operators around the world have succeeded in offering a quality product that is highly safe and usually affordable (meeting another customer requirement: low fares), the air operators have not been rewarded for the quality of their services. The airline industry is notorious for never having paid returns to its shareholders in the aggregate. The problem of the profitability of the industry needs to be urgently targeted.

For efficiency and profitability, airlines can benefit from an advanced form of quality management, total quality management (TQM). This tool goes well beyond satisfying the customer or offering quality products as required by ISO 9000.[3] TQM is a management approach in which all members of an organization participate in improving processes, products, services and the culture in which they work.[3] Airlines can benefit from TQM because it is widely agreed that the industry needs cost reduction and control, without losing the focus on product safety.

TQM emphasizes, among other things, eradicating defects and waste from operations, reducing development cycle times, reducing product and service costs, and challenging quantified goals and benchmarking.[3] In implementing TQM, airlines could follow the European Foundation for Quality Management model or the U.S. Malcolm Baldrige model. The latter provides a framework for business excellence that stresses the importance of financial and marketplace performance.

Mario Pierobon is an aviation safety professional and writer. He has worked at the International Air Transport Association in Montreal and holds a master of science degree in air transport management from City University London.

Notes

1. ISO. *ISO 9000:2005 Quality Management Systems — Fundamentals and Vocabulary,* 2005.

2. ICAO. *Safety Management Manual (SMM)*, Doc 9859, AN/474, second edition, 2009.

3. Buono, G. *Course Book of Quality Management in Airline Operations.* City University London, 2010.

4. EU Regulation No 1899/2006 of the European Parliament and of the Council of 12 December 2006. Published in *Official Journal of the European Union*, Dec. 12, 2006.

5. Lonsbury, S."Integrated Aviation Management Systems (IAMS)." Presentation at City University London, May 28, 2010. Sandra Lonsbury is senior vice president aviation and aerospace practice, Aviation Risk Advisory Solutions at Marsh.

BY RICK DARBY

Absolute Zero

Large U.S. scheduled air carriers and commuter airlines had no fatal accidents in 2011.

For the second year in a row, U.S. Federal Aviation Regulations Part 121 and Part 135 scheduled (commuter) operations resulted in no fatalities, according to preliminary data from the U.S. National Transportation Safety Board (NTSB).[1] Part 135 on-demand (air taxi) flights, however, had the most fatal accidents and fatalities since 2008.

The accident rates for scheduled Part 121 flights and scheduled Part 135 flights favored Part 121 flights. The former had a rate of 0.314 accidents per 100,000 departures, the latter 0.714 accidents per 100,000 departures, or 2.3 times the Part 121 rate (Table 1). The contrast based on rates per 100,000 flight hours was even starker: 0.162 for Part 121

Accidents, Fatalities and Rates, U.S. Civil Aviation, 2011

	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	28	0	0	0	0.162	—	0.314	—
Nonscheduled	3	0	0	0	0.637	—	1.987	—
U.S. air carriers operating under FARs Part 135								
Commuter	4	0	0	0	1.303	—	0.714	—
On-Demand	50	16	41	41	1.500	0.480	—	—
U.S. general aviation	1,466	263	444	433	6.510	1.170	—	—
U.S. civil aviation	1,550	279	485	474	—	—	—	—
Non-U.S.-registered aircraft	10	2	4	4	—	—	—	—

FARs = U.S. Federal Aviation Regulations

Notes: All data are preliminary.

Flight hours and departures are compiled and estimated by the U.S. Federal Aviation Administration (FAA). On-demand Part 135 and general aviation flight hours are estimated by the FAA. Departure information for on-demand Part 135 operations and general aviation is not available. On-demand Part 135 operations encompass charters, air taxis, air tours, or medical services when a patient is aboard.

Accidents and fatalities in the categories do not necessarily sum to the figures in U.S. civil aviation because of collisions involving aircraft in different categories.

Source: U.S. National Transportation Safety Board

Table 1

Accidents and Accident Rates, FARs Part 121, by NTSB Classification, 2002–2011

	Accidents				Accidents per Million Hours Flown			
Year	Major	Serious	Injury	Damage	Major	Serious	Injury	Damage
2002	1	1	14	25	0.058	0.058	0.810	1.446
2003	2	3	24	25	0.114	0.172	1.374	1.431
2004	4	0	15	11	0.212	0	0.794	0.583
2005	2	3	11	24	0.103	0.155	0.567	1.238
2006	2	2	7	22	0.104	0.104	0.363	1.142
2007	0	2	14	12	0	0.102	0.713	0.611
2008	4	1	8	15	0.209	0.052	0.419	0.785
2009	2	3	15	10	0.114	0.170	0.852	0.568
2010	1	0	14	14	0.056	0	0.789	0.789
2011	0	0	19	12	0	0	1.070	0.676

FARs = U.S. Federal Aviation Regulations; NTSB = U.S. National Transportation Safety Board

Notes: The NTSB classifications are as follows:

Major — an accident in which any of three conditions is met: A Part 121 aircraft was destroyed, or there were multiple fatalities, or there was one fatality and a Part 121 aircraft was substantially damaged.

Serious — an accident in which at least one of two conditions is met: 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.

Injury — a nonfatal accident with at least one serious injury and without substantial damage to a Part 121 aircraft.

Damage — an accident in which no person was killed or seriously injured, but in which any aircraft was substantially damaged.

Source: U.S. National Transportation Safety Board

Table 2

versus 1.303 for commuter flights, making the commuter rate eight times that for Part 121 air carriers.

Departure information was unavailable for Part 135 on-demand operations, but the rate for all accidents per 100,000 flight hours showed nearly the same discrepancy: 2.4 times the rate of nonscheduled Part 121 operations. The rate for commuters was 1.303, that for on-demand flights was 1.500, 15 percent higher.

The term "accident," which covers a lot of sins, is an inexact metric for risk management. The NTSB endeavors to be more descriptive by classifying accidents as major, serious, injury or damage in descending order of severity.[2] Part 121 operations have enjoyed two years in the 2002–2011 decade with no major accidents, and 2011 was one of them (Table 2). On top of that, there were no serious accidents, the next-most significant category, for the second successive year.

The 2011 rate per million flight hours of Part 121 major accidents — zero — compares with an average rate of 0.108 for the 2002–2010 period.[3] The rate of serious accidents in the nine years previous to 2011 averaged 0.090, versus zero in 2011. The injury accident rate, 1.070 per million flight hours in 2011, was up from the 0.742 average from 2002 to 2010.

In Part 121 scheduled operations, there were 28 accidents in 2011, one more than in 2010 and less than the average 29.7 for the 2002–2010 stretch (Table 3). The accident rate per 100,000 departures in 2011, at 0.314, was the highest since 2003 and above the average for the previous nine years, 0.288.

Part 121 nonscheduled operations — cargo flights and some charter flights in transport category airplanes — resulted in three accidents in 2011, none fatal (Table 4). It was the first year since 2006 with no fatal accidents in this industry segment. The number of accidents matched that of 2010, and was less than the 2002–2010 average of 5.2. The 2011 accident rate per 100,000 departures, 1.987, was an increase over 2010's 1.801.

Part 135 scheduled (commuter) operations had no fatal accidents for the fifth straight year (Table 5, p. 52). There were four accidents in 2011, down from six in 2010; the average for the previous nine years was 4.4. The 2011 rate, 0.714 accidents per 100,000 departures, was a 29 percent improvement on 2010's 1.011. The average rate for 2002–2010 was 0.800.

Accident Rates, FARs Part 121 Scheduled Operations, 2002–2011

	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
2002	34	0	0	0	0.2030	—	0.0049	—	0.3310	—
2003	51	2	22	21	0.3020	0.0120	0.0073	0.0003	0.4990	0.0200
2004	23	1	13	13	0.1260	0.0050	0.0030	0.0001	0.2130	0.0090
2005	34	3	22	20	0.1820	0.0160	0.0043	0.0004	0.3120	0.0270
2006	26	2	50	49	0.1390	0.0110	0.0033	0.0003	0.2450	0.0190
2007	26	0	0	0	0.1370	—	0.0032	—	0.2420	—
2008	20	0	0	0	0.1080	—	0.0026	—	0.1950	—
2009	26	1	50	49	0.1520	0.0060	0.0036	0.0001	0.2720	0.0100
2010	27	0	0	0	0.1570	—	0.0037	—	0.2850	—
2011	28	0	0	0	0.1620	—	0.0038	—	0.3140	—

FARs = U.S. Federal Aviation Regulations

Notes: 2011 data are preliminary.

Flight hours, miles and departures are compiled by the U.S. Federal Aviation Administration.

Source: U.S. National Transportation Safety Board

Table 3

Accidents, Fatalities and Rates, FARs Part 121, Nonscheduled Operations, 2002–2011

	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
2002	7	0	0	0	1.2250	—	0.0265	—	3.0120	—
2003	3	0	0	0	0.5170	—	0.0113	—	1.4620	—
2004	7	1	1	1	1.0020	0.1430	0.0215	0.0031	2.9150	0.4160
2005	6	0	0	0	0.8850	—	0.0186	—	2.7280	—
2006	7	0	0	0	1.1380	—	0.0243	—	3.6190	—
2007	2	1	1	1	0.3210	0.1610	0.0069	0.0034	1.0300	0.5150
2008	8	2	3	1	1.4640	0.3660	0.0313	0.0078	4.8320	1.2080
2009	4	1	2	2	0.9010	0.2250	0.0184	0.0046	2.8540	0.7130
2010	3	1	2	2	0.5820	0.1940	0.0122	0.0041	1.8010	0.6000
2011	3	0	0	0	0.6370	—	0.0131	—	1.9870	—

FARs = U.S. Federal Aviation Regulations

Notes: 2011 data are preliminary.

Flight hours, miles and departures are compiled by the U.S. Federal Aviation Administration.

Source: U.S. National Transportation Safety Board

Table 4

Two years earlier, in 2009, the number and rate of fatal accidents for Part 135 on-demand (air taxi) operations showed an impressive year-over-year improvement (*ASW*, 4/10, p. 48). That now appears to have been a one-off. Numbers and rates of fatal accidents rose in 2010 and 2011 (Table 6, p. 52). In 2011, there were 16 fatal accidents, up from six in 2010. The fatal

Accidents, Fatalities and Rates, FARs Part 135, Commuter Operations, 2002–2011

	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
2002	7	0	0	0	2.5590	—	0.1681	—	1.3630	—
2003	2	1	2	2	0.6270	0.3130	0.0422	0.0211	0.3490	0.1750
2004	4	0	0	0	1.3240	—	0.0855	—	0.7430	—
2005	6	0	0	0	2.0020	—	0.1312	—	1.1380	—
2006	3	1	2	2	0.9950	0.3320	0.0645	0.0215	0.5280	0.1760
2007	3	0	0	0	1.0280	—	0.0651	—	0.5060	—
2008	7	0	0	0	2.3850	—	0.1508	—	1.2150	—
2009	2	0	0	0	0.6480	—	0.0441	—	0.3460	—
2010	6	0	0	0	1.9470	—	0.1264	—	1.0110	—
2011	4	0	0	0	1.3030	—	0.0843	—	0.7140	—

FARs = U.S. Federal Aviation Regulations

Notes: 2011 data are preliminary. Flight hours, miles and departures are compiled by the U.S Federal Aviation Administration (FAA).

Based on a February 2002 FAA legal interpretation provided to the U.S. National Transportation Safety Board, any Part 135 operation conducted with no revenue passengers aboard is to be considered an on-demand flight.

Source: U.S. National Transportation Safety Board

Table 5

Accidents, Fatalities and Rates, FARs Part 135, On-Demand Operations, 2002–2011

	Accidents		Fatalities		Accidents per 100,000 Flight Hours	
Year	All	Fatal	Total	Aboard	All	Fatal
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	65	11	18	16	1.70	0.29
2006	52	10	16	16	1.39	0.27
2007	62	14	43	43	1.54	0.35
2008	58	20	69	69	1.81	0.62
2009	47	2	17	14	1.62	0.07
2010	31	6	17	17	1.00	0.19
2011	50	16	41	41	1.50	0.48

FARs = U.S. Federal Aviation Regulations

Notes: 2011 data are preliminary.

Flight hours are estimated by the U.S Federal Aviation Administration (FAA).

In 2002, the FAA changed its estimate of on-demand activity. The revision was retroactively applied to the years 1992 to 2002. In 2003, the FAA again revised flight activity estimates for 1999 to 2002.

On-demand Part 135 operations comprise charters, air taxis, air tours or medical services when a patient is aboard.

Source: U.S. National Transportation Safety Board

Table 6

accident rate per 100,000 flight hours was 0.48, compared with 0.19 in 2010. The rate for all accidents per 100,000 flight hours rose from 1.00 in 2010 to 1.50 in 2011.

Notes

1. <www.ntsb.gov/data/aviation_stats_2012.html>.
2. The NTSB classifications are as follows:

   Major — an accident in which any of three conditions is met: A Part 121 aircraft was destroyed, or there were multiple fatalities, or there was one fatality and a Part 121 aircraft was substantially damaged.

   Serious — an accident in which at least one of two conditions is met: 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.

   Injury — a nonfatal accident with at least one serious injury and without substantial damage to a Part 121 aircraft.

   Damage — an accident in which no person was killed or seriously injured, but in which any aircraft was substantially damaged.
3. All averages in this article are means.

Save the Data

FAA data management is progressing, but gaps include tracking runway excursions.

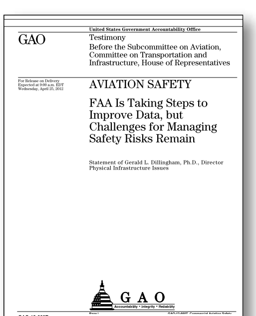
BY RICK DARBY

REPORTS

Toward Risk Prediction and Mitigation

FAA Is Taking Steps to Improve Data, but Challenges for Managing Safety Risks Remain

Gerald L. Dillingham, Ph.D., director, physical infrastructure issues, U.S. Government Accountability Office (GAO). Testimony before the U.S. House of Representatives. GAO-12-660T. April 25, 2012. 20 pp. <www.gao.gov/products/GAO-12-660T>.


United States Government Accountability Office

GAO

Testimony

Before the Subcommittee on Aviation, Committee on Transportation and Infrastructure, House of Representatives

For Release on Delivery Expected at 9:00 a.m. EDT Wednesday, April 25, 2012

AVIATION SAFETY

FAA Is Taking Steps to Improve Data, but Challenges for Managing Safety Risks Remain

Statement of Gerald L. Dillingham, Ph.D., Director Physical Infrastructure Issues

GAO Accountability * Integrity * Reliability

GAO-12-660T

Like the U.S. aviation industry itself, its regulator, the U.S. Federal Aviation Administration (FAA), is shifting its emphasis away from "backward-looking" data — such as analysis of accidents — and toward risk prediction and mitigation strategies. Since 1998, as part of that new principle, the FAA has partnered with the airlines in the Commercial Aviation Safety Team to identify "sleeping" precursors to accidents and root them out before they cause mischief. Such an approach must be heavily data-driven because latent causal factors may only become apparent in huge numbers of observations.

Dillingham began by outlining the FAA's processes designed to help ensure the availability of quality data. "For example, FAA established an agency-wide order on data management that specifies the roles and associated responsibilities for data management within the agency," he said. "This order applies to all sharable information from FAA and other sources used to perform the agency's mission."

The FAA's Office of Aviation Safety created a four-step process for importing data from other FAA offices and outside sources:

- "Data acquisition — obtaining information from various data owners;
- "Data standardization — validating data by comparing a new data set with previous data sets to identify inconsistencies;
- "Data integration — translating data values into plain English and correcting data errors; [and,]
- "Data loading — importing data into the agency's own systems."

Dillingham said that the FAA has developed training for users of data systems and had some controls in place to ensure that erroneous data are identified, reported and corrected. "However, several of the databases lacked an important control in that managers do not review the data prior to entry into the system," he said.

Data limitations and lack of some data hinder the FAA's ability to manage safety risks, Dillingham said. He cited examples of what the GAO considered the FAA's data use problems.

Changes to reporting policies: Operational errors by air traffic controllers "have increased considerably in recent years, with the rate nearly doubling for errors in the terminal area from 2008 to 2011. Multiple changes to reporting policies and processes during this time make it difficult to know the extent to which the recent increases in operational errors are due to more accurate reporting, an increase in the occurrence of safety incidents or both."

'FAA still collects no comprehensive data on incidents in the ramp area.'

He mentioned FAA's instituting a policy of removing controllers' names from the incident report database, which the agency believes encouraged reporting and is responsible for the apparent increase in operational errors. But he said the agency "has not yet conducted an analysis to validate the linkage."

Multiple reporting systems and incomplete data: "FAA's current process for analyzing data on losses of separation captured by [two different systems] only assesses those incidents that occur between two or more radar-tracked aircraft. By excluding incidents such as those that occur between the aircraft and terrain or aircraft and protected airspace, FAA is not considering the systemic risks associated with many other airborne incidents." The FAA says it will include other kinds of incidents in risk assessment before the end of 2013.

Lack of coordination among data systems: The FAA is rich in safety reporting systems. They include the Air Traffic Safety Action Program (ATSAP), through which individual controllers report; the Air Traffic Quality Assurance (ATQA) database, used by quality assurance staff; the Traffic Analysis and Review Program (TARP), which captures incidents automatically at some air traffic control facilities; and the Risk Analysis Process (RAP), to which ATQA and TARP feed data.

An appendix to the testimony notes that the FAA also operates the Aviation Safety Information Analysis and Sharing (ASIAS) system and the Air Transportation Oversight System (ATOS).

Dillingham said, "Though both ATSAP and RAP look at some of the same types of incidents (e.g., airborne losses of separation), they had not coordinated on a common set of contributing factors to describe and analyze the incidents. As a result, it is difficult to compare the data and conduct comprehensive analyses. According to FAA officials, they are currently developing a common set of contributing factors for ATSAP and RAP, as well as a translation capability that will allow for the inclusion of historical data on contributing factors in future analyses."

Limitations of pilot data: Since 1996, U.S. law has required airlines to conduct background checks before hiring pilots, and another law requires the FAA to develop a pilot records database fit for the purpose. "According to the Department of Transportation Inspector General (IG), FAA met the act's initial milestone in developing a centralized electronic pilot records database that will include records previously maintained by air carriers," Dillingham said. "However, the IG indicated that FAA needs to address the level of detail that should be captured from air carrier pilot training records — such as determining whether recurrent flight training will be included, determining how to transition from the current practices to the new database without disrupting information flow and deciding how to ensure the reliability of data."

Lack of ramp incident data: "FAA still collects no comprehensive data on incidents in the ramp area, and the National Transportation Safety Board does not routinely collect data on ramp accidents unless they result in serious injury or substantial aircraft damage," Dillingham said. "The lack of ramp incident data will pose a challenge as airports move to implement SMS [safety management systems]." The FAA responded to an earlier GAO recommendation for ramp incident monitoring that it does so indirectly via its oversight of airlines. The agency has also proposed requiring airports with air carrier operations to establish an SMS.

Not tracking runway excursions: "Runway excursions can be as dangerous as incursions; according to Flight Safety Foundation, excursions have resulted in more fatalities than incursions globally [*ASW*, 8/09, p. 12]," Dillingham said. "FAA does not have a process to track excursions, unlike [that] for runway incursions. We recommended in 2011 that FAA develop and implement plans to track and assess runway excursions. FAA agreed and will be developing a program to collect and analyze runway excursion data and is drafting an order to set out the definitions and risk assessment processes for categorizing and analyzing the data.

"However, according to our review of FAA's plans, it will be several years before FAA has obtained enough detailed information about these incidents in order to assess risks."

Difficulty ensuring safety standards for pilot schools and pilot examiners: The FAA is charged with oversight of the "gatekeepers" of initial pilot training, including U.S. Federal Aviation Regulations Part 141 pilot schools and pilot examiners. Dillingham said, "It was unclear from our analysis of FAA inspection data … whether FAA met its oversight requirements, because we could not determine the number of active entities that should have been inspected each year. FAA does not maintain a historical listing of pilot schools and examiners, and thus, we could not define the universe of active entities that was required to be inspected.

"Because of this data limitation, we could not determine the completion percentage of the inspections for either group. In November 2011, we recommended that FAA develop a comprehensive system for measuring its performance in meeting its inspection requirements for pilot schools and examiners. FAA acknowledged our recommendation and noted that (1) it needed to clarify its inspection requirements for pilot schools in the revision of its national oversight policy guidelines, and (2) its new designee management system, which would include oversight of pilot examiners, will provide more comprehensive data once it is developed."

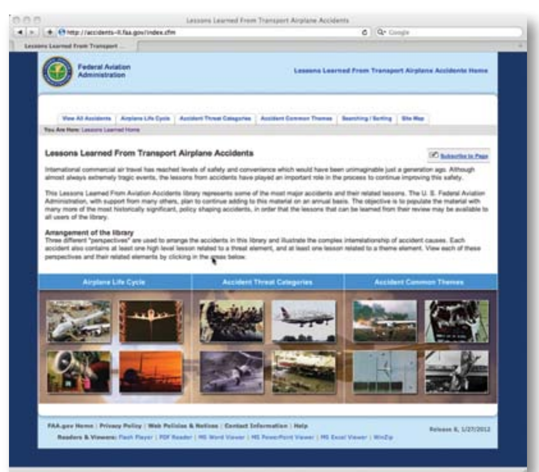
Dillingham concluded, "Shifting to a data-driven, risk-based safety oversight approach means that FAA needs data that are appropriate, complete and accurate to be able to identify system-wide trends and manage emerging risks. Furthermore, when implementing changes in safety data reporting systems, or processes used to assess and analyze data to determine risk, FAA needs to take into account how such changes might impact trend analysis. … While FAA is working diligently to improve its data in some instances, more work remains to address limitations and to collect additional data where necessary."

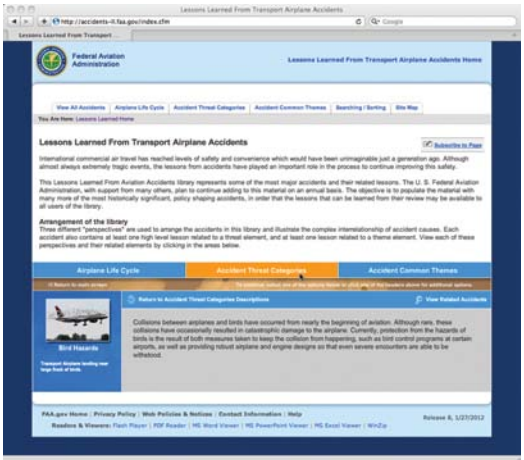
WEBSITES

Causal Factor Library

Lessons Learned From Transport Airplane Accidents, <accidents-ll.faa.gov>

The U.S. Federal Aviation Administration Aviation Safety Information Analysis and Sharing system website features a link to the "Lessons Learned" library, which uses the Web's linking capability to illustrate accident causal factors.





"Three different 'perspectives' are used to arrange the accidents in this library and illustrate the complex interrelationship of accident causes," the site says. "Each accident also contains at least one high-level lesson related to a threat element and at least one lesson related to a theme element."

While that explanation sounds like educational jargon, the site is logically arranged and easy to use. The three top-level perspectives are "Airplane Life Cycle," "Accident Threat Categories" and "Accident Common Themes." Each perspective is shown by four photographs; clicking any photograph leads deeper into the subject.

For example, when you move the cursor into the "Airplane Life Cycle" section of the main screen and click the lower right photo, you see photos representing "Design/Manufacturing," "Operational" and "Maintenance/Repair/Alteration." Let us say you click the last subcategory. A description appears:

"As the airplane continues to be operated, maintenance is performed which is intended to keep the airplane in an airworthy condition. Repair may be necessary in order to correct damage or other events that might have occurred. Alterations may also be desired which change the configuration of the original design."

You are offered two options: "Return to Airplane Life Cycle descriptions" or "View related accidents." If you select the second option, a page appears with descriptions of relevant accidents, with further links to study each accident in detail.

One accident in which maintenance was a factor was the uncontained engine failure involving a McDonnell Douglas MD-88 at Pensacola, Florida, U.S., on July 6, 1996. The description of the accident says:

"The National Transportation Safety Board determined that the probable cause of this accident was the fracture of the left engine's front compressor fan hub, which resulted from the growth to failure of a fatigue crack. A causal analysis undertaken as part of the accident investigation revealed the following: The crack initiated from an area of altered microstructure that was created during a hole drilling process by Volvo for Pratt & Whitney. The anomaly went undetected by Volvo's production inspection system."

Similarly, back at the main screen, clicking "Accident Common Themes" leads to "Flawed Assumptions," "Human Error," "Organizational Lapses," "Pre-existing Failures" and "Unintended Effects." Selecting "Human Error" brings up this description:

"This is the most common of all accident themes and exists in one form or another on nearly all accidents. It involves humans that, in the course of doing their work, make errors that are later shown to have caused, or substantially contributed to the accident. These are human actions that, if done correctly, result in a safe outcome, but if done incorrectly, can result in an accident. It also represents one of the greatest opportunities for advancing safety by the application of targeted interventions which are intended to reduce the risks for human error." Once again, you can choose to open a page with accidents whose causal factors are related to the theme.

The "Accident Threat Categories" perspective leads to a more elaborate link tree; 18 subcategories such as bird hazards and in-flight upsets are listed, each connected to a description and list of related accidents.

Hard Landing Destroys Freighter

‘Exaggerated control inputs’ were made in response to bounces.

BY MARK LACAGNINA

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

JETS

High Sink Rate Not Detected

McDonnell Douglas MD-11F. Destroyed. One serious injury, one minor injury.

The MD-11 freighter bounced twice on landing, and on the third touchdown, the aft fuselage ruptured and the nose landing gear collapsed. The aircraft came to a stop off the left side of the runway and was destroyed by fire. The first officer was seriously injured, and the captain sustained minor injuries.

The accident occurred during a cargo flight from Frankfurt, Germany, to Riyadh, Saudi Arabia, the morning of July 27, 2010. In its final report on the accident, the Aviation Safety Division (ASD) of Saudi Arabia’s General Authority of Civil Aviation issued the following “cause-related” findings:

- “The flight crew did not recognize the increasing sink rate on short final;
- “The first officer delayed the flare prior to the initial touchdown, thus resulting in a bounce;
- “The flight crew did not recognize the bounce;
- “The captain attempted to take control of the aircraft without alerting the first officer, resulting in both flight [crewmembers] acting simultaneously on the control column;
- “During the first bounce, the captain made an inappropriate, large nose-down column input that resulted in the second bounce and a hard landing in a flat pitch attitude;
- “The flight crew responded to the bounces by using exaggerated control inputs; [and,]
- “The company bounced-landing procedure was not applied by the flight crew.”

Among other findings was that “the aircraft had no [aural] or visual indicator, such as a HUD [head-up display], to inform the flight crew of a bounced landing.”

The accident flight was the first time the pilots had flown together. The captain had 8,270 flight hours, including 4,466 hours in type. The first officer had 3,444 flight hours, including 219 hours in type. “The captain decided that the first officer would be the PF [pilot flying], as the first officer had not flown into Riyadh before and it would be an appropriate leg for him to fly,” the report said.

The first officer was transitioning to the MD-11 after serving for nearly 3,000 hours as an Airbus A319 first officer. He had conducted 17 landings in an MD-11 flight simulator and three landings in the aircraft within the previous 30 days.

“En route to Riyadh at cruising altitude, both flight crewmembers took advantage of the company napping policy, where each had about 30 minutes of sleep while remaining in their respective seats,” the report said.

The weather was clear at Riyadh's King Khalid International Airport, with surface winds from 340 degrees at 14 kt. The temperature was 39 degrees C (102 degrees F), and density altitude was about 5,300 ft.

'Prior to the third, and final, touchdown, both pilots pulled back on the control column.'

The crew received radar vectors from air traffic control (ATC) for the instrument landing system (ILS) approach to Runway 33L. The first officer hand flew the approach. "The aircraft was centered on the glideslope and localizer … until 25 seconds before touchdown, when it dipped by half a dot below the glideslope," the report said, noting that groundspeed gradually increased from 164 kt to 176 kt. The reference landing speed (V_{REF}) was 158 kt.

The MD-11 was between 23 and 31 ft above the runway when the first officer began the flare, and it touched down 945 ft (288 m) from the threshold of the 13,797-ft (4,205-m) runway with a descent rate of 780 fpm. The aircraft bounced 4 ft above the runway, and the captain pushed the control column forward. "The aircraft touched down a second time in a flat pitch attitude, with both the main gear and nose gear contacting the runway, at a descent rate of … 660 fpm, achieving a [vertical acceleration] of 3.0 g," the report said.

Rebound from the nose landing gear contact and aft control column input by both pilots caused the airplane to bounce again — this time, 12 ft above the runway and with a pitch attitude of 14 degrees nose-up. "Early in this second bounce, the captain pushed the control column to its forward limit," the report said. "Prior to the third, and final, touchdown, both pilots pulled back on the control column" but only partially arrested the nose-down pitch rate.

The descent rate was 1,020 fpm and vertical acceleration was 4.4 g when the aircraft touched down the third time. "The aft fuselage ruptured behind the wing trailing edge," the report said. "Two fuel lines … were severed, and fuel spilled within the left-hand wheel well. A fire ignited and traveled to the upper cargo area."

The MD-11 veered off the left side of the runway and came to a stop on a gravel surface 8,800 ft (2,682 m) from the approach threshold and 300 ft (91 m) left of the centerline. The pilots used the left-front door escape slide to evacuate the aircraft. "The captain sustained minor cuts to the head," the report said. "The first officer sustained spinal injuries that required major surgery and hospitalization."

Bounced landing recovery procedures are included in the MD-11 flight crew operating manual (FCOM), which states, "If the aircraft should bounce, hold or re-establish a normal landing attitude and add thrust as necessary to control the rate of descent. Avoid rapid pitch rates in establishing a normal landing attitude."

Investigators found, however, that it is difficult for MD-11 pilots to recognize a bounced landing. "The difficulty is that flight crews do not know that the aircraft is airborne after the landing," the report said. "This difficulty comes mainly from the fact that the flight crews do not feel/sense a bounce, and there is no visual or [aural] indication of a bounce."

Based on the findings of the investigation, the ASD issued several recommendations, including a revision of the MD-11 FCOM to "re-emphasize high sink rate awareness during landing, the importance of momentarily maintaining landing pitch attitude after touchdown and using proper pitch attitude and power to cushion excess sink rate in the flare, and to go around in the event of a bounced landing." The report noted that Boeing, which acquired McDonnell Douglas in 1997, subsequently amended the FCOM accordingly.

Computers Stop Communicating

Airbus A319-131. No damage. No injuries.

An intermittent "loss of communication" between the A319's probe heat computers and the centralized fault display system, combined with icing of the standby pitot probe, resulted in the deletion of airspeed information on the commander's and the standby flight displays during final approach to London Heathrow Airport the afternoon of Dec. 17, 2010, said a report on the incident issued in April by the U.K. Air Accidents Investigation Branch (AAIB).

The flight crew conducted a go-around, diverted to London Luton Airport and landed the aircraft without further incident.

The incident occurred during a scheduled flight from Geneva with 122 passengers and six crewmembers. Nearing London, the aircraft encountered icing conditions when it descended into instrument meteorological conditions, and the electronic centralized aircraft monitor (ECAM) displayed cautionary messages and remedial actions for faults in the heating systems for the captain's right static probe and total air temperature probe. The crew responded accordingly but then received ECAM messages about a fault in the right standby static probe anti-icing system.

"Because of the number of messages received relating to anti-icing, the crew decided, as a precaution, to review the QRH [quick reference handbook] procedure for unreliable speed [indications]," the report said.

The A319 was about 800 ft above airport elevation when the airspeed indication on the commander's primary flight display decreased to about 60 kt and the indication on the standby display decreased to zero. The commander called "unreliable airspeed," initiated a go-around and declared an emergency.

While troubleshooting the problem, the crew found that reliable airspeed information was available by selecting the no. 2 air data reference system. The pilots decided to divert to Luton because the weather was better there and icing conditions would not be encountered during the approach and landing.

Caught in a Sink Hole

Boeing 737-800. Substantial damage. No injuries.

The 737 was being taxied from a paint facility to the runway at Mid Delta Regional Airport in Greenville, Mississippi, U.S., the night of May 6, 2011, when the left main landing gear dropped through the ramp surface. "The left main landing gear strut failed, and the airplane settled onto the left engine and rear fuselage, damaging the engine cowl and fuselage sheet metal," the U.S National Transportation Safety Board (NTSB) report said. The two pilots were not hurt.

Examination of the ramp by U.S. Federal Aviation Administration personnel showed that the surface comprised about 6 in (15 cm) of concrete reinforced by 3/4-in (2-cm) steel rods. "A large void was found directly beneath an area of sunken ramp pavement," the report said. "The void was about 6 ft [2 m] deep and 20 ft [6 m] across. Further examination of the void revealed the presence of a failed utility water pipe, which was found to have failed at a pipe joint."

'Hot Corrosion' Causes Engine Failure

Boeing 747-400F. Substantial damage. No injuries.

The 747 freighter was about 140 ft above the runway during takeoff from Narita (Japan) International Airport the night of June 11, 2010, when the flight crew heard an abnormal noise and observed instrument indications that the no. 1 (left outboard) engine had failed. The crew secured the engine, climbed to 7,000 ft, jettisoned about 150,000 lb (68,040 kg) of fuel and returned to Narita, where they landed the freighter without further incident, said the report by the Japan Transport Safety Board.

An initial borescope examination of the no. 1 engine showed that four of the 80 blades on the stage 1 high-pressure turbine were fractured and all the others were damaged; all 74 blades on the stage 2 high-pressure turbine were damaged; and the low-pressure rotor had seized.

The flight crew heard an abnormal noise and observed instrument indications that the no. 1 (left outboard) engine had failed.

A subsequent teardown inspection of the engine revealed signs of "hot corrosion" on the stage 1 high-pressure turbine blades. The report said that hot corrosion occurs during combustion when the sulfur in jet fuel reacts with sodium chloride carried in by the airflow and creates sodium sulfate and other products that accumulate on turbine blades and cause pitting and fatigue cracking. Inspection of the other three engines on the 747 revealed pitting on the blade shank areas.

The report said that it is "highly probable" that hot corrosion in the failed engine had caused the stage 1 high-pressure turbine blades to fracture, producing fragments that had caused further damage to the engine, which had accumulated more than 17,000 hours and 3,126 cycles since its manufacture in 2005.

General Electric, the manufacturer of the CF6-80C engines, had issued recommendations in 2007 and 2008 to install blades with a modified shape and vapor chromide coating that protect against hot corrosion, the report said, noting that the operator of the incident aircraft had planned to install the new blades during the next scheduled overhauls of the engines.

Wet-Runway Overrun

Cessna 525A. Substantial damage. No injuries.

The right-front-seat passenger, who held a student pilot license and was a co-owner of the Citation CJ2, was at the controls for the majority of the business flight from Artesia, New Mexico, U.S., to Nashville, Tennessee, the afternoon of June 15, 2011, said the NTSB report. The airplane is certified for single-pilot operation, but the pilot-in-command (PIC), who had logged 670 of his 13,500 flight hours in type, did not hold a flight instructor certificate.

On final approach to Nashville's John C. Tune Airport, the PIC told the student pilot that the airplane was "real high and hot" and that he needed to "get down and slow down." The student pilot replied that the "landing is yours."

The PIC told investigators that he assumed control and "started a steep approach." The enhanced ground-proximity warning system generated eight "SINK RATE" and "PULL UP" warnings. The PIC considered a go-around but decided to continue the approach. The airplane touched down about 1,500 ft (457 m) down the wet, 5,500-ft (1,676-m) runway. The PIC said that although he applied full wheel braking, the airplane overran the runway and struck ILS antennas.

"The PIC applied full left rudder to avoid going down an embankment," the report said. "The airplane came to rest after turning about 180 degrees." The left main landing gear collapsed and the wings were structurally damaged during the accident, but the five people aboard the airplane escaped injury.

The report said that after the accident, the company that managed the Citation "modified its operational procedures to restrict unqualified personnel from the cockpit during flight [and initiated] a formal risk-assessment program."

Struck by a Truck

Bombardier CRJ200. Substantial damage. No injuries.

The driver parked the service truck nose-first against the terminal building at Chicago O'Hare International Airport the morning of Nov. 2, 2010. He set the transmission in the "PARK" position but did not shut off the engine or set the parking brake before walking away from the truck, the NTSB report said.

Surveillance video showed the truck moving backward and passing in front of the CRJ, which was being taxied from the gate. The truck then made a 180-degree turn, struck the front left fuselage and lodged beneath the nose of the airplane. None of the 37 people aboard the CRJ was injured.

"A postaccident inspection of the truck revealed that the transmission shift cable was out of adjustment, which allowed the transmission to slip into reverse," the report said, noting that a maintenance inspection of the truck was 84 hours overdue.

TURBOPROPS

Short Spurs False Smoke Warning

Bombardier Q400. No damage. No injuries.

The Q400 was cruising at 24,000 ft during a scheduled flight with four crewmembers and 47 passengers from New Quay, Wales, to Edinburgh, Scotland, the morning of July 21, 2011, when the pilots received warning indications of smoke in the forward baggage compartment. They donned oxygen masks and smoke goggles, and conducted the "Fuselage Fire or Smoke" checklist, which resulted in the removal of electrical power to several flight displays, the autopilot, the transponder and the data recorders, the AAIB report said. In addition, the cabin began to depressurize, and fire suppressant material was discharged into the forward baggage compartment.

The crew declared an urgency and were told by ATC that the aircraft was 90 nm (167 km) from Edinburgh. The commander told the senior cabin crewmember to secure the cabin in preparation for an emergency descent into Edinburgh.

"The pilots then took off their oxygen masks and smoke goggles because there were no signs of fire or smoke in the flight deck," the report said. "The senior cabin crewmember reported on the interphone that she could not smell any smoke."

The crew conducted a surveillance radar approach to Edinburgh Airport and landed the aircraft without further incident. "The aircraft was taxied from the runway onto [a taxiway], brought to a halt near the fire vehicles and shut down, following which the commander ordered the passengers to evacuate," the report said. "The fire service found no signs of fire or smoke."

Examination of the aircraft revealed that moisture had accumulated in a connector on the forward smoke detector, causing an intermittent short circuit and the false smoke warning.

Electrical Failure Traced to Switches

Beech King Air 200. Substantial damage. No injuries.

Shortly after taking off from Montpellier, France, on a business flight with two passengers the morning of Jan. 7, 2011, the copilot, who was flying the King Air from the left seat, found that his attitude director indicator was not functioning and transferred control to the captain.

The copilot then noticed that the generator caution lights were illuminated and tried unsuccessfully to reset the generators, said the report by the French Bureau d'Enquêtes et d'Analyses (BEA). The captain decided to return to Montpellier, which had good visibility and broken ceilings at 900 ft and 2,000 ft.

When the copilot attempted to extend the landing gear, a total electrical failure occurred, and he began to manually extend the landing gear. "The lighting conditions in the cockpit were then very dark, and the crew had difficulty in reading the instrument displays," the report said. After establishing visual contact with the runway, the captain circled the airport while the copilot continued the manual gear extension.

The copilot said that he did not feel sufficient resistance to movement of the gear-extension lever to indicate that the landing gear was fully extended. "Given the weather and the difficulty of reading the instruments, the captain decided to land," the report said. "During the landing roll, the main landing gear collapsed slowly, the fuselage came into contact with the ground, and the aircraft stopped on the runway."

Investigators concluded that before beginning the takeoff, the copilot inadvertently had selected the ignition and engine-start switches to the "ON" position when he attempted to select the engine auto-ignition switches to the "ARM" position. This action automatically disengaged the generators. "The crew did not immediately notice the warning lights coming on that resulted from this and continued the takeoff," the report said.

'The crew did not immediately notice the warning lights.'

The BEA said a factor that contributed to this accident — and two similar accidents — was the similarity of the switches and their proximity on the lower left subpanel. "Since this accident occurred, the operator has completed the installation of foolproof engine auto-ignition switches," the report said.

ATC Faulted in Near Midair Collision

Beech 1900C, Piper Navajo. No damage. No injuries.

The Beech 1900 was about 3.5 nm (6.5 km) west of Fairbanks (Alaska, U.S.) International Airport and was entering a right downwind leg to land on Runway 20L when the flight crew told the approach controller, "We just had a Navajo fly over the top of us." The crew later reported that they had descended to avoid the Navajo and estimated that it had passed 100-150 ft over their airplane.

The NTSB report on the near midair collision, which occurred in visual meteorological conditions the afternoon of June 14, 2011, said that it was caused by "ATC actions that failed to establish and maintain required separation."

Shortly before the incident, a shift change had occurred at the approach control position, and the incoming controller believed that the 1900 crew was in radio communication with the airport traffic (local) controller.

Meanwhile, the local controller had cleared the pilot of the Navajo, which had four charter passengers aboard, for takeoff from the parallel runway, 20R, and had approved her request to climb on an on-course heading of 278 degrees. The local controller also had told the Navajo pilot to maintain 2,000 ft and had advised her of the inbound 1900. The controller issued two more traffic advisories, but the pilot stated that she did not have the traffic in sight.

"Neither the local controller nor the controller-in-charge, who was responsible for monitoring the operation and assisting the local controller, initiated any coordination with the approach controller to resolve the conflict," the report said.

Loon Penetrates Wing

Bombardier Q400. Substantial damage. No injuries.

The airplane was nearing Los Angeles International Airport at 7,500 ft and 234 kt the afternoon of Nov. 8, 2010, when it struck a bird. The flight crew declared an emergency and landed the Q400 without further incident.

Examination of the airplane revealed a hole 12 in (30 cm) in diameter in the leading edge of the right wing, between the engine nacelle and wing tip. The remains of the bird were analyzed and identified by the Smithsonian's Feather Identification Laboratory as those of a common loon, which has an average weight of about 11 lb (5 kg).

PISTON AIRPLANES

Fuel Starvation Follows Electrical Failure

Beech Baron 55. Destroyed. One minor injury.

After dropping off two charter passengers at Thicket Portage, Manitoba, Canada, the morning of May 13, 2010, the pilot noticed that the engines turned over more slowly than normal during the restart. Investigators later determined that both generators were off line due to a short circuit in one voltage regulator and improper adjustment of the other regulator to a voltage that was insufficient to allow its associated generator to power the electrical bus, said the report by the Transportation Safety Board of Canada (TSB).

Retraction of the landing gear on takeoff depleted battery power. The pilot used his cell phone to call the Winnipeg Flight Information Center and report an "electrical problem" and that he would be landing in Thompson, which is about 29 nm (54 km) north of Thicket Portage, without radios or a transponder.

The weather in the area was clear, but the pilot became disoriented while trying to use the electrically powered horizontal situation indicator to navigate, and the Baron strayed well to the east of course. The pilot eventually saw railroad tracks that led to the Pikwitonei Airport, which is about 27 nm (50 km) southeast of Thompson, and decided to follow them.

The pilot was turning the aircraft onto an extended base leg to land at Pikwitonei when both engines lost power due to fuel starvation. He repositioned the fuel selectors from the main tanks to the auxiliary tanks, and "neither engine was feathered in the hope that the windmilling engines would restart," the report said.

The Baron was in a steep left bank when it struck trees, rolled inverted and crashed about 3 nm (6 km) east of the airport. "The force of the impact was severe, and the pilot lost consciousness briefly but sustained only minor injuries," the report said, attributing this to the pilot's use of his seat belt and shoulder harness.

Distraction Leads to Gear-Up Landing

Douglas DC-6B. Substantial damage. No injuries.

The DC-6 was on an on-demand cargo flight from Togiak Village, Alaska, U.S., to Cold Bay the afternoon of June 12, 2011. The captain told investigators that he inadvertently distracted the crew during approach by pointing out a boat dock. As a result, none of the four crewmembers realized that the landing gear had not been extended. The captain said that he did not hear the landing gear warning horn.

"He said that after touchdown, he realized that the landing gear was not extended, and the airplane slid on its belly, sustaining substantial damage to the underside of the fuselage," the NTSB report said.

Below Minimums, Into Trees

Cessna 310R. Destroyed. Two fatalities.

The pilot was conducting a charter flight the afternoon of March 30, 2011, from Dayton, Ohio, U.S., to Pike County (Kentucky)

Airport, an uncontrolled field located on a 1,473-foot ridge. The automated weather observation system reported that visibility ranged from 1.0 to 1.5 mi (1,600 to 2,400 m) and the ceiling was between 200 and 300 ft.

However, when the pilot established radio communication on the common traffic advisory frequency, an airport employee told him that "the weather conditions were worse than what was reported," the NTSB report said.

The pilot requested and received clearance to conduct the global positioning system (GPS) approach to Runway 09. The minimum descent altitude (MDA) for the approach is 1,960 ft, or 506 ft above runway touchdown zone elevation. The report noted that the pilot chose the non-precision approach although an ILS approach to Runway 27 also was available, with a decision height 200 ft above touchdown zone elevation.

Recorded ATC radar data showed that the 310 descended below the MDA. Witnesses saw the airplane emerge from the clouds and strike trees. "They stated that the fog was heavy and that the clouds were on top of the trees," the report said. "The first identifiable tree strikes were 1,100 ft [335 m] right of the runway centerline and about 100 ft below the airport elevation."

Toxicological tests revealed above-therapeutic levels of doxylamine in the pilot's blood. "This was a common over-the-counter antihistamine marketed as NyQuil and used in the treatment of the common cold and hay fever," the report said. "It was also marketed as Unisom, a sleep aid."

HELICOPTERS

Collision With Glassy Water

Bell 212. Substantial damage. One fatality.

The helicopter was engaged in forest fire suppression near Slave Lake, Alberta, Canada, on May 20, 2011, and the pilot was making his 12th approach to Lesser Slave Lake to pick up water in a bucket attached to a 100-ft (30-m) external line. "The pilot likely overestimated the helicopter's altitude while on final approach due to glassy water conditions and a lack of visual references, which led to the water bucket inadvertently entering the water before the helicopter was established in a hover," the TSB report said, noting that glassy water "has a mirror-like appearance which significantly reduces a pilot's depth perception."

When the bucket contacted the water, the 212 descended abruptly in a near-level attitude almost to the lake surface. The pilot apparently had not armed the electric belly hook release mechanism, which prevented him from quickly jettisoning the bucket. However, investigators believe that he did activate the floor-mounted manual release lever, which would have required him to take one foot off an anti-torque pedal. Although the bucket was jettisoned, the pilot was not able to regain control of the helicopter, which climbed about 100 ft, rapidly rolled right and descended vertically into the water.

The pilot had not secured his shoulder harness, and he succumbed to severe head injuries suffered during the impact. His helmet was found in his flight bag. "Despite the recognized benefits of head protection, there is no requirement for helicopter pilots to wear helmets," the report said.

Breakup Occurs During Check Flight

Bell 222. Destroyed. Two fatalities.

A witness heard a "loud crack" before seeing the main rotor hub, main rotor blades, tail boom and other components separate from the emergency medical services helicopter shortly after it departed from Grand Prairie, Texas, U.S., for a postmaintenance check flight on June, 2, 2010. The pilot and a mechanic were killed.

"A postaccident examination revealed that the helicopter's [main rotor] swashplate A-side drive pin had failed in flight, which resulted in the helicopter's in-flight breakup and uncontrolled descent," the NTSB report said. "The fracture surface of the … drive pin displayed brittle cleavage-like fractures with intergranular separations and small regions of ductile dimples, consistent with hydrogen embrittlement." The source of the hydrogen was not determined, and the B-side drive pin was found intact.

Preliminary Reports, April 2012

Date	Location	Aircraft Type	Loss Type	Injuries
April 1	Calhoun, Kentucky, U.S.	Beech 58 Baron	destroyed	1 fatal
The pilot lost control of the Baron shortly after taking off from a private airstrip.				
April 2	Tyumen, Russia	ATR 72-201	destroyed	33 fatal, 10 serious
The ATR 72 stalled and crashed about 2.5 km (1.4 nm) from the runway on takeoff. The aircraft had been parked outside in snow showers and was not deiced before departure.				
April 2	Sturgeon Bay, Wisconsin, U.S.	Cessna 414A	minor	1 fatal, 1 minor
Another pilot and an air traffic controller provided assistance by radio to an 80-year-old passenger who assumed control of the 414 after the pilot lost consciousness. One engine later lost power, but she was able to land the airplane with only minor damage to the nose gear. The 414 pilot later was pronounced dead.				
April 3	Caribbean Sea	Hawker Beechcraft King Air C90GTx	substantial	2 none
The airplane was ditched 17 nm (31 km) north of Aruba after both engines lost power during a delivery flight from Florida, U.S., to Curaçao. The pilots boarded a life raft before the King Air sank and later were rescued by a U.S. Coast Guard helicopter.				
April 6	Huy, Belgium	Robinson R22 Beta II	destroyed	2 fatal
The helicopter was on an aerial photography flight when it struck a cable car cable and crashed in a park.				
April 6	Rostov, Russia	Boeing 737-400	minor	157 none
The 737 overran a wet runway on landing and struck approach lights.				
April 8	Mulia, Papua, Indonesia	de Havilland Canada Twin Otter	substantial	1 fatal, 4 serious, 3 minor/none
One passenger was killed, and two passengers and both pilots were seriously injured when the airplane was struck by attackers' gunfire on landing.				
April 9	Kigoma, Tanzania	de Havilland Canada Dash 8-300	destroyed	39 minor/none
The right wing separated and the engine penetrated the fuselage when the Dash 8 overran the runway during a rejected takeoff.				
April 14	Chambéry, France	Boeing 737-300	substantial	136 none
After landing in London, the 737 was found to have been damaged during a tail strike on takeoff from Chambéry.				
April 17	Gulf of Mexico	Sikorsky S-76B	substantial	7 none
The helicopter was ditched after losing power on approach to an offshore drilling platform.				
April 17	Amman, Jordan	Airbus A300B4-605R	none	1 fatal
The captain fell to the apron while trying to close the front door in preparation for a positioning flight.				
April 19	Gulf of Mexico	Cessna 421C	destroyed	1 fatal
Radio contact with the pilot was lost after the 421 deviated from course and its assigned altitude. The twin-piston airplane, which might have had a cabin pressurization problem while en route from Louisiana to Florida, U.S., circled for about three hours and climbed to 33,000 ft before descending into the gulf.				
April 20	Juniaí, Brazil	Beech C90 King Air	destroyed	1 fatal
The pilot declared an emergency due to a power loss shortly after taking off for a post-maintenance functional check flight. The King Air stalled and struck terrain while returning to the airport.				
April 20	Islamabad, Pakistan	Boeing 737-200	destroyed	127 fatal
Thunderstorms and rain showers were in the area when the 737 struck terrain on approach about 10 km (5 nm) from the runway.				
April 21	Santa Cruz, Bolivia	Curtiss C-46F Commando	destroyed	3 fatal, 1 serious
Instrument meteorological conditions prevailed when the C-46 stalled and crashed during a go-around. The flight crew had decided to return to the airport shortly after departing for a training flight.				
April 26	Ostrov, Romania	Kamov 32 Helix	destroyed	5 fatal
The helicopter crashed during a positioning flight from Moldova to Turkey, where it was to assist in fighting forest fires.				
April 28	Galkayo, Somalia	Antonov 24RV	destroyed	36 minor/none
The landing gear collapsed and the wings partially separated from the fuselage when the aircraft touched down hard and bounced several times.				

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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