FLIGHT SAFETY FOUNDATION

AeroSafety WORLD

UNEXPECTED CONSEQUENCES
A320 Strikes the Sea

AUTOMATION INFLUX
Improving ATM Guidelines

UNDERPINNINGS OF SAFETY
Setting National Standards

INTO THE BLUE
DISPATCHERS' SAFETY CONCERNS

THE JOURNAL OF FLIGHT SAFETY FOUNDATION

APRIL 2016

MEDICAL PRIVACY VS. Public Safety?

The final report of the French aviation accident investigation agency, the Bureau d'Enquêtes et d'Analyses (BEA), on the March 24, 2015, crash of Germanwings Flight 9525, raised some disturbing and complicated issues, so it is imperative that the aviation industry, regulators and the medical community read the report and carefully consider its recommendations.

The BEA found that the crash of the Airbus A320 in the French Alps, which resulted in the deaths of 144 passengers and six crewmembers, was due to the "deliberate and planned action of the copilot, who decided to commit suicide while alone in the cockpit. The process for medical certification of pilots, in particular self-reporting in case of decrease in medical fitness between two periodic medical evaluations, did not succeed in preventing the copilot, who was experiencing mental disorder with psychotic symptoms, from exercising the privilege of his license."

According to the report, the investigation found that a private physician referred the Germanwings copilot to mental health professionals one month before the accident and diagnosed a possible psychosis two weeks before the accident. A psychiatrist treating the copilot prescribed antidepressant medication one month before the accident, and other antidepressants, along with sleeping aid medication, eight days before the accident. Yet "no health care providers reported any aeromedical concerns to authorities," according to an English translation of the report, and "no aviation authority, or any authority, was informed of the mental state of the copilot."

The BEA cited the copilot's "probable fear of losing his ability to fly as a professional pilot" and the "potential financial consequences" as reasons why he didn't self-report.

The BEA is to be commended for challenging regulators and the industry to come up with better rules for balancing a patient's right of medical privacy with public safety. It's disturbing to learn that the Germanwings copilot was taking prescription antidepressant medications with possible significant side effects, and that a doctor just weeks before this tragedy had recommended psychiatric hospital treatment, but neither the pilot's employer nor the regulator were informed. We need to find better ways to encourage pilots and other aviation professionals to come forward to obtain treatment for mental health issues without jeopardizing their jobs. It's unacceptable to keep their employers and regulators in the dark, and the traveling public at risk.

Let's be clear, this is not just an aviation issue. The BEA addressed its recommendations to the European Aviation Safety Agency, the International Air Transport Association, the World Health Organization, and the European Commission and its member states. It is essential that these stakeholders and the aviation medical examiner community work together to craft reasonable, fair and risk-reducing rules and best practices.

Jon L. Beatty
President and CEO
Flight Safety Foundation

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U.S. aircraft dispatchers cite problems involving miscommunication, task saturation and technical failure.
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Share Your Knowledge

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 Editor-In-Chief Frank Jackman, 701 N. Fairfax St., Suite 250, Alexandria, VA 22314-2058 USA or jackman@flightsafety.org.

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AeroSafety WORLD

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Conflict Zones

After Malaysia Airlines Flight 17 (MH17) was shot down while flying over Ukraine and crashed, killing 298 passengers and crew in July 2014, the International Civil Aviation Organization (ICAO), among other actions, set up a Conflict Zone Information Repository as a means to share relevant information among states and air carriers. The repository, accessible via ICAO's website, is searchable by countries affected by conflict and includes notices to airmen (NOTAMs) and aeronautical information circulars (AICs) that affect those states, but that, in most cases, are issued by other countries. For example, a recent search of the repository showed three NOTAMs issued about Saudi Arabia — two by Saudi Arabia itself and one by Germany. In another example, the repository returned three NOTAMs, issued by the United States, Germany and the United Kingdom, about Libya, and an AIC issued by France.

The European Task Force on Conflict Zones has concluded that more needs to be done. In a report released March 17, the European task force said the NOTAMs and AICs in the ICAO repository reflect risk assessments of individual states that "may not reflect the full scope of the problem" and may, as a result, overestimate or underestimate the risk. Also, "It is accepted after the downing of MH17 that some states will fail to meet their obligations [to issue information concerning overflight in their own flight information region], and it's therefore essential that alternative information mechanisms are available."

The report goes on to say that airlines have expressed a need for a consolidated picture of the safety/security situation. "Operators have vastly different resources available to them," the report said. "However, all operators and passengers should have access to the best information available."

In its report, the task force recommended the development of a common European assessment of conflict zones and development of a quick alert mechanism to notify the aviation community. The report now will be submitted to the Presidency of the Council of the European Union for action.

The report offers recommendations for the European Aviation Safety Agency, the European Commission, aircraft operators and national intelligence agencies, demonstrating again that mitigating risk requires participation and cooperation from a spectrum of stakeholders. It will be interesting to see how this initiative plays out and if a common risk assessment can be developed and shared effectively.

Frank Jackman
Editor-in-Chief, ASW
Flight Safety Foundation

Serving Aviation Safety Interests for Nearly 70 Years

Since 1947, Flight Safety Foundation has helped save lives around the world. The Foundation is an international nonprofit organization whose sole purpose is to provide impartial, independent, expert safety guidance and resources for the aviation and aerospace industry. The Foundation is in a unique position to identify global safety issues, set priorities and serve as a catalyst to address the issues through data collection and information sharing, education, advocacy and communications. The Foundation's effectiveness in bridging cultural and political differences in the common cause of safety has earned worldwide respect. Today, membership includes more than 1,000 organizations and individuals in 150 countries.

MemberGuide

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APRIL 4–6 ➤ 2016 CHC Safety and Quality Summit. CHC Helicopter. Vancouver, British Columbia, Canada. <chcsafetyqualitysummit.com>.

APRIL 7–8 ➤ 6th China Aviation Training and Education Summit (CATES) 2016. Pincaux Media. Shanghai. Michael Gao, <michaelg@opplandcorp.com>, <pincaux.com/training2016>.

APRIL 14–15 ➤ Global Safety Information Project (GSIP) Workshop. Flight Safety Foundation. Tokyo. <fsfgsip.org>.

APRIL 18–20 ➤ IATA Ops Conference 2016. International Air Transport Association (IATA). Copenhagen, Denmark. <iata.org>.

APRIL 19–20 ➤ Global Safety Information Project (GSIP) Workshop. Flight Safety Foundation. Hong Kong. <fsfgsip.org>.

APRIL 19–21 ➤ 3rd International Accident Investigation Forum. Air Accident Investigation Bureau of Singapore, Singapore Aviation Academy. Singapore. <saa.com.sg>.

APRIL 20–21 ➤ Global Safety Information Project (GSIP) Workshop. Flight Safety Foundation. São Paulo. <fsfgsip.org>.

APRIL 25–26 ➤ World Aviation Safety Summit. Government of Dubai and Dubai Civil Aviation Authority. Dubai, United Arab Emirates. <info@aviationsafety.ae>, <aviationsafety.ae>.

APRIL 29–30 ➤ Aviation English Training for Operational Personnel. International Civil Aviation English Association (ICAEA). The Azores, Portugal. <icaea.aero>.

MAY 5–6 ➤ Business Aviation Safety Summit 2016 (BASS 2016). Flight Safety Foundation. Austin, Texas, U.S. Namratha Apparao, <apparao@flightsafety.org>, +1 703.739.6700, ext. 101.

MAY 9–12 ➤ RAA 41st Annual Convention. Regional Airline Association. Charlotte, North Carolina, U.S. <raa.org>.

MAY 10–12 ➤ Cabin Operations Safety Conference. International Air Transport Association (IATA). Miami. <iata.org>.

MAY 11–12 ➤ Global Safety Information Project (GSIP) Workshop. Flight Safety Foundation. Kuala Lumpur, Malaysia. <fsfgsip.org>.

MAY 15–18 ➤ 88th Annual AAAE Conference and Exposition. American Association of Airport Executives (AAAE). Houston. <aaae.org>.

MAY 15–18 ➤ 29th IATA Ground Handling Conference. International Air Transport Association (IATA). Toronto. <iata.org>.

MAY 17–18 ➤ Global Safety Information Project (GSIP) Workshop. Flight Safety Foundation. Jakarta, Indonesia. <fsfgsip.org>.

MAY 18–19 ➤ Global Safety Information Project (GSIP) Workshop. Flight Safety Foundation. Panama City, Panama. <fsfgsip.org>.

JUNE 7–8 ➤ 2016 Safety Forum. Eurocontrol, Flight Safety Foundation, European Regions Airline Association. Brussels. <skybrary.aero>.

JUNE 8–9 ➤ Global Safety Information Project (GSIP) Workshop. Flight Safety Foundation. Lima, Peru. <fsfgsip.org>.

JUNE 9–10 ➤ Global Safety Information Project (GSIP) Workshop. Flight Safety Foundation. New Delhi. <fsfgsip.org>.

JUNE 20–22 ➤ Inflight Emergency Response (IER) 2016. Green Light Ltd. Riga, Latvia. Sarah-Jane Prew, <editor@cabinsafetyupdate.com>, <inflightemergencyresponse.com>.

JUNE 20–23 ➤ 7th Pan American Aviation Safety Summit. Latin American and Caribbean Air Transport Association (ALTA). Panama City, Panama. <alta.aero>.

JUNE 20–24 ➤ Master Class Human Factors and Safety with Prof. Sydney Dekker. Aviation Academy of the Amsterdam University of Applied Sciences. Amsterdam. <amsterdamuas.com/aviation/events>.

JUNE 26–28 ➤ ASA 2016. Aviation Suppliers Association (ASA) Annual Conference. Las Vegas. <aviationsuppliers.org>.

JULY 4–17 ➤ Summer School Human Factors & Safety. Aviation Academy of the Amsterdam University of Applied Sciences. Amsterdam. <amsterdamuas.com/aviation/events>.

JULY 13–14 ➤ Global Safety Information Project (GSIP) Workshop. Flight Safety Foundation. Mexico City. <fsfgsip.org>.

JULY 28 ➤ Flight Safety Foundation Annual Dinner. Flight Safety Foundation. Washington. Namratha Apparao, <apparao@flightsafety.org>. <apparao@flightsafety.org>, +1 703.739.6700, ext. 101.

OCTOBER 24–27 ➤ Eighth Triennial International Aircraft Fire and Cabin Safety Research Conference. U.S. Cabin Safety Research Technical Group. Atlantic City, New Jersey, U.S. <fire.tc.faa.gov>.

OCTOBER 31–NOVEMBER 2 ➤ SAFE Association 54th Annual Symposium. Dayton, Ohio, U.S. SAFE Association. <safe@peak.org>, <safeassociation.org>.

NOVEMBER 3–4 ➤ International Cross-Industry Safety Conference. Aviation Academy of the Amsterdam University of Applied Sciences. Amsterdam. <amsterdamuas.com/aviation/events>.

NOVEMBER 14–16 ➤ 69th annual International Air Safety Summit (IASS 2016). Flight Safety Foundation. Dubai, United Arab Emirates. Namratha Apparao, <apparao@flightsafety.org>, +1 703.739.6700, ext. 101.

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

If you have a safety-related conference, seminar or meeting, we'll list it. Get the information to us early. Send listings to Frank Jackman at Flight Safety Foundation, 701 N. Fairfax St., Suite 250, Alexandria, VA 22314-2058 USA, or <jackman@flightsafety.org>.

Be sure to include a phone number, website, and/or an email address for readers to contact you about the event.

Safety News

Preventing Disappearances

The International Civil Aviation Organization (ICAO) has adopted provisions intended to prevent situations in which commercial aircraft vanish in remote locations.

The provisions — adopted in early March by the ICAO Council — take the form of amendments to Annex 6, *Operation of Aircraft*, and will take effect over the next five years. They were developed in the aftermath of the disappearance of Malaysia Airlines Flight 370, a Boeing 777-200ER that vanished March 8, 2014, after departure from Kuala Lumpur, Malaysia, with 239 passengers and crew. Although several pieces of wreckage have washed ashore, the airplane remains missing.

ICAO said the new provisions involve requirements for aircraft to "carry … distress tracking devices which can autonomously transmit location information at least once every minute in distress circumstances" and to "be equipped with a means to have flight recorder data recovered and made available in a timely manner." Another provision calls for extension of cockpit voice recordings to 25 hours "so that they cover all phases of flight for all types of operations."

Olumuyiwa Benard Aliu, ICAO Council president, said that "taken together, these new provisions will ensure that, in the case of an accident, the location of the site will be known immediately to within 6 nm [11 km] and that investigators will be able to access the aircraft's flight recorder data promptly and reliably. They will also contribute to greatly improved and more cost effective search-and-rescue operations."

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Cockpit Protection Plan

The European Aviation Safety Agency (EASA) is wrapping up a comment period for feedback on its safety recommendation requiring two crewmembers in the cockpit at all times.

The recommendation, proposed in March 2015, was prompted by the crash that month of a Germanwings Airbus A320 that killed all 150 passengers and crew. The French Bureau d'Enquêtes et d'Analyses, which released its final report on the March 24 accident in the French Alps, concluded that the airplane was deliberately flown into the ground by the first officer.

The report said that while in cruise, when the first officer was alone in the cockpit, he locked the door and refused to let the captain back in or to respond to calls from air traffic control. He intentionally changed the autopilot settings so the airplane would descend to the ground.

After the crash, an EASA task force began a review of a number of related factors, including cockpit access and exit procedures, the cockpit door-locking system and the medical monitoring of pilots.

Tracking 'Rogue Drones'

A new system is being developed to detect and identify unmanned aircraft operating too close to an airport or to traditionally piloted aircraft.

The U.S. Federal Aviation Administration (FAA), working with the Department of Homeland Security and information technology company CACI International, says it has tested a CACI system that uses radio frequency sensors to locate unmanned aircraft systems (UAS) aircraft and their operators.

The sensors, placed at strategic locations at and around airports, detect the frequencies typically used by unmanned aircraft and triangulate the signals to determine UAS locations.

The FAA receives more than 100 reports each month of UAS aircraft operating in airspace that, according to regulations, is off limits.

"In addition to the FAA's ongoing outreach and education efforts, an additional step toward a solution is to detect and identify these 'rogue drones' and their operators," the agency said.

Marke "Hoot" Gibson, FAA senior adviser on UAS integration, added that the UAS industry's rapid growth means that evaluation of detection technologies is an "urgent priority. This research is totally aimed at keeping our skies safe."

John Mengucci, CACI CEO and president of U.S. operations, said that the company's SkyTracker system was tested at Atlantic City (New Jersey) International Airport for nine days earlier this year and "successfully identified, detected and tracked UAS in flight and precisely located drone ground operators — all without interfering with airport ground operations."

A final report on the Atlantic City project will be developed later this year, the FAA said.

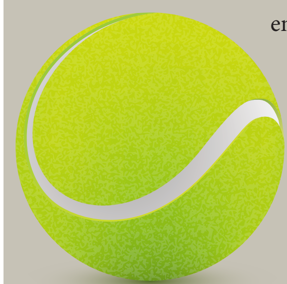
The agency said its research on UAS detection systems "may go beyond addressing the FAA's concerns with the safety of UAS in the nation's airspace. The effort also may contribute to keeping the skies safe from 'bad actors' who want to use unmanned aircraft for malicious purposes."

Tennis Ball Warning

A tennis ball attached to the end of a flight control in a Cessna has prompted the Australian Civil Aviation Safety Authority (CASA) to issue a warning about unapproved aircraft modifications.

In Airworthiness Bulletin 02-054, issued in late January, CASA said that during an audit of the aircraft — described only as "a Cessna … involved in parachute operations" — it found that "the copilot's roll and pitch control … had been modified by removing the control yoke and covering the open end of the tube using the tennis ball."

It added that "the forward-and-aft motion of the control column had been disabled by disconnecting one end of the pitch control push-tube from the elevator control system, with the rod-end loosely secured to an electrical loom under the instrument panel."



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The unapproved modification was "a significant threat to safety of flight," CASA said, adding that all unapproved modifications leave the aircraft un-airworthy.

Expanded Airspace for UAS?

The U.S. Federal Aviation Administration (FAA) is establishing an aviation rulemaking committee to develop regulations that would allow some unmanned aircraft systems (UAS) to be operated above people who are not involved in the operation of those aircraft.

The committee is expected to issue a final report to the FAA on April 1.

The FAA said the rulemaking panel would be responsible for developing recommendations for "performance-based standards for the classification and operation of certain UAS that can be operated safely over people, identify how UAS manufacturers can comply with the requirements and propose operational provisions based on the requirements."

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More Research Urged on Battery Safety

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Stricter regulatory enforcement and intensified research into new methods of packing and transporting lithium batteries are crucial in addressing the biggest safety issue facing the air cargo industry, Tony Tyler, director general and CEO of the International Air Transport Association (IATA), says.

In a speech delivered to the 10th annual World Cargo Symposium, meeting in mid-March in Berlin, Tyler praised efforts to bolster the safety of lithium battery shipments, noting that "the vast majority … are packaged, documented and tendered in full compliance with appropriate aviation regulations."

Nevertheless, he added, "with 400 million lithium batteries being produced each week, ICAO [the International Civil Aviation Organization] has had to acknowledge the risks of improperly manufactured batteries, not packed in compliance with the dangerous goods regulations (DGR) and IATA Lithium Battery Shipping Guidelines."

ICAO's acknowledgement took the form of a temporary ban — effective April 1 — on shipments of lithium batteries in cargo holds of passenger aircraft.

"This decision is not a reflection on the thoroughness of the DGR or the industry's commitment to safety," Tyler said. "The issue lies with the lack of enforcement of the regulations by governments. Banning lithium batteries from air freight does not solve the issue of counterfeit or non-declared goods. So it's essential that governments redouble their efforts to enforce the regulations and close the loopholes that prevent prosecutions of serial offenders."

The industry also must continue its research to develop new methods of fire suppression as well as new ways to pack and transport batteries, he said, adding that after progress has been made in both areas, "I am confident that the ban will eventually be lifted by ICAO."

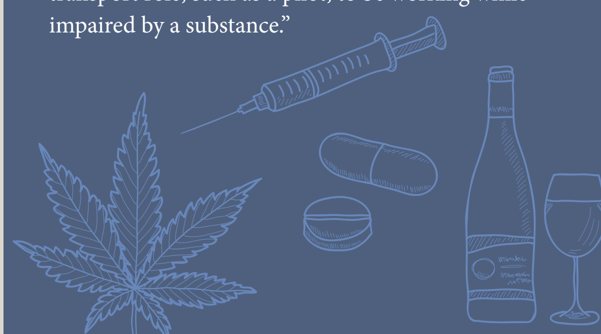
Substance Abuse Crackdown

The New Zealand Transport Ministry has ordered random drug and alcohol testing in the commercial aviation industry to "strengthen the culture of zero tolerance," Associate Transport Minister Craig Foss says.

The random testing, announced in February, calls for all commercial aviation and maritime operators to implement drug and alcohol management plans by 2017. The plans, which must be approved by the Civil Aviation Authority (or Maritime New Zealand), must include random testing of "safety-sensitive staff," the Transport Ministry said.

The ministry's action was prompted by the New Zealand Transport Accident Investigation Commission's (TAIC's) investigation of a January 2012 accident in which a hot air balloon crashed into power lines, killing all 11 people on board. The TAIC said in its final report that the pilot "was a cannabis user who had a level of cannabis in his system that was likely to have resulted from long-term and recent use. … It was highly likely that he had smoked cannabis on the morning of the flight."

When the report was issued in 2013, the TAIC "found that the accident was caused by errors of judgment by the pilot, and the possibility that the pilot's judgment was impaired by the use of cannabis cannot be excluded," said Chief Commissioner John Marshall. "It is totally unacceptable for anyone in a safety-critical transport role, such as a pilot, to be working while impaired by a substance."



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In Other News …

The International Air Transport Association is proposing a new agenda calling on **Russia** to further implement global standards and best practices in an effort to strengthen the nation's aviation community. … The U.S. Federal Aviation Administration has proposed overhauling **airworthiness standards** for small airplanes in order to shorten the time required to introduce safety-enhancing technologies to small general aviation airplanes. … The European Union and China have begun a five-year, 10-million-euro project to encourage **technical cooperation** between the Civil Aviation Administration of China and the European Aviation Safety Agency.

Compiled and edited by Linda Werfelman.

THE NEXT LEVEL OF Business Aviation Safety

BY PETE AGUR

The global business aviation accident rate is laudably low. We have a right to be proud of our safety record, right? Yes and no.

Business aviation aircraft often are equipped with the latest technology, so today it is much harder to unknowingly drive one aircraft into another, into a hillside or into a thunderstorm. Avionics advances preclude many catastrophic accidents.

On another front, business aviation training technology and standards are leading the aviation industry. The knowledge of our aircraft and how they perform is pervasive because of the excellence of our airframe manufacturers (OEMs) and training vendors. Additionally, the OEMs are developing fly-by-wire systems that are lighter and easier to manufacture and will help prevent bad days caused by poor piloting.

Even so, we have substantial room to improve. We still incur injuries and damage aircraft at unacceptable rates. There are three factors we must address to achieve the next level of safety:

- Redefine business aviation safety;
- Adjust our safety culture; and,
- Advance our professionalism.

This article discusses the redefinition of business aviation safety, and future columns will describe how the other two critical elements can be addressed.

Why Change?

Having no accidents or incidents means my operation is "safe," right? Maybe, maybe not. You might have been taking inappropriate and unnecessary risks, but skill and luck might have been on your side, so far. In other words, "safe" is a pass-fail descriptor. It does not define how you got there.

If we remain focused on a pass-fail concept of safety, we will continue to make only incremental improvements to accident rates. An alternative is to change our safety frame of reference to "risk" and reap the rewards of dramatic improvements. Risk identification–assessment–mitigation is like taking a rifle with legacy "iron sights" and mounting a


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scope on it. The change in target acquisition and accuracy is huge. Our use of fatalities and damaged airframes as our reference points is gross mis-targeting. The scope of our future focus must be much finer: on the risks that have a significant probability of causing injuries and damage.

Injuries

For decades, companies, with the help of the U.S. Occupational Safety and Health Administration (OSHA), have addressed the causes of on-the-job injuries. The results have been significant reductions in lost work days and worker's compensation claims.

Using those same standards, our worker injury performance at the airport is often substandard. Noncompliance with basic OSHA standards is rampant. Floors are slick. Walkways are unmarked, poorly lighted and littered with obstructions. Fall protection is either nonexistent or underused. The threats of injuries in and around the hangar are numerous and often go unchecked; the results are significant injuries and numerous workdays lost.

Another imposing threat is the risk of off-duty flight crew injuries. These events are especially challenging because they tend to occur away from home. For instance, every winter, crewmembers suffer disabling injuries while skiing or snowboarding during a trip's off time. Others become victims of street crimes or suffer from food poisoning. The threats are numerous and often ignored, sometimes with disabling effects.

Any of these events could be tragic, embarrassing and expensive for a business aviation operator and its passengers.

What about injuries to passengers? Consider the value of the business passengers' time, the deals they do and the impact they have on the enterprise. The time they save using business aviation creates immeasurable benefits. Yet the negative impact that occurs if they are injured while traveling on your aircraft can have equally negative results.

One major threat to passengers is the unsafe use of airstairs with a business aircraft. Presidents and popes have fallen while ascending or descending them. In technical climbing (mountain climbing or advanced bouldering with roped protection) a basic rule is to maintain three points of contact at all times to prevent falls. The same should be true for passengers while they transit airstairs. Yet passengers tackle those unfamiliar, and often unstable stairs, with their hands full of bags, overcoats and what not. No wonder they slip, trip and fall so often. What should your crewmembers be doing to mitigate this threat?

Aircraft Damage

The president of one of the largest aircraft insurance companies says ground handling incidents are the greatest source of aircraft damage claims. Ground handling incidents rarely result in fatalities, and data are not prominently presented by the U.S. Federal Aviation Administration. However, a dinged wing will take your aircraft out of service for weeks, and the costs easily can run into hundreds of thousands of dollars for repairs, diminution of value and loss of use of the aircraft. Even if it is easy to blame the fixed base operator staff member who drove the tug, isn't the end responsibility yours? It is your duty to assess the risk and mitigate it. From a risk perspective, ground handling events have a high cost and are likely to happen. Even so, very few crews assign someone to directly supervise an aircraft until it is refueled and parked at its final resting place for the night.

Stair falls and ramp rash seem outside the traditional realm of flight safety, but they are excellent examples of how the legacy definition of safety is inadequate. Broaden the scope of your focus and tighten your attention to risk, its identification, assessment and mitigation. The results will take your business aviation safety to a dramatically higher level.

Next time, we'll dive into the cultural issues that can either be barriers or boosters to your risk mitigation efforts. Until then, be safe!

Pete Agur is chairman and founder of The VanAllen Group, a management consulting firm for business aviation. He holds an airline transport pilot certificate for fixed-wing aircraft, a commercial pilot certificate for helicopters and a private pilot glider rating. He has been an active member of Flight Safety Foundation's Business Advisory Committee for over 25 years.

61st annual Business Aviation Safety Summit

BASS2016

FLIGHT SAFETY FOUNDATION

NBAA

May 5–6, 2016
Hilton Austin
Austin, Texas

Preliminary Agenda

(as of March 18, 2016)

Tuesday, May 3, 2016

0800–1600 **IBAC Workshop: Fundamentals of IS-BAO**
Separate registration and payment required. (More information is available at <flightsafety.org>.)

Wednesday, May 4, 2016

0730–1700 **3rd annual Safety Manager Roundtable**
Separate registration required.
(More information is available at <flightsafety.org>.)

0800–1600 **IBAC Workshop: IS-BAO Auditing**
Separate registration and payment required.
(More information is available at <flightsafety.org>.)

0900–1200 **Business Advisory Committee Meeting**

1400–1800 **Registration**

1400–1800 **Exhibitor Move-In**

1700–1730 **Day One Speakers Meeting**

Thursday, May 5, 2016

0730–1700 **Registration**

0730–1700 **Exhibit Hall Open**

0730–0830 **Continental Breakfast with Exhibitors**

0830–0850 **Opening Ceremonies and Welcome**
Greg Marshall, vice president, global programs, Flight Safety Foundation
Jon Beatty, president and CEO, Flight Safety Foundation

0850–0925 **Keynote Address**
Col. Rich Graham, U.S. Air Force (retired)

SESSION I — Human Factors and Fitness for Duty

Session Chair: Greg Marshall, vice president, global programs, Flight Safety Foundation

0925–1000 **Human Factors in Extremis: The Rogue Pilot Phenomena**
Tom Anthony, director, Aviation Safety and Security Program, University of Southern California

1000–1030 **Refreshment Break with Exhibitors**

1030–1115 **Fitness for Duty: How Much Fatigue is Too Much?**
Dr. Daniel Mollicone, president, Pulsar Informatics

1115–1200 **Losing the Right Stuff? A Review of Pilot Fitness for Duty**
Dr. Quay Snyder, president and CEO, Aviation Medicine Advisory Service

1200–1330 **Lunch with Exhibitors**

SESSION II — Managing Organizational Risk

Session Chair: Peter Agur, member, Business Advisory Committee, Flight Safety Foundation; chairman, The VanAllen Group

1330–1415 **Avoiding Human, Organizational and Cultural Accidents at NASA**
Dr. Charles Justiz, principal, JFA Inc.

1415–1500 **Risk and Change Management: Transitioning from Turboprop to Jet Operations**
Richard "Spike" Boyer, SCANA Services

1500–1530 **Refreshment Break with Exhibitors**
Sponsored by TrainingPort.net

1535–1555 **Global Safety Information Project (GSIP) Update**
Mark Millam, vice president, technical, Flight Safety Foundation

1555–1625 **LOSA Programs**
Dr. James Klinect, CEO, The LOSA Collaborative

1625–1655 **Human Factors Issues in the 2014 G-IV Crash at Hanscom Field**
William Bramble, senior human performance investigator, U.S. National Transportation Safety Board

1655–1700 **Wrap-Up**

1730–1800 **Day Two Speakers Meeting**

1800–1900 **Networking Reception**

Friday, May 6, 2016

0730–1600 **Registration**

0730–1530 **Exhibit Hall Open**

0730–0830 **Continental Breakfast with Exhibitors**

SESSION III — Risk and Crisis Management

Session Chair: Capt. Jim Kelly, co-chair, Business Advisory Committee, Flight Safety Foundation; pilot/safety manager, Pfizer Aviation

0830–0920 **Effective Improvement of Pilot-Airplane State Awareness**
Paul Ransbury, president, Aviation Performance Solutions

0920–1000 **"Drones" and Safety: Think Before You Launch**
Sean McClung, director for space innovation, Millennium Engineering and Integration

1000–1030 **Refreshment Break with Exhibitors**

1030–1110 **Crisis Management for the Small Operator; Dealing with the Investigation**
John Cox, chief executive officer, Safety Operating Systems

1110–1200 **Panel Session: Your First ERP Tabletop Drill**

1200–1330 **Lunch with Exhibitors**

SESSION IV — Operational Risk

Session Chair: Lisa Sasse, co-chair, Business Advisory Committee, Flight Safety Foundation; executive director, business development, VisionSafe

1330–1415 **NTSB Briefing**
The Honorable Robert Sumwalt, member, U.S. National Transportation Safety Board

1415–1450 **The Psychology of Noncompliance in Decision Making During Unstable Approaches**
Dr. Martin Smith, founder, Presage Group
Capt. Bill Curtis, chairman, International Advisory Committee, Flight Safety Foundation; head of aviation, Presage Group

1450–1520 **Refreshment Break with Exhibitors**

1520–1555 **Raise Your Standard of Safety: Address Non-Catastrophic Threats**
Peter Agur, member, Business Advisory Committee, Flight Safety Foundation; chairman, The VanAllen Group

1555–1625 **Organization Performance vs. Culture**
Jerry Dibble, president, LMC Enterprises

1625–1655 **Fight Path Management for Safe Operations**
David McKenney, director, pilot training programs, Air Line Pilots Association, International

1655–1710 **Wrap-Up and Closing Remarks**
Greg Marshall, vice president, global programs, Flight Safety Foundation
Jon Beatty, president and CEO, Flight Safety Foundation

1710 **Exhibitor Move-Out**

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American Airlines Integrated Operations Center
at Dallas/Fort Worth International Airport

About 21,000 aircraft dispatchers at 47 airlines in the United States have more venues than ever for sharing safety concerns and lessons learned in the course of their daily work. Centralized safety data collection and analysis systems easily enable their perspectives of aviation risks, threats and human factors to be compared with narratives from the flight crew and air traffic controllers involved in a common event during flight operations, whether in commercial air transport or business aviation (see "Voluntary Safety Report by an Aircraft Dispatcher," p. 21).

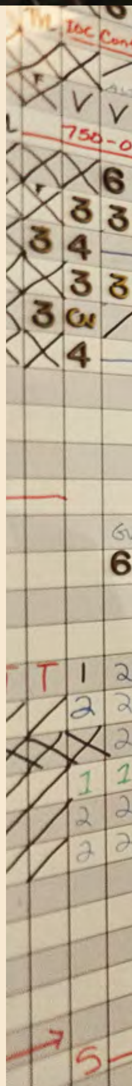
For example, they can submit safety reports to their airline's aviation safety action program (ASAP), where an event review committee will study the issues in a confidential setting and follow through with risk mitigations as required. They can present or informally discuss concerns and events in forums such as annual safety meetings of the Airline Dispatchers Federation.

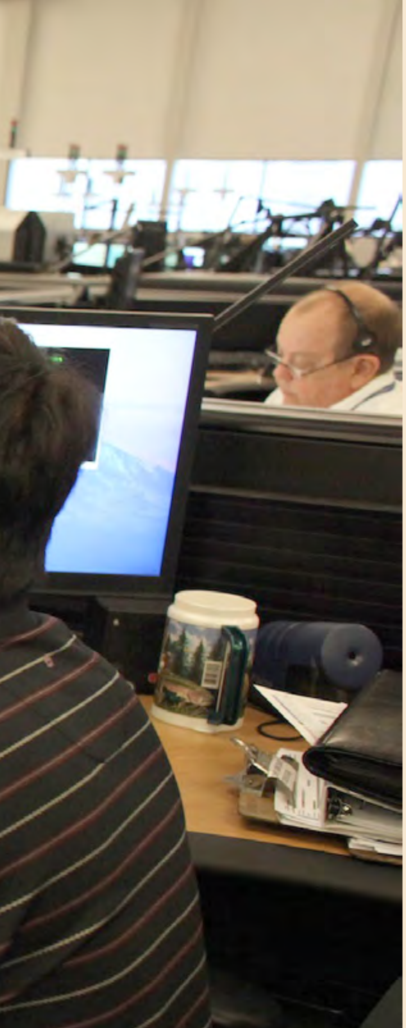
The National Business Aviation Association (NBAA), another provider of annual safety conferences for dispatchers, says, "Dispatchers, who are licensed by the FAA [U.S. Federal Aviation Administration], not only have basic scheduling skills, they are well versed in aviation regulations, flight planning, meteorology, aerial navigation, aircraft aerodynamics, air traffic control procedures and other technical aspects of aviation. Companies that operate a fleet of aircraft, fly overseas or have especially complex travel requirements often employ FAA-licensed dispatchers."

Some dispatchers attend and present issues in the confidential, twice-a-year Infoshare meetings of the FAA's Aviation Safety Information Analysis and Sharing (ASIAS) program and/or submit reports directly to the U.S. National Aeronautics and Space Administration's (NASA's) Aviation Safety Reporting System (ASRS) for screening by analysts and possible addition to its deidentified, searchable public subset — called the full-form online dataset or ASRS Database Online. ASRS also is the repository for all ASAP and FAA Air Traffic Safety Action Program (ATSAP) reports, which are indistinguishable from direct-to-ASRS reports in the public subset.

Before ASAP programs were established, ASRS — funded by the FAA and administered by the NASA Ames Research Center — had been the only independent U.S. program to directly receive such reports from dispatchers, said Linda Connell, program director, NASA ASRS.

June 2016 will mark the beginning of the 10th year since dispatchers — one of several employee groups that voluntarily participate in airline ASAPs or ATSAP (*ASW,* 3/12, p. 43)





BY WAYNE ROSENKRANS

Operational CONTROL

Voluntary reports by U.S. aircraft dispatchers highlight miscommunication, task saturation and technical failures.

A scheduler notes movements of the John Deere Flight Department based at Quad City International Airport in Moline, Illinois

© NBAA

Dispatch Reports Received by ASRS, June 2007–November 2015

ASRS = Aviation Safety Reporting System, U.S. National Aeronautics and Space Administration (NASA); ASAP = aviation safety action program

* Dispatch affiliation was added to the ASRS screening taxonomy in June 2007.

** The 2015 full-form dataset is complete through November.

Source: NASA ASRS

Figure 1

— were added to ASRS. The number of dispatch ASAP groups grew from 15 to 47 in that period, and the annual number of ASAP-originated dispatch reports received grew from 205 for the last six months of 2007 to 1,991 for the 11 months ended in November 2015, Connell told *AeroSafety World* (Figure 1). Except for ATSAP, each group represents a distinct aircraft operator.

By comparison, the number of reports sent directly to ASRS by dispatchers fluctuated from 18 in the second half of 2007 to 50 for all of 2011 to 15 for the first 11 months of 2015. ASRS periodically analyzes its database of all dispatch-related reports — a current total of 9,269 — and has published 502 of these in the full-form online dataset on its public website <asrs.arc.nasa.gov>. For context, as of November 2015, ASRS had 599,403 reports from all employee groups, of which 60,671 can be found in the full-form online dataset.

Task Saturation

For the aircraft dispatchers and the schedulers–flight coordinators in business aviation, trip planning requires juggling dozens of work projects, flights and other requests around the clock and possibly around the world, said participants in a January NBAA panel discussion[1] citing these professionals' reports of fatigue and task saturation, issues also reported by aircraft dispatchers at some airlines. Mobile communication technology facilitates nonstop communication, frequent extension of actual work beyond designated work hours, and task saturation that affects fitness for duty, panelists said.

Whether they accept safety responsibilities for domestic trips, international trips or both, their individual safety considerations include duty-day length (including taking work home), working with flights in many different time zones, recovery time to overcome fatigue, increase of workload because of factors such as congested airports and language issues, regulator compliance in the home country and other countries, industry recommendations and best practices, adherence to company policies on these issues and individual worker behavior, related training, and adjusting staffing to enable personal time off from duty.

The panelists said constant vigilance is required for managers at business aircraft operators to prevent task saturation by taking notice of these employees' cases of, and reasons for, work following the worker home, office interruptions, assignment of new tasks, too many tasks and out-of-control requests or changes of priorities. Rescheduling priorities to include adequate rest and taking control of tasks in accordance with company safety goals address these problems, they said, advising conference attendees to "create options for self-reporting [fatigue/task saturation] challenges, without retaliation."

ASRS Perspectives

About four times a week, based on immediate screening of its report intake, NASA ASRS distributes urgent *ASRS Alert Bulletins* and non-urgent *ASRS For Your Information Bulletins* to potentially affected government and industry stakeholders. Dispatchers' reports, however, have led to only one unpublished alert (in 2015) since 2010, Connell said, whereas, "In 2015, 152 messages [reports from other groups] warranted an *ASRS Alert Bulletin.*"

In 2007–2010, by comparison, ASRS had issued dispatch-related *ASRS Alert Bulletins* on the following subjects: weight and balance issues (as of mid-March, this one had not yet been distributed externally); dispatch computer delays; McDonnell Douglas MD-11 electrical anomalies; Boeing 747 erroneous VNAV (vertical navigation) path indication; Taxiway E weight restriction not charted at Salgado Filho International Airport (Porto Alegre, Brazil); VOR DME-B (VHF omnidirectional radio distance measuring

Voluntary Safety Report by an Aircraft Dispatcher

AeroSafety World selected this excerpt of a report by a U.S. aircraft dispatcher as one example of safety concerns, experiences and issues in 2012–2015 after reviewing 179 reports written by dispatchers. To retrieve the full-form report, search the public database of the National Aeronautics and Space Administration's Aviation Safety Reporting System (ASRS) <asrs.arc.nasa.gov> for the report number shown.

An airline's dispatcher for a Bombardier CRJ-200 described how operational control was disrupted when the captain stopped cooperating with the dispatcher after air traffic control vectors directed the aircraft away from the planned destination, Will Rogers World Airport (OKC), Oklahoma City, and a line of thunderstorms curtailed the flight crew's options for reaching that airport or for landing nearby prior to exhausting their fuel on board.

The dispatcher reported, "The flight pushed with 9,000 lb [4,082 kg] of fuel on board for OKC. Liftoff occurred [almost an hour later]. … The first time I realized there was a problem was when the pilot called me after departure on the ground maintenance radio. He stated that he was approximately 80 nm [148 km] northwest on the west side of a solid line of thunderstorms and that ATC [air traffic control] had vectored him up there. He requested an assessment of his proposed route and the fuel required to fly down the west side of the solid line of thunderstorms and crossing that line near the Nebraska–Kansas border then [flying] direct OKC." A series of aircraft communications addressing and reporting system (ACARS) messages continued the discussion for a while.

The dispatcher told the captain, "I don't like it," noting that the current flight path would take the aircraft through thunderstorms while their mutual objective should be to fly around the thunderstorm activity. The dispatcher calculated and communicated the required fuel and consulted with the airline duty manager. He told the captain, "You do not have enough fuel to go around to the south; you may be able to find a hole [gap between storm cells] abeam [Sioux Falls Regional Airport, South Dakota] and go east to [Fort Dodge Regional Airport, Iowa]."

The captain "made a brief attempt to get through" and stated his preference for a different route to OKC, however, in the context of being "stuck" to the west of the weather. The dispatcher replied that thunderstorm tops precluded that routing choice and asked whether the fuel on board would suffice. The captain then said, "We are going around the weather over [Wolbach VHF omnidirectional range (VOR)] and planning direct [to] OKC from there."

The dispatcher again consulted the duty manager, then told the captain that no visible holes in the storm system could be detected between the VOR station and OKC, and again questioned the fuel situation. The captain responded with a new plan to fly directly to OKC with a deviation to the west using estimated fuel on aircraft of 1.7 (1,700 lb, 771 kg]. The dispatcher's report said, "It was now apparent that the crew was not accepting reality. … I recommended to the duty manager that we consider diverting the flight immediately to Denver International Airport [DEN] or Colorado Springs Airport [COS]. Shortly after this last ACARS, the pilot contacted me via radio. He admitted that he would have to go to OKC via [Liberal–Mid-America Regional Airport, Kansas,] and estimated that he would arrive at OKC with minimum fuel of 800 to 1,000 lb [363 kg]. I suggested diverting to DEN or COS but the connection was soon lost." The dispatcher repeatedly sent the captain ACARS messages urging a diversion to COS but received no responses via radio or ACARS. After a silent period, the pilot replied, "We are now going direct [Liberal] direct OKC. We are [minimum] fuel."

The dispatcher recalled, "It was now obvious that the pilot was making decisions by ignoring input from me. It was also obvious that I had completely lost operational control of the flight. I resigned myself to change to a supporting role exclusively in an attempt to prevent harm to the passengers on board. I also discussed with the duty manager the possibility of declaring an emergency for [the captain].

"I called OKC tower and advised that the flight was approximately 100 [nm, 185 km] to the northwest with a very low fuel situation. I requested that he expeditiously clear them for a straight-in [approach] for the most suitable runway, [with] no unnecessary turns. I also asked him to inform [terminal radar approach control and the air route traffic control center] of the situation. I then sent the following [ACARS message]: 'What is your current [fuel on board]?' The captain replied that fuel on board was [2,200 gal, 8,328 l], estimated the fuel quantity on arrival at OKC would be 1,200 gal (estimated 4,542 l) and changed to a fuel-conserving airspeed.

The dispatcher calculated the fuel burn for the trip so far, and estimated the ending fuel on board would be "approximately 1,050 lb of fuel, no more than 21 minutes to [engine] flame-out." The landing at OKC was uneventful, however.

"The crew failed to follow my directive to divert to COS," arguing that their own flight management system calculations showed zero fuel on board for a landing at COS, he said. "Had they followed my directive, they probably would have landed with just under 2,000 lb [907 kg] of fuel — a much larger margin for error." (ASRS 118043, June 2014).

— WR

U.S. Aircraft Dispatcher–Related Event Anomalies, All ASRS Reports Received, 2015

Event Anomaly	Number	Fraction of Total Reports Received
Published material/policy issue	1,603	79.91%
FARs issue	346	17.25%
MEL issue	278	13.86%
Aircraft equipment problem — less severe	210	10.47%
In-flight weather/ turbulence encounter	154	7.68%
Weight and balance	149	7.43%
Clearance issue	107	5.33%
Maintenance issue	86	4.29%
Fuel issue	82	4.09%
ATC issue	41	2.04%
Illness issue	37	1.84%
Track/heading	22	1.10%
Critical aircraft equipment problem	9	0.45%
Hazardous material violation	8	0.40%
Security issue	6	0.30%
Ground conflict — less severe	4	0.20%
Speed deviation	4	0.20%
Smoke/fire/fumes/odor issue	4	0.20%
Wake vortex encounter	3	0.15%
Airspace violation	2	0.10%
Landing without clearance	2	0.10%
Passenger misconduct	2	0.10%
Taxiway excursion	2	0.10%
Runway incursion	2	0.10%
Excursion from assigned altitude	1	0.05%
Altitude overshoot	1	0.05%
In-flight bird/ animal encounter	1	0.05%
In-flight object encounter	1	0.05%

ASRS = Aviation Safety Reporting System, U.S. National Aeronautics and Space Administration (NASA); ATC = air traffic control; FARs = U.S. Federal Aviation Regulations; MEL = minimum equipment list

Notes: A total of 2,006 reports was submitted in 2015 by aircraft dispatchers — indirectly through aviation safety action programs of airlines or directly to ASRS. They comprise part of the total ASRS internal screening dataset. Reports from other groups also may be studied by ASRS analysts as dispatch-related event anomalies. Event anomaly categories are not mutually exclusive.

Source: NASA ASRS

Table 1

equipment–B) approach at Yampa Valley Regional Airport (Hayden, Colorado, U.S.); performance data availability for de Havilland Canada DHC-8-400 Dash 8; company fuel policies affecting flight safety; Runway 26 displacement at Luis Muñoz Marín International Airport (San Juan, Puerto Rico); a transponder 'dead zone' on Taxiway A10 at Sacramento International Airport (California, U.S.); and a pre-departure clearance anomaly involving the WEVIC One RNAV SID (area navigation standard instrument departure procedure) at Salt Lake International Airport (Utah, U.S.).

Qualitative Analysis

Government-industry discussions about dispatcher-identified safety issues show that dispatchers primarily report issues affecting critical elements of flight operations, challenges with communication and data systems, workload and task saturation, and maintaining operational control, Connell said (Table 1).

Overall, ASRS analysts have cited the following subjects as predominant among 2007–2015 reports by aircraft dispatchers (through November 2015). The weight and balance reports involved software/hardware–associated problems, zero fuel weight miscalculations, passenger count discrepancies, misloaded cargo, loose cargo and late revisions to "final weights."

Communication breakdown–related reports involved distracting/overloading–type information, departmental miscommunication, system-related undelivered messages, challenging communication coordination issues and equipment shortcomings. Reports about flight planning focused on departmental miscommunication, system-related undelivered messages, challenging communication coordination issues and weather forecasts.

Reports related to notices to airmen (NOTAMs) involved layout and presentation, incomplete or outdated information and conflicting information between NOTAM providers. Reports about flight monitoring systems involved a system locking or crashing, failure to identify identical flight numbers, inaccurate minimum equipment list–tracking issues, unintended system restarts and outdated software.

In October 2013, ASRS had presented a descriptive analysis of 100 dispatcher-reported events/concerns to an airline dispatcher safety symposium using categories that were not mutually exclusive.[2] They similarly found that the contributing factors by number of events were communication breakdown, 26; workload, 20; situational awareness problem, 17; time pressure, 16; confusion, 13; and distraction, 12.

(Data for this article were provided to ASW *by Connell; Dennis Doyle, ASRS project manager; and Travis Trotter, ASRS program manager.)*

Notes

1. Glenn, Dion; Grady, Gerald; Laux, Debbi; Whitaker, Holly. "Scheduling the Scheduler." Panel presentation slides presented to the NBAA Schedulers and Dispatchers Conference, Tampa, Florida, U.S. Jan. 22, 2016.

2. Connell, Linda; Doyle, Dennis. "NASA Aviation Safety Reporting System: Dispatcher Reports to ASRS." Presentation to *Enhancing Safety Through Aircraft Dispatchers,* the 10th Safety Symposium of the Airline Dispatchers Federation, October 2013.

The pilots of an A320 tried a different way of solving a recurring flight control problem and were startled by the results.

© Stephane Beilliard | AirTeamImages

BY MARK LACAGNINA

Unresolved Fault

Persistent and increasingly frequent failures of the Airbus A320's rudder travel limiter system had occurred for several months. Ultimately, when the normal procedure failed to stem a rash of failures during a flight over Indonesia's Java Sea on Dec. 28, 2014, the pilot-in-command (PIC) tried a different method — one he had seen a maintenance engineer perform on the ground.

The unexpected consequences — an uncommanded, rapid left roll and disengagement of the autopilot — startled the flight crew. They responded improperly to the upset and lost control of the A320, which descended fully stalled into the sea, with the loss of 162 lives, according to the report by the Indonesian National Transportation Safety Committee (Komite Nasional Keselamatan Transportasi, KNKT).

The rudder travel limiter is part of the electronic flight control (fly-by-wire) system used in most Airbus aircraft. A simple description of the system is that yaw, roll and pitch control signals to and from the autopilots and inputs from the pilots' sidesticks are processed and coordinated by seven flight control computers that, in turn, send electronic control signals to the hydraulic actuators for the rudder, horizontal stabilizer, ailerons, elevator and spoilers.

Two of the computers are flight augmentation computers (FACs), which are used for rudder control. Among other functions, the FACs govern the rudder travel limiter units (RTLUs), which guard against structural overload by preventing the rudder from exceeding certain deflection limits as airspeed increases. (The rudder travel limit is 25 degrees up to 160 kt and progressively decreases to 3.4 degrees as airspeed increases to 380 kt.)

Unrecognized Problem

Maintenance data collected during 2014 by the aircraft operator, Indonesia Air Asia, included 23 reports of RTLU failures in the accident aircraft. The data showed that the problems were becoming more frequent, with five reports in November and nine in December.

Beyond the 23 reported incidents, investigators found that there had been numerous incidents in which RTLU failures were rectified in flight and not subsequently written up by the flight crews or logged as distinct events by the automatic aircraft defect reporting system.

For example, the KNKT report notes that during two flights on Dec. 19, the pilots (not the accident flight crew) responded to 22 RTLU failure annunciations by carrying out the actions displayed on the electronic centralized aircraft monitor (ECAM). The pilots reset the FACs one-by-one each time by cycling their on/off pushbuttons on the overhead panel. The procedure returned the RTLUs to normal operation only briefly.

"The aircraft defect reporting system logged the [22] RTLU system faults as a single event," the report said. "An operational check of the autoflight system was performed [by maintenance personnel]. The operational check was satisfactory, and the defect maintenance action was closed."

Always a 'New Problem'

Due to the methods with which the airline's maintenance organization collected and addressed reported problems, each of the RTLU failure reports had been dealt with on an individual basis as a "new problem" and closed after the problem appeared to have been resolved on the ground, the report said.

Thus, the RTLU failures were never classified as a repetitive problem requiring further troubleshooting and maintenance action.

Three days before the accident, the PIC of the ill-fated flight, flying with a different second-in-command (SIC) than on the accident flight, received an indication of RTLU failure after the engines were started in preparation for a scheduled flight from Surabaya, Indonesia, to Kuala Lumpur, Malaysia.

The PIC used the radio to report the problem to the company's engineering staff while returning the aircraft to its parking position at the gate. The passengers and crewmembers

The flight crew was dealing with a rudder system anomaly and trying to avoid cumulus buildups when the upset occurred.

Indonesian National Transportation Safety Committee remained aboard the aircraft while an engineer used the ECAM and built-in test equipment to troubleshoot the problem.

The PIC observed that the engineer returned the RTLUs to normal operation by cycling the circuit breakers for the FACs, as well as resetting the computers with the overhead pushbuttons as prescribed by the ECAM. (The circuit breaker for the no. 1 FAC is on the overhead panel, and the breaker for the no. 2 FAC is on a panel behind the right seat.)

"The PIC and the engineer engaged in a discussion," the report said. "The PIC asked whether he may perform the same reset action whenever the problem reappeared. The engineer stated that the pilot may reset [the FAC circuit breakers] whenever instructed on the ECAM."

The report noted that although the circuit breakers for all the flight control computers may be reset on the ground, the A320 quick reference handbook (QRH) includes a list of breakers that can be reset in flight. The FACs are not on the list.

However, the QRH also said that the circuit breakers for flight control computers that are not on the list may be reset in flight but cautioned that "before taking any action on other computers, the flight crew must consider and fully understand the consequences."

The "consequences" were not spelled out in any documents available to pilots. "It requires good understanding of the aircraft system to be aware of the consequences," the report said, noting that such awareness typically can be gained only by consulting the manufacturer.

Although the RTLU problem appeared to have been solved by the engineer after the aircraft was returned to the gate, the fault message appeared again when the engines were restarted after pushback. The pilots cycled the FAC on/off pushbuttons, as called for by the ECAM, and also cycled the circuit breakers, as the engineer had done. However, the problem persisted.

This time, the PIC returned the aircraft to the gate, shut down the engines and disembarked the passengers. Maintenance technicians ultimately addressed the problem by replacing the no. 2 FAC (an action that had not been taken in response to any of the previous RTLU failures).

Subsequent tests with the aircraft's engines running revealed no further problems with the RTLUs. The A320 then was flown to Kuala Lumpur and back to Surabaya without further incident.

No Upset Recovery Training

On the day of the accident, the A320 was scheduled for a flight from Surabaya to Singapore with 156 passengers, four flight attendants and two pilots.

The PIC, 53, was an Indonesian and had served in the country's air force as a fighter and transport pilot for 10 years. He then flew for several airlines before joining Indonesia Air Asia as a Boeing 737 pilot in 2008, later transitioning to the A320. He had 20,537 flight hours, including 4,687 hours in type.

The SIC, 56, had earned an airline transport pilot license in his native France, and the license later was renewed by Indonesian authorities. The report provides little information about his background before he joined Indonesia Air Asia's management staff in 2012. He served in several management positions before entering pilot training at the airline. The SIC had 2,247 flight hours, including 1,367 hours in A320s.

The report noted that the PIC had received upset recovery training in a 737 flight simulator and that both pilots had received stall-recovery training in an A320 simulator. However, neither pilot had received upset recovery training in the A320 because it was not required by the airline.

According to the report, the airline's A320 *Flight Crew Training Manual* stated that "the effectiveness of fly-by-wire architecture … eliminates the need for upset recovery [training]."

Weather No Factor

The aircraft departed from Surabaya at 0535 local time and climbed northeast to Flight Level (FL) 320 (approximately 32,000 ft). The SIC was the pilot flying.

Meteorological data showed that the aircraft entered an area of towering cumulus with tops extending to 44,000 ft over the Java Sea. However, the KNKT concluded that the convective activity had no direct bearing on the accident.

"The FDR [flight data recorder] data indicated that the flight was not affected by the weather conditions, and [the] investigation concludes that the weather was not [a] factor to the accident," the report said.

Nevertheless, the report indicates that the pilots apparently were concerned about the weather. Shortly after leveling at cruise altitude, the SIC asked the PIC to activate the aircraft's anti-ice systems. Shortly thereafter, a flight attendant made a public address announcement directing the passengers to return to their seats and fasten their seat belts "due to weather conditions and [the] possibility of turbulence," the report said.

About three minutes later, when the aircraft had been airborne for 25 minutes, the flight crew received an advisory that the no. 1 RTLU had failed. The SIC called for "ECAM action," but before any action could be taken, the pilots received aural and visual master warnings that both RTLUs had failed.

The PIC returned the units to normal operation by cycling the FAC pushbuttons, as prescribed by the ECAM.

The PIC then requested and received clearance from air traffic control (ATC) to deviate 15 nm (28 km) left of course to avoid a cumulus formation directly ahead of the aircraft.

When later told to establish radio communication with another ATC facility, the PIC checked in and informed the controller that they had diverted left of course to avoid weather and requested clearance to climb to FL 380 when possible. The controller told the pilot to stand by.

Unexpected Consequences

Shortly thereafter, the second and third warnings of RTLU failure occurred in quick succession. The pilots responded both times by performing the prescribed ECAM actions, and the RTLUs returned to normal functioning.

About four minutes after the PIC requested clearance to climb to FL 380, the controller issued a clearance to climb to FL 340. There was no response from the flight crew.

The pilots had received their fourth warning that the rudder travel limiter system had failed. This time, they not only cycled the FAC pushbuttons but also attempted to reset the circuit breakers, as the PIC had observed the engineer do during the troubleshooting on the ground three days earlier.

The report said that the PIC did not fully understand the consequences of trying to reset the FAC circuit breakers in flight. When the breaker for the no. 2 FAC was pulled, the autopilot disengaged, causing the flight control system to revert from "normal law" to "alternate law" and the rudder to deflect 2 degrees left (due to inertia).

The rudder deflection induced a roll rate of 6 degrees per second, or about twice the normal roll rate.

Although the FAC circuit breakers eventually were closed, the crew did not subsequently recycle the on/off pushbuttons. The FACs remained off-line, and the flight control system remained in alternate law.

The report noted that when functioning in normal law, the electronic flight control system prevents the aircraft from reaching a stall angle-of-attack; when the system reverts to alternate law due to a component malfunction or other cause, the flight crew becomes solely responsible for guarding against a stall.

Startled and Disoriented

The disengagement of the autopilot and the unexpected and rapid left roll likely startled the SIC and led to disorientation that caused a significant delay in his response to the upset and his subsequent "spontaneous or involuntary action" while attempting to recover control, the report said.

The "startle reflex" apparently also affected the PIC, whose exclamation of "oh, my God" was captured by the cockpit voice recorder.

The uncommanded left roll continued for nine seconds, with the aircraft reaching a bank angle of 54 degrees, before the SIC responded with manual sidestick control input. The aircraft rapidly rolled back to an almost wings-level attitude.

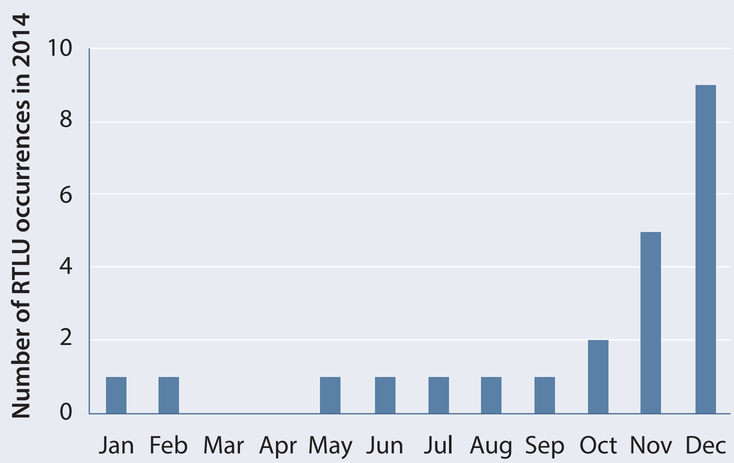
However, the rapid movement likely was sensed by the spatially disoriented SIC as excessive, and he overcorrected with left sidestick input that caused the aircraft to roll back into a 50-degree left bank.

Investigators found that the SIC then applied mostly continuous back pressure on his sidestick, increasing the aircraft's pitch attitude. The stall warning sounded when the aircraft's angle-of-attack reached 8 degrees.

The PIC said "level … level," but this ambiguous statement likely was interpreted by the SIC as a command to level the wings rather than to level the pitch attitude, the report said.

As a result of the SIC's continuous back pressure on the sidestick, the A320 climbed, at rates reaching 11,000 fpm, to 38,500 ft. As the aircraft reached the

Increasing Trend of Rudder System Failures



RTLU = rudder travel limiter unit

Notes: Maintenance data revealed 23 reported RTLU failures in 2014, with 11 between Nov. 27 and Dec 27, the day before the accident

Source: Indonesian National Transportation Safety Committee

Figure 1

peak of the climb, the PIC made two tentative sidestick inputs. After a few seconds, the PIC's sidestick inputs became continuous.

No Priority

Although both pilots were applying continuous sidestick inputs, neither pressed and held the "priority" pushbutton on his sidestick, which would have caused the flight control system to respond only to the inputs from the priority sidestick.

The PIC briefly pressed the priority pushbutton twice but did not hold it down long enough (about 40 seconds) to actually assume priority. Moreover, he did not announce "I have control," as prescribed by standard operating procedures.

An aural "dual input" warning was generated, but it likely was suppressed by the continuous stall warning, the report said.

With no priority established, the flight control system averaged the sidestick inputs. Because the SIC's sidestick continued to command nearly maximum nose-up pitch, the aircraft remained at a very high angle-of-attack.

The PIC told the SIC several times to "pull down." This command, too, was ambiguous and constituted a contradiction in terms, the report said, with "pull" implying that the SIC should increase back pressure on his sidestick and "down" implying that the sidestick should be moved forward to bring the aircraft's nose down. The SIC continued applying nearly full back pressure.

Angle-of-attack reached a maximum of 48 degrees, and the aircraft was in a steep left bank when it entered a descent reaching 20,000 fpm. The pilots were able to level the wings and the pitch attitude, but the angle-of-attack remained at about 40 degrees.

Although they had received stall-recovery training, the pilots typically had experienced stalls only at high pitch attitudes. "The condition of stall at zero pitch had never been trained," the report said.

The A320 descended in a flat pitch attitude and fully stalled until it struck the sea at 0620.

Open Circuit

The investigation determined that the repetitive failures of the aircraft's RTLUs resulted from intermittent open circuits caused by cracks in the solder on an electronic module. The solder cracks had progressively become worse due to thermal cycles induced by the frequent disengagements and re-engagements of the FACs.

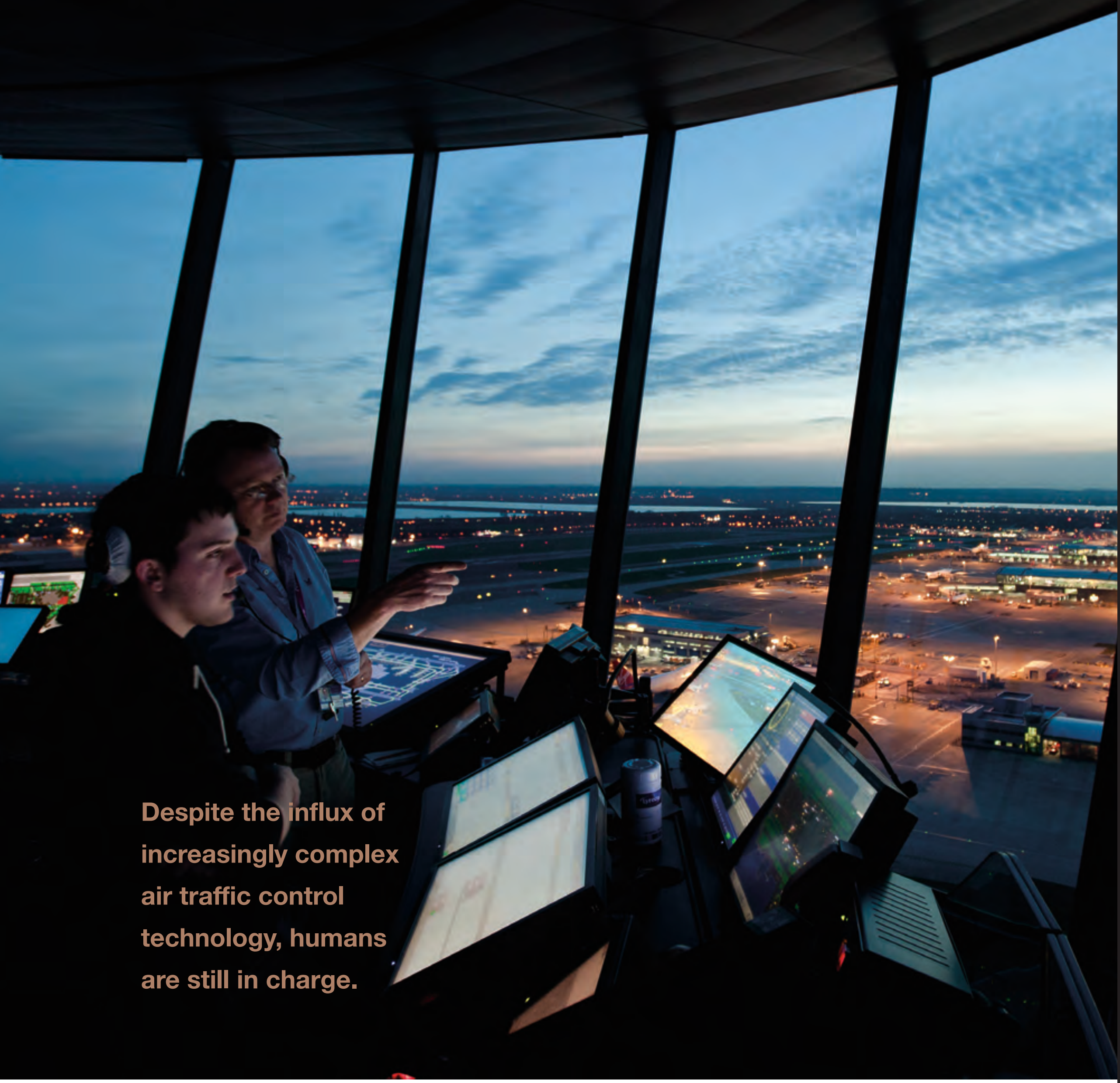
Based on the accident investigation, the KNKT recommended in part that the Indonesian Directorate General of Civil Aviation ensure that aircraft operators have maintenance systems that are able to "detect and address all repetitive faults appropriately."

The committee also recommended that aviation authorities worldwide implement mandatory upset recovery training and that the training be introduced even before the 2019 deadline established by the International Civil Aviation Organization.

This article is based on Komite Nasional Keselamatan Transportasi of the Republic of Indonesia Aircraft Accident Investigation Report KNKT.14.12.29.04, "PT. Indonesia Air Asia Airbus A320-216, PK-AXC; Karimata Strait, Coordinate 3°37'19"S — 109°42'41"E, Republic of Indonesia; 28 December 2014." The report is available at <kemhubri.dephub.go.id/knkt/ntsc_home/ntsc.htm>.

Interacting With Automation

BY LINDA WERFELMAN



Despite the influx of increasingly complex air traffic control technology, humans are still in charge.

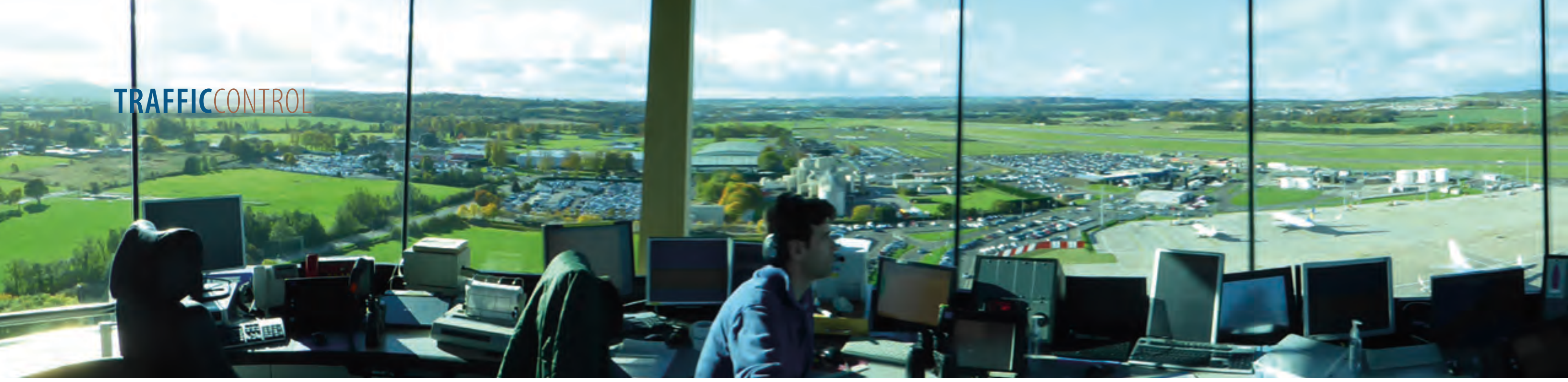
Although high-tech innovations will play an increasingly larger role in air traffic management (ATM), air traffic controllers will retain a central position of operational authority; as a result, new methods will be required to ensure safe, effective interactions between humans and technology, the U.K. Civil Aviation Authority (CAA) says.

The CAA's CAP 1377, *ATM Automation: Guidance on Human-Technology Integration*, outlined methods of addressing the relationships between humans and automation in changing ATM systems.

"For the foreseeable future, humans are expected to play a key role in the delivery of … ATM, and the maintenance support of the technical systems used," said the document, released in late February. "However, it is expected that the tasks, roles and means of the human delivering these services will evolve through the deployment of a broad range of complex automation."

Among the new technologies being introduced into the system are remote tower systems (*ASW*, 9/15, p. 18) and variants of advanced surface movement guidance and control systems, both of which "enhance the capability of air traffic controllers to track and manage aircraft," the document said, adding that "ever-more sophisticated technologies can be expected to come on stream in the near future."

CAP 1377 was developed in the aftermath of a 2014 CAA-industry workshop on automation, which concluded that no additional regulations were necessary to deal with the ongoing wave of automation changes. Instead, new guidance



material was recommended for both the industry and its regulators.

Automation, Defined

The word *automation* describes a variety of systems — typically systems that are based on relatively new inventions, the document said.

"Socially, what we consider to be categorised as automation changes over time," the document added. "What is thought of as automation today may not be [thought of that way in the] future when it becomes accepted as routine. For example, home central heating thermostats and electric kettles are not today thought of as forms of automation. … Yet … these functions fit the definition and would have been socially considered as being examples of technology augmenting human functions when first introduced."

Although ATM already relies on a number of relatively new technologies, including radar data processing, electronic data displays and electronic flight strips, there has been relatively little use of automation in decision making, the document said.

Nevertheless, "when workload increases and users become more confident in the systems that provide possible solutions and advice, automation can, and perhaps already has, surreptitiously become a decision maker by proxy," the document added.

'Systems of Systems'

As numbers of diverse ATM systems increase, those systems will be more likely to interact, to share data and to "operate across interconnected and closely coupled 'systems of systems,'" the document said. "This will lead to the concept of 'levels of automation' becoming blurred as it becomes less realistic to assess specific functions for their particular level."

The document said that individual technologies can be assessed by examining the extent to which they contribute to performance of a specific function, "from a low level (no assistance from technology) to a high level (completely automated system)." Even at high levels of automation, however, some element of human involvement remains, the document added.

Despite the benefits of automation in enhancing safety and efficiency, it also introduces challenges, the document said, adding, "Human error does not vanish; automation changes its nature."

Among the challenges are problems in the design of automated systems, including a lack of understanding by the designers of the needs of the individuals who will use the systems. In addition, the document said, "revised roles, responsibilities and accountabilities resulting from the introduction of technology are not appropriately bounded or reasonable," planning for technical failures is often insufficient, and "emergent properties and human behaviours are not identified and acted on in service."

'A Key Enabler'

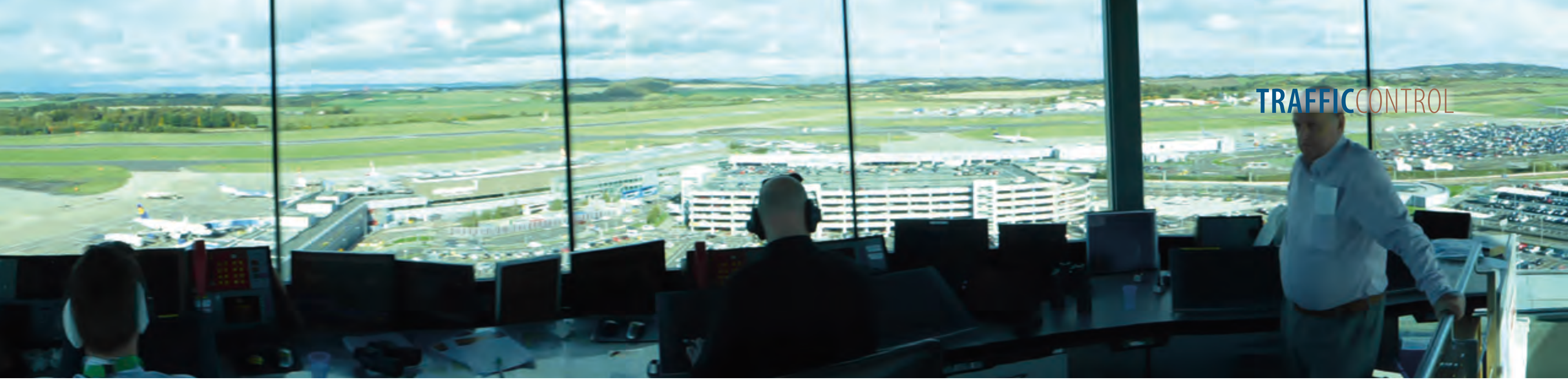
As the aviation industry has developed, automated systems have become essential "to help to ensure safe and resilient services, delivered more cost effectively and in a manner that delivers capacity to meet demand," the document said, adding that automation is "a key enabler for the deployment of SESAR," the Single European Sky ATM Research program to overhaul European ATM infrastructure.

The guidance material included in the document addresses not only the industry but also regulators and the workforce, noting that guidance material for dealing with automation must be aligned with regulatory requirements; that, "when automating any aspect of the ATM system, a human-centered design approach should be used"; and that the users of the system should be involved in all phases of its design and implementation.

The guidance material itself was designed as "a guide and crosscheck for the safety assurance and oversight of the human performance aspects of the design, development, transition and in-service operation of ATM automation," the document says.

The guidance material outlines eight themes, beginning with understanding the *scope* of the ATM operation and the need for automation. At the outset, the effects of proposed changes on the organization and the workforce must be understood, the material says.

"ATM automation has the potential to generate workforce issues by changing or redistributing roles, responsibilities, methods of work or



places of employment," the guidance says. "The workforce often fear that they will be forced to use a system they are not comfortable with and that they will lose control of their destiny. People have concerns that automation will lead to reduction in staffing or de-skilling. Early staff involvement can allay these fears, ensure buy-in to the solution and make use of their operational experience leading to efficient design solutions and acceptance."

Next, the guidance says, *human* performance must be a primary consideration in the design, development, deployment and operation of any automated system, and members of the workforce will need to understand their *obligations* when working with any automated system.

"People will remain accountable for the safety of ATM," the guidance says. "Humans will still have to take responsibility and accountability for the unintended consequences of their interactions with automation."

As a result, as automated systems are introduced, efforts should be made to "ensure that new or transferred accountabilities, responsibilities and roles are appropriate and unambiguous to the individuals concerned," the guidance says. "New system complexities will also involve differing combinations of humans and technology working together. Although the technology or a computer cannot be held to account, those who design, code, assure, maintain and operate the system can be held accountable."

Integration of the automated systems must be safe, efficient and accomplished so that new systems work in cooperation with other internal and external ATM systems, the guidance says, adding that, as systems become increasingly complex and interdependent, they must be designed with adequate *resilience* to enable recovery from a technical failure. Any failure should be easy for the workforce to recognize, and fallback procedures should "place reasonable demands on the capability and capacity of [human] users," the guidance says.

Another theme calls for the users to not only understand how to operate the systems but also how the systems work, and to undergo training that ensures their *competency* in case of equipment failures.

"Technology changes the order and routine in which tasks are completed," the guidance says. "Consideration of [changes in] both cognitive and physical activity … is necessary. For example, the implementation of electronic flight strips fundamentally changes the brain, eye [and] hand activities conducted to deliver what is an identical end function. Additionally, automatic coordination can reduce awareness of aircraft approaching the sector. … Automation requires more (and different) learning for users."

Transition planning is crucial to ensuring safe changes from old systems to new, automated ATM systems, the guidance says, and transition plans should address the effects of new technology on human performance, among other things. In some cases, the best choice may be to implement several complementary new systems simultaneously, but other times, an incremental transition to new systems may be appropriate.

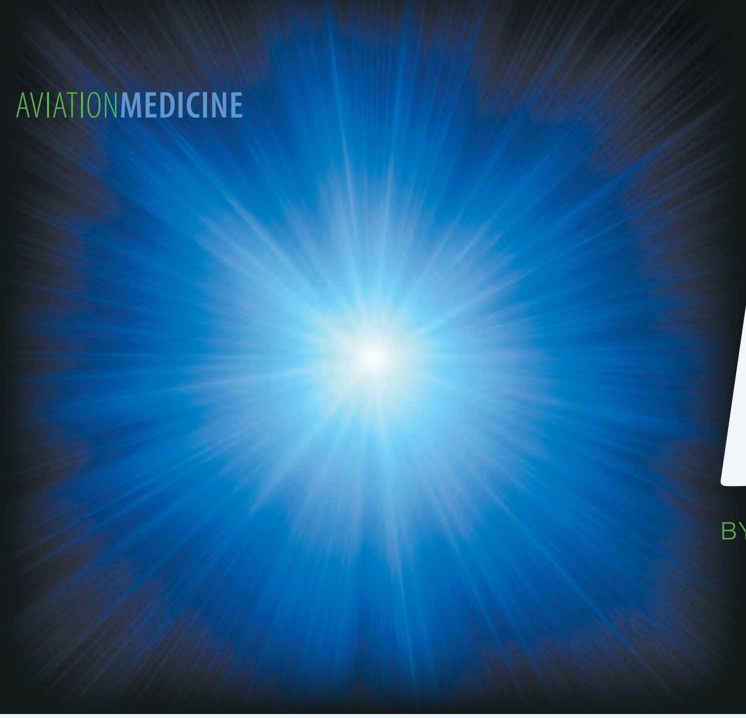
The final theme — *emergence* — calls for gathering information about how newly introduced technologies are being used, how well they are performing, how the nature of the work has changed with their introduction and whether there have been any unintended consequences.

"The deployment of innovative technology is likely to result in unpredictable and hard-to-foresee properties and behaviours of both the technology and the users," the guidance says. "In-service safety and performance monitoring processes should be implemented to identify and address emergent behavior from the human-technology integration."

In addition, the guidance adds, "It should be assumed that technical and human performance will change over time; this may well undermine design assumptions and prediction.

"Old skills that have been assumed will be maintained might not last as they are no longer practiced. These changes need to be identified, the consequences considered and actions taken as necessary to reflect the reality."

This article is based on CAP 1377, "ATM Automation: Guidance on Human-Technology Integration," available at <www.caa.co.uk>.



Flash

BY LINDA WERFELMAN

British physicians have described what they say may be "the first evidence-based report" of a commercial airline pilot experiencing a medically documented retinal injury caused by a laser strike to an aircraft.[1]

Publication of their report in the January 2016 issue of *Aerospace Medicine and Human Performance* came as officials in several countries voiced fears that the number of laser strikes on aircraft is increasing, even as efforts have intensified to prevent strikes by publicizing the dangers that they present for pilots.

The physicians' report said that the airline pilot was seen at the Department of Ophthalmology at Royal Hallamshire Hospital in Sheffield, England, "complaining of a blind spot in the upper left area of his visual field in the right eye," one day after his airplane was struck by a laser beam during approach to landing at "a busy international airport within the United Kingdom."

"At around 1,300 ft (396 m), a blue laser beam from the ground directly entered his right eye, with immediate flash blindness and pain," the report said.

As recommended in guidelines for pilots (see "Advice for Pilots"), the report added, "Aircraft controls were directly passed to his copilot for safe landing of the plane, with the pilot's vision recovering 45 [minutes] after exposure."

The report did not include additional details of the event, such as when and where it occurred or the type of aircraft involved. The British Air Line Pilots Association (BALPA), however, said the event was associated with a "military-strength" laser during approach to Heathrow Airport in London.[2]

During his examination, the pilot's unaided visual acuity was better than normal, measuring at 6/4 in both eyes. This meant that, at a distance of 6 m (20 ft), he could see what someone with normal visual acuity could see from 4 m (13 ft). Normal vision is considered to be 6/6 (also referred to as 20/20).

However, tests of his right eye showed "a localized area of photoreceptor disruption" — a blind spot — large enough to lead the physicians to suspect that the laser had "a radiant power of several watts, known to be injurious to the human retina," the report said.

Within two weeks of the laser strike, the pilot's symptoms had disappeared, although doctors identified a lesion on his retina as being "commensurate with a retinal laser burn," the report said. Tests found no problems with his visual function and no other anomalies.

The physicians wrote that this was "to the best of our knowledge … the first documented case report of a likely

Examination of a pilot's right eye found photoreceptor disruption after his aircraft was struck by a laser beam.

in the Sky

Physicians attribute an injury to an airline pilot's retina to an in-flight laser strike.

retinal laser injury to a pilot during flight from a laser on the ground. … We suspect this blue laser … potentially could have led to permanent loss of central vision in the pilot's right eye had the fovea, the area of retina responsible for high acuity vision, been involved."

The physicians noted that retinal injuries inflicted by hand-held laser devices are being reported in growing numbers, and that data show an increasing number of laser strike events involving aircraft. They added that the case they described "highlights the growing threat to the ocular health of airline crew and, potentially, passenger safety."

882 Laser Events

The event described in the physicians' report was one of 882 laser events reported to the U.K. Civil Aviation Authority (CAA) in the first nine months of 2015. In 2014, the last year for which complete data were available, laser events in the U.K. totaled 1,440 — about 3 percent more than the previous year but about 25 percent fewer than were recorded in 2011, which had the highest annual total reported from 2009 through 2014.[3]

The CAA has not released data for 2016, but BALPA cited a February laser strike on Virgin Atlantic Flight VS25 after takeoff from Heathrow Airport — and the flight crew's subsequent decision to return to Heathrow because one of the pilots was having problems with his vision — in asking for a crackdown on the abuse of high-powered laser pointers.[4,5]

"Aircraft are attacked with lasers at an alarming rate and with lasers with ever-increasing

Advice for Pilots

Pilots' organizations and aviation regulatory authorities have recommended actions for pilots to take to limit the harmful effects of laser strikes, including the following recommendations by the U.S. Federal Aviation Administration (FAA):

- When operating "in a known or suspected laser environment," the pilot not flying should be prepared to take the controls in case of a laser strike.
- After a laser strike, consider engaging the autopilot to maintain the flight path.
- Climb or turn away from the laser beam and let the aircraft's fuselage block the beam. Do not look directly at the beam, and shield your eyes with your hand, a clipboard or other device.
- Tell air traffic control about the event, including the likely location of the laser pointer. After landing, file a "Laser Beam Exposure Questionnaire."
- Turn up cockpit lights to minimize the effects of further laser illumination.
- Do not rub your eyes. Rubbing can cause further irritation or injury.
- If visual problems persist after landing, consult an eye doctor.

— LW

Note

1. FAA. *Laser Hazards in Navigable Airspace*. <www.faa.gov>.

strength," BALPA General Secretary Jim McAuslan said, adding that the British government should "classify lasers as offensive weapons, which would give the police more power to arrest people for possessing them if they had no good reason to have them."

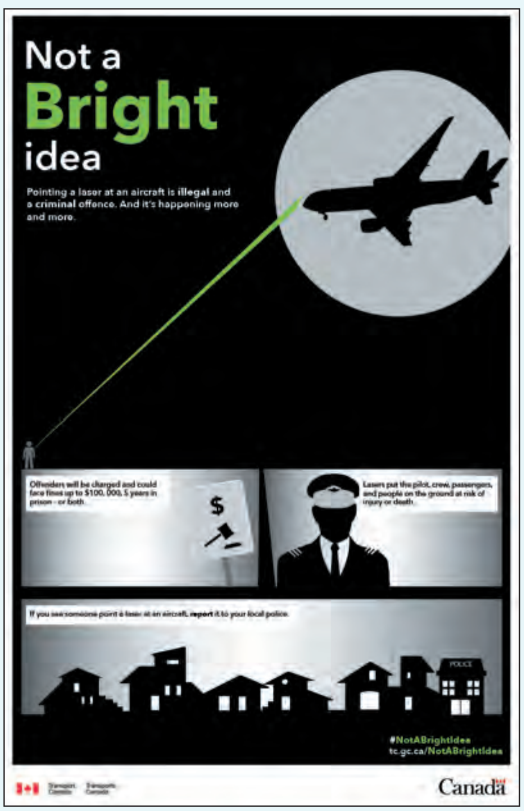
Canadian Campaign

In Canada, authorities have stepped up efforts to prevent laser strikes with their Not a Bright Idea campaign, launched in mid-2015 to "help Canadians better understand why pointing a laser at aircraft is not a bright idea."

Campaign information adds that a laser pointed at an aircraft "could cause a major accident. It could also distract the pilot, create glare [or] cause temporary blindness."

Transport Canada (TC) reported 502 events in 2014 in which lasers were pointed at aircraft — an increase of 43 percent since 2012. Individuals convicted of pointing a laser at an aircraft face penalties of up to C$100,000 (US$76,866) in fines or five years in prison or both.[6]

The Canadian government launched its Not a Bright Idea campaign in an attempt to prevent laser strikes against aircraft.



© Transport Canada

"The greatest danger may be that the general public is simply unaware of the power and potential impact of lasers," TC said. "While many people treat lasers like toys, it's important to remember they can be dangerous."

The Air Line Pilots Association, International (ALPA), which represents pilots in Canada and the United States, says the sight of "a green light slicing across the cockpit" is increasingly common in both countries.[7]

In the United States, the number of laser strikes reported to the Federal Aviation Administration nearly doubled in 2015, when 7,703 strikes were recorded, compared with 3,894 in 2014.[8]

The agency has been working since 2014 with ALPA and the U.S. Federal Bureau of Investigation on a safety campaign aimed at ensuring that the general public is aware of the dangers of pointing a laser at an aircraft. Under a 2012 law, knowingly pointing a laser beam at an aircraft is a federal crime, punishable by up to five years in prison and a $250,000 fine.

"As hard as it is to believe, some individuals make a deliberate choice to repeatedly endanger the lives of air travelers as well as people on the ground by aiming lasers at aircraft," said Joe DePete, ALPA first vice president and national safety coordinator. "We owe it to the public safety to fully enforce the law and apply the prison time and fines that come with violating it."[9]

Notes

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2. *The Guardian*. "Virgin Atlantic Laser Incident: Pilots' Union Demands Action." Feb. 15, 2016. <www.theguardian.com>.

3. U.K. CAA. *Laser Incidents Reported to the U.K. CAA, 2015: Q1–Q3*. <www.caa.co.uk/WorkArea/DownloadAsset.aspx?id=4294978067>.

4. BALPA. *Laser Incident Shows More Action Is Needed*. Feb. 15, 2016.

5. *The Guardian*.

6. TC. *Transport Canada Launches National Campaign on Laser Safety*. June 24, 2015. <www.tc.gc.ca>.

7. ALPA Staff. "Stopping Laser Attacks on Aircraft: No Shot in the Dark." *Air Line Pilot* Volume 84 (November 2015): 21–23.

8. LaserPointerSafety.com. *Laser Incident Statistics*. <laserpointersafety.com>.

9. ALPA Staff.


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Common-sense recognition of everyday threats and self-auditing are first steps to making effective changes.

BY JAMES COX

Fatigue
in Corporate Culture

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Although we grew up learning fatigue risk management, we likely didn't realize this was what we were being taught by our teachers and parents. Our earliest teachers taught us that after lunch, we took a nap so that we would be alert afterward. Our parents used the same nap-time theory on us at home, and told us napping was so we would be ready to go outside to play. (In reality, our parents needed a break and were managing their fatigue.)

Looking back on my days as a young adult on a farm in Kentucky, I realize that, as a community, we recognized fatigue risk management and circadian rhythms in our daily lives. We got up before sunrise, worked hard until lunch and then, after lunch, took a short nap. We were as productive and alert after our short break as if we had slept for eight hours, which was important because we were operating heavy farm machinery that did not have many of the safety features that can be found on the equipment we operate today. If I were to go back and speak with some of my childhood friends who are farming now, and explained fatigue risk management and circadian rhythms, I am sure they would just smile and say, "We call that common sense."

We all likely have dealt with fatigue risks in aviation operations. They play a bigger part in our daily lives then most realize, and self-auditing is the first step in changing the corporate culture in this regard. Fatigue can manifest in many ways and is not always a short-term issue with a short-term fix. Employees who appear cranky or show signs of stress, or those who struggle to comprehend tasks may be showing signs of fatigue.

Sleep debt, one aspect of fatigue, is a real issue for flight crewmembers and other safety-critical employees in your company. You do not have to be slumped over the yoke or over your keyboard to be demonstrating signs of fatigue. Managing your circadian rhythm is important to safe operations and to your employees' health, both of which can impact the bottom line as well. Fatigue risk management requires a common-sense approach.

When safety management systems (SMS) were introduced, some flight departments embraced the cultural changes involved but others did not, sometimes saying they had yet to see its advantages. Now, with the inclusion of fatigue risk management systems (FRMS) in SMS, a new round of comparable cultural challenges has been created for safety managers to overcome. Stakeholders need to understand that fatigued employees increase the inherent risk and decrease the overall safety level of flight operations.

The U.S. Federal Aviation Administration (FAA) requires an SMS and an FRMS for Federal Aviation Regulations (FARs) Part 121 air carriers, and likely will impose the same requirements in the near future for Part 135 commuter and on-demand operators.

Flight departments flying under the Part 91 general operating and flight rules already have started to recognize these changes through the International Standard for Business Aircraft Operations (IS-BAO) certification process. Managing risk does not have to be mandated by the FAA; we should embrace it and adopt it ahead of mandates.

Along with these additional SMS and FRMS requirements come changes in workplace philosophies, scheduling and overall human factors management in daily operations. The hardest part of this change is providing the proper training and education of employees about managing their fatigue levels, and explaining how the company will benefit from this change.

Operators still have to apply common sense, as noted, in their implementation of FRMS. It makes sense to monitor the health and productivity of the staff from the top down while complying with the FARs or IS-BAO and the bottom line. Our industry is not a forgiving one; when an accident or incident occurs, there is no room for do-overs.

As an aircraft management company, we deal with Part 91 and Part 135 operations daily, and we have adopted the regulatory standards of Part 135 across the board rather than have varying standards within our operations. Our clients know this and say they respect that our corporate philosophy on safety includes safeguarding the health of our staff members.

In our experience, the keys to changing corporate culture regarding fatigue have been seeing the value of FRMS and doing a little self-auditing. It took me a while to realize, as a flying director of operations, that even though I was complying with the FARs rest requirements and was perfectly legal to be on duty, I was still more fatigued than I realized.

The keys to changing corporate culture … have been seeing the value of FRMS self-auditing.

Aviation professionals need to be aware that anything that interrupts an individual's normal window of circadian low has a potential for a cumulative effect on performance. I occasionally spend several days at a time on the West Coast of the United States during trips, and struggle to adapt to the different local time of my sleep cycle. By the time I return home, I struggle again to adapt to my home base time. Although the difference is only two time zones, it still interrupts my normal sleep cycle and circadian rhythm. The cumulative effect is obvious through my terse responses to queries, irritability and lack of initiative, which has been noticed by my fellow employees.

So I have made it a practice to say to colleagues that I'm tired, and I have instructed other flight crewmembers and staff that they should do the same. This is not simply a new excuse to get out of work for the day, but a real factor that has to be addressed on all levels in the company.

Part of the cultural change in aviation departments is getting buy-in from the stakeholders and managing fatigue from the standpoint of minimizing potential losses and not breaking the bank. You do not have to build sleep facilities on site or reconfigure your aircraft for a sleeping berth. Structuring a presentation based on "what if" fatigue scenarios is a good way to start. We train for what-if when we go to annual flight training or when we practice our emergency response plan (ERP) drills. Through proper oversight and fatigue risk management, a company can minimize the potential for such "what if" events to actually happen.

Start on the operations side by looking at your scheduler(s) or dispatcher(s), if you have them (see "Operational Control," p. 18). Do you often question the decision making on routing, trip details or fixed base operator choices? Do the dispatchers ever look like they pulled an all-nighter?

Depending on your staffing levels, some of these people may be on the phone nearly 24/7 or may be pulling an on-call duty schedule all weekend and then be returning to the office first thing Monday morning. Certain technology has also been shown to cause mental fatigue. Many people, after staring at a computer monitor answering emails continuously, are mentally exhausted by 10 or 11 a.m. Have you ever noticed that these usually nice, courteous people become irritable as the day progresses? That's fatigue.

What about the people maintaining your aircraft? Did you ever look at them and ask, "Did you have a good night's rest?" Probably not, but maybe you should. Again, depending on the size of your department, a maintenance technician may wait all day for your return so that he can work all night to prepare the aircraft for your early morning departure. Was the same person who welcomed you home the same person who sent you off? It's just as important that these technicians be well rested and at their best when servicing your aircraft. They need to know how to manage their own fatigue, and they need to be able to comfortably tell management, without fear of repercussion, that they are tired and need help.

As pilots, numerous factors cause us stress, including weather, duty time, extended international flight operations, financial matters, crew pairing, lack of a good night's sleep, and worrying about personal matters. Issues associated with passenger requirements, such as catering and on-time performance, also cause stress. There are far more items than I have mentioned here, but the point is that we have a lot on our minds that causes stress, and that leads to fatigue.

Stakeholders across the organization need to be educated on the benefits of fatigue risk management and its direct correlation with their safety. They need to understand that having well-rested employees lessens the risk of human error and thereby removes part of the error chain.

By proactively looking at schedules and mitigating areas of concern, a company can reduce the potential for loss, which impacts the bottom line. Every loss has a dollar value attached to it, and weighing the cost of additional rest breaks, crew rotations or temporary staff may show that those steps are far more economical than an accident, incident or other loss. There are multiple ways to manage fatigue, but each department has to come up with a workable plan and then get everyone's buy-in.

When looking at safety reports submitted through our SMS, we investigate if human error possibly played a part in the event. If human error is suspected, the individual's work schedule is taken into account to see if fatigue may have been a factor and whether, through proper mitigation, the event could have been avoided.

Part of effecting cultural change is demonstrating the importance of fatigue risk management to the company. Most companies have a drug and alcohol program in place to protect clients and employees from the effects of someone who may be under the influence, and to provide employees with a safe working environment. During the associated training, the financial impact that someone under the influence may have on an organization is discussed.

We also need to show the potential financial impact of someone working while fatigued. Using an FRMS provides similar protection for clients and employees against other employees who may be suffering from fatigue. You can look, for example, at the line service at a fixed base operator — asking, for example, which shift is responsible for the most "hangar rash" (typically minor damage to aircraft due to poor ground handling) and what is the cost of that to the company. Monitoring each shift's fatigue levels and perhaps modifying work schedules or adding staff can help mitigate the loss potential. Human error cannot be eliminated but can be minimized with proactive programs like this.

We use Pulsar Informatics' Aviation Fatigue Meter to monitor our employees' fatigue levels. This program can be used with our flight crew scheduling software and our payroll system for all non-flight personnel. This allows managers to look at employee schedules from a fatigue standpoint, and it affords employees the opportunity to review their cumulative fatigue levels. Managers and employees can review their schedules and modify them to reflect actual rest or duty periods if different than scheduled. The fatigue level recorded will be based partly on relationship of work to the employee's normal window of circadian low, and reflect whether the employee is able to adjust his or her sleep cycle, shift or duty time, or to add additional rest time. The key to fatigue mitigation is giving each individual the opportunity to manage his fatigue.

This is not a difficult process. During our weekly management planning/scheduling meeting, we review these potential areas for fatigue and look at areas where a cumulative fatigue effect may occur. This enables managers to discuss possible mitigation plans and to support optimum work performance from staff. Fatigue risk management is more than a program; it requires a proactive approach from all stakeholders.

Fatigue has been cited in numerous aviation accidents over the years as a factor or a cause. Don't wait until you have an accident or incident to make changes. By being proactive, you can minimize the risk. A cultural change is difficult to make, but the first step is being able to relate the benefits of an FRMS to every person in your company.

Capt. James Cox has more than 30 years of aviation experience and currently flies the Dassault Falcon 900EX EASy and Gulfstream G-IVSP for Business Jet Access, where he also is director of operations. He was instrumental in implementing the company's SMS and fatigue risk management program. The company is in the process of seeking FAA approval/acceptance of its SMS, aviation safety action program and FRMS.

Fatigue has been cited in numerous aviation accidents over the years as a factor or a cause.

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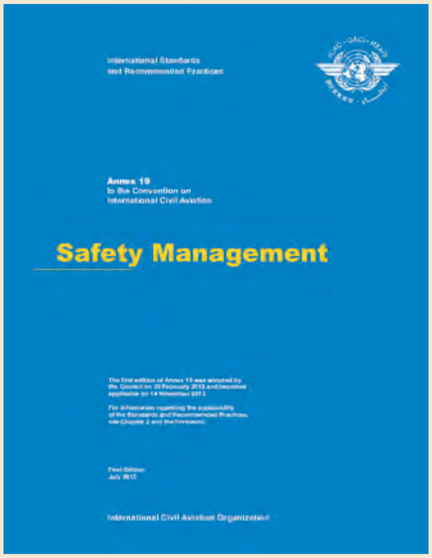
Safety Management at the State Level

BY HAZEL COURTENEY AND AMER M. YOUNOSSI

The regulation of aviation safety at the state level involves ensuring that each of the elements in the aviation system meets at least a minimum standard of safety. This system has been successful and has underpinned an impressively safe commercial air transport system. However, the aviation industry is growing, and public tolerance for risk is shrinking. Technology is changing, new entrants are joining the market, and new business models are being introduced. If we are to avoid an unacceptable number of accidents in the future, the pressure to improve our safety levels must be sustained.

The problem with ensuring that each element of the system meets at least a minimum standard is that in a highly complex and dynamic system, this does not necessarily guarantee a safe outcome. In 2010, the International Civil Aviation Organization (ICAO) Assembly determined that in addition to the standards and recommended practices for each sector of the aviation system, it was necessary to introduce Annex 19, *Safety Management*.



Annex 19 became applicable Nov. 14, 2013, and contains three basic premises: the management of safety at the state level through the development of a state safety program (SSP), a safety management system (SMS) for industry, and the protection of safety data and information. In July 2015, the state letter containing proposals for Amendment 1 to Annex 19 was circulated to states. The proposals for Amendment 1 include harmonization between the SSP and eight critical elements of safety oversight[1] (to avoid duplication and overlap), a stronger line on protection of safety data, and some additional elements, including safety management at the state level. This is a subject about which some states already have some experience, and this article is an attempt to share that experience, which may be of interest to other states that may not yet have embarked on this activity.

Case Study: U.K. CAA

The Civil Aviation Authority (CAA) in the United Kingdom has been receiving mandatory occurrence reports (MORs) of safety-related events in the U.K. aviation industry for over 35 years; these MORs are processed and, when possible, the cause of the safety issue is addressed. However, these actions are mainly at the level of individual reports and issues, although analysis is used to inform technical staff of general trends and performance levels. This sometimes results in regulatory actions, inspector attention or research projects.

Formal safety management at the state level started in around 2000 with formulations of the first internal safety plans. A safety risk panel (SRP) was formed comprising representatives from each technical area of the CAA, and these representatives monitored the safety performance of the industry and had oversight of the CAA safety plan production. The safety plan consisted of projects and actions put forward by technical staff from any area that was evaluated by the SRP, under three general headings: safety actions (in which safety trends or multiple similar events had been reported and needed to be addressed), emerging issues (in which something was new or changing and needed proactive preparation), and regulatory intervention (in which it was felt that regulatory material needed to be changed or updated). The actions included in the safety plan were those approved by the SRP, and were seen to have value, and a budget was assigned so that projects that required resources, such as external research, could be supported.

This system focused on active improvements in safety. However, a disadvantage was that these individual projects were often proposed and championed by enthusiastic individuals, and often, when such individuals leave their jobs, the active support may fade. Perhaps more important, with hindsight, the actions in the plan were a collection of worthy but apparently random items. There was no obvious systematic logic to show that the resources invested in particular actions were proportional to the relative size of the aviation safety risk to the travelling public, or to indicate why certain subjects had been put forward in preference over others.

At this point, the SRP took a fresh look at the question. How could they frame the safety landscape to create a systematic and proportional action plan? The initial reaction was to examine first principles, such as the question "How can an aircraft crash?" Starting from this most basic premise, it soon became apparent that there are a limited number of answers:

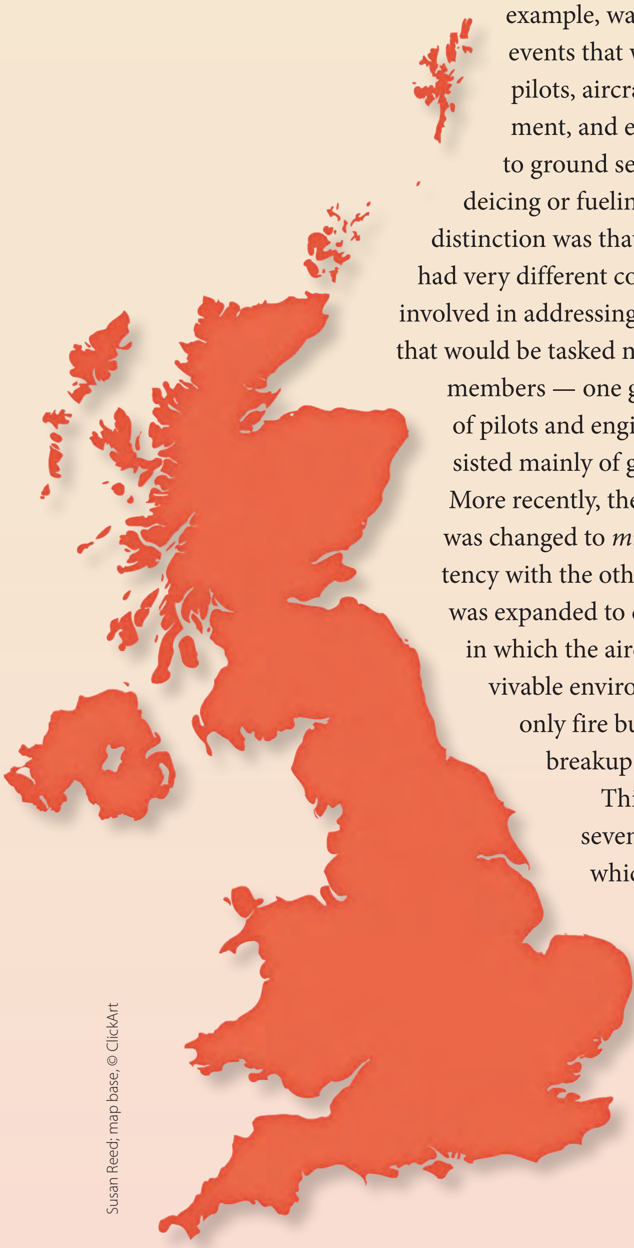
- Collide with the ground (controlled flight into terrain);
- Collide with another aircraft in the air (airborne conflict);
- Collide with another aircraft (or vehicle) on a runway (runway incursion);
- Collide with obstacles or water off the end or edge of a runway (runway excursion);
- Stall, spin or invert and fall to the ground (loss of control–in flight [LOC-I]); and,
- Catch on fire (fire).

The SRP reasoned that if the most common causes of the most common accident types could be addressed, that might be the most effective way to contribute to safety improvement.

In parallel with the safety planning work, the CAA had been conducting other types of data analysis using multidisciplinary teams of experts to study events and classify them, using causal and circumstantial factors. One of these was an accident analysis group (AAG) analysis of fatal accidents involving large public transport aircraft worldwide; reviewing the data showed clearly that the types of accident the SRP had identified were reflected in the "consequences" of real fatal accidents.

The other analysis was The High Risk Events Analysis Team (THREAT), which examined U.K. events that had been classified at higher severity levels. These analyses showed that the potential events that were at risk of happening reflected the same outcomes the SRP had identified. Over time, the list evolved and matured, and some changes have been made. LOC-I, for example, was split into two categories: events that were attributed to the pilots, aircraft or operating environment, and events that were attributed to ground services such as loading, deicing or fueling. The reason for this distinction was that the two types of events had very different communities of people involved in addressing them, and so the groups that would be tasked needed different types of members — one group consisted mainly of pilots and engineers, and the other consisted mainly of ground operations crew. More recently, the title *airborne conflict* was changed to *midair collision* for consistency with the other accident types, and *fire* was expanded to cover any circumstance in which the aircraft becomes an unsurvivable environment; this includes not only fire but also fumes or structural breakup in flight.

This resulted in a total of seven main accident types, which were promoted by the CAA as the *Significant Seven*. By using the data from the AAG analysis, it was possible to show which accident types happened most frequently, what the most common scenarios were that created the accident situation and which causal and circumstantial factors were typically involved. Additionally, by using the THREAT data, the general set of potential accident types was validated, and it was also possible to tailor this to the U.K. in particular.



Susan Reed; map base, © ClickArt

For example, although midair collisions are rare worldwide (accounting for fewer than 2 percent of fatal accidents), they are a far more important threat in the U.K., where airspace is more complex and more crowded than the worldwide average. For each of the *Significant Seven* accident types, multidisciplinary task force teams including industry members were established with systematic analysis methods to find the most effective interventions to prevent these accident types.

The rationale was that if the CAA could put the most resources into the most common causes of the most common accident types, then it would have a more comprehensive logic to determine why CAA activities gave the best safety improvement for the resources spent, and why the agency had chosen these actions in preference over others. For example, it is now well known that LOC-I is the most common accident type for large public transport aircraft. The most common scenarios that lead to this outcome are low airspeed undetected, engine failure in twins not successfully handled by crew, or (much less commonly) icing not mitigated.

The actions taken included placing free pilot training material about monitoring (especially airspeed) on the CAA website, developing a training DVD for pilots on handling engine failure, and distributing industry information on deicing best practices. The thinking was that CAA activity that addressed these most common causal factors would create the best safety advantage for the resources available. The main scenarios for each of the *Significant Seven* accident types have been subjected to a bowtie analysis to identify the relevant safety barriers, and these are also available on the CAA website. This construction has been widely used in U.K. industry, including the taxonomy for data collection.

After these specific causal factors were addressed, the safety program expanded to address the more fundamental "upstream" risks at a more general level: For example, the program provided better guidance on crew resource management, reviewing the fitness of pilot training and implementing a crew supply chain project to ensure that training adequately prepares the crew for flying in today's airlines.

SSP Development

When it first became an ICAO standard for states to have an SSP, the U.K. initially fulfilled this requirement by producing a document that describes how aviation safety is addressed in the U.K., for example, with legislation, the CAA, and the independent Air Accidents Investigation Branch. However, as the SSP became increasingly important, there was further discussion of what an SSP should achieve. It was decided that it should be expanded to address not only the issues that fall strictly within the U.K. responsibility but also to consider any flight safety risks to the U.K. public. An assessment of where such risks originate led to the conclusion that more than half of the risk to the public comes from sources that the CAA does not oversee: ground services, foreign airlines, overseas destinations, military aircraft and others.

Of course, like all states, the U.K. entrusts the level of safety in other states to ICAO and other national aviation authorities and, in general, this works well. However, the realization of the "citizen risk" gave rise to a government-funded program that enabled the CAA to work with other states to tackle risk hotspots through safety partnerships or individual local safety initiatives. These have succeeded in reducing event rates and have been as illuminating to the U.K. as to its safety partners. Some issues have been shown to be simple misunderstandings that can be resolved by getting pilots and air traffic controllers to meet together. In addition, a tool is being developed to enable the CAA to see where U.K. citizens travel and to identify the most popular destinations. This will help the authority to be proportionate in its efforts.

A Regulatory SMS

The CAA SSP has now implemented a full internal SMS. It has the same general features as an industry SMS, with an accountable manager (the CEO) who chairs a safety review board, a safety action group and contributions from local SRPs in each discipline area. There are some differences from an industry SMS, however. For example, the fact that the safety issues discussed are occurring outside of the organization creates a different kind of action plan. The CAA SMS was launched in September 2015 as part of the ICAO performance-based oversight initiative and will evolve for years to come.

Case Study: U.S.

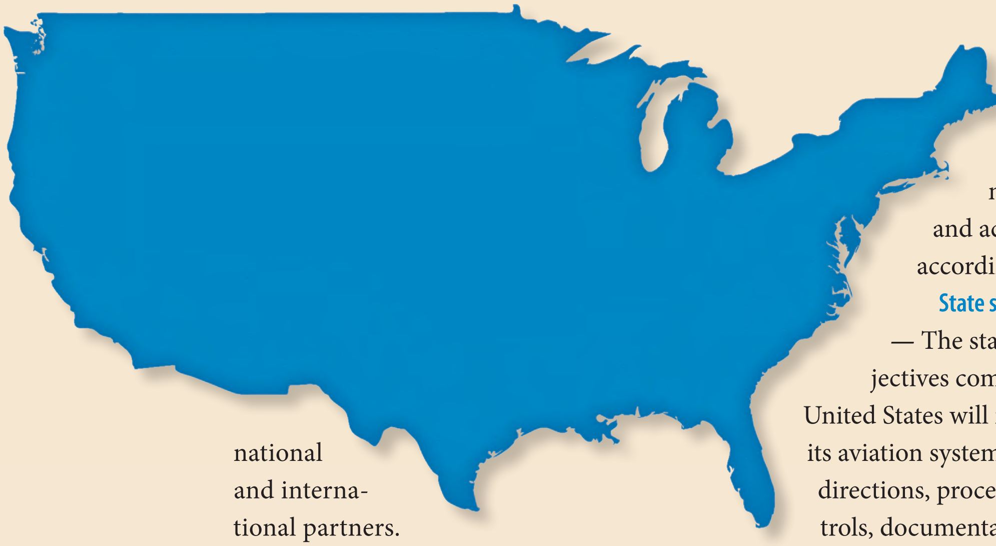
Aviation safety in the United States has improved significantly over the past several decades. The United States has a mature regulatory framework, well-defined roles and responsibilities, advanced accident and incident investigation capabilities, effective certification, surveillance and enforcement processes, exceptional capacity for data collection and analysis to focus on areas of greatest safety risk, and established means to communicate with aviation service providers, government representatives and stakeholders. By working through the government-industry Commercial Aviation Safety Team (CAST), the risk of fatalities in U.S. commercial aviation was reduced by 83 percent over a 10-year period. Accidents are now rare, however, as the industry continues to grow and technology evolves, and the United States must be proactive and push for the highest level of safety.

While many U.S. government agencies contribute to aviation safety, two organizations perform most safety management–related functions. They are the Federal Aviation Administration (FAA) and the National Transportation Safety Board (NTSB), an independent federal agency charged by Congress to investigate accidents. To support its mission to provide the safest, most efficient aerospace system in the world, the FAA is implementing an SMS to systematically integrate the management of safety risk into business planning, operations and decision making. The FAA SMS goes beyond ICAO SSP requirements because it includes identification of hazards and mitigation of the risks associated with them.

Strategic Initiatives

The FAA is laying the foundation for the aerospace system of the future through the administrator's strategic initiatives. The FAA has an opportunity to make a difference for aviation stakeholders while addressing the challenges presented by this complex industry. The success of voluntary reporting programs has yielded more aviation safety data than ever. Safety data help the FAA and industry be proactive and use safety management principles to make smarter, risk-based decisions.

The United States continues to improve aviation safety through CAST and to share information with the international aviation community. The future of U.S. aviation safety depends on successful collaboration with



Susan Reed; map base, © ClickArt

national and international partners.

The implementation of the FAA SMS, the administrator's strategic initiatives and collaboration with these partners represent a continued evolution in safety and will move the United States toward cohesive management of safety. The first 50 years of aviation safety in the United States was based on individual risk assessment. The second 50 years was dominated by safety compliance. Today, safety management leverages the first two and uses information-age processes and management techniques to better inform decision makers and empower them to manage risk.

Safety data help the FAA and industry be proactive and use safety management principles to make smarter, risk-based decisions.

For U.S. aviation service providers and regulatory bodies alike, safety management accomplishes several things: It provides for more informed decision making, improves safety by reducing the risk of accidents, provides for better resource allocation, increases efficiencies and reduces costs, and strengthens organizational culture. Application of safety management principles also provides a clear and documented approach to achieving safe operations that can be explained to others, active involvement of staff in safety, demonstrable assurance that safety risks are under control, and a common language to establish safety objectives and targets, and to implement and monitor safety risk controls.

ICAO SSP Framework

The ICAO SSP framework combines the components of both the prescriptive and performance-based approaches to the management of aviation safety. U.S. safety management responsibilities and activities can be categorized according to four SSP components:

State safety policy and objectives — The state safety policy and objectives component defines how the United States will manage safety throughout its aviation system, through explicit policies, directions, procedures, management controls, documentation and corrective action processes that guide safety management efforts of the FAA and other U.S. organizations. The U.S. national safety legislative framework and specific regulations define how the United States conducts aviation safety management. The U.S. civil aviation safety system encompasses a number of government agencies with specific functions and responsibilities; most functions are fulfilled by the FAA and NTSB. The FAA establishes regulatory standards and requirements. The FAA administrator has broad authority to take action he or she considers necessary to carry out statutory responsibilities and powers relating to safety in air commerce, including conducting investigations; prescribing regulations, standards and procedures; and issuing orders. Aviation product and service providers have the legal and functional primary responsibility for the safety of their products and services; they must be in compliance with safety regulations and standards established by the FAA.

State safety risk management —To achieve the next level of safety, the United States must augment its traditional methods of analyzing the causes of an accident or incident after the fact by adopting tools and metrics to further anticipate potential sources of risk, identify and address accident precursors and contributors, and strategically manage safety resources for maximum safety improvement in a cost-effective manner. The FAA SMS helps manage safety risk in the aviation system. The FAA is developing processes to identify hazards, assess associated risks and mitigate the risks that are at an unacceptable level. Also, in accordance with ICAO Annex 19 standards, the United States has in place SMS requirements for the air navigation service provider, the FAA Air Traffic Organization. Additionally, on Jan. 8, 2015, FAA issued a final rule requiring each Federal Aviation Regulations Part 121 air carrier to develop and implement an SMS to improve the safety of its aviation-related activities. Currently, there are no regulations in place requiring the implementation of SMS by other U.S. aviation service providers. However, the FAA does have other rulemaking activities under way and has had an active voluntary SMS implementation program for many years.

State safety assurance — Safety oversight based on SMS principles reinforces the responsibility of aviation service providers to focus on safety throughout their organizations and operating environments. However, the U.S. government and its aviation agencies retain a critical role in maintaining safety assurance of the broader safety system. This includes safety oversight and data collection, analysis and exchange. The United States currently collects aviation safety data from numerous sources, including through oversight processes and voluntary reporting programs. These data are analyzed at various levels, including at the national level, and are used to inform decisions regarding oversight activities and safety in the aerospace system. The FAA is enhancing its processes to allow for further exchange and analysis of aviation safety data. The United States developed risk-based oversight systems for various sectors of the industry to prioritize inspections, audits and surveys in areas of greater safety concern or need, as identified by the analysis of data on hazards, their consequences in operations and the assessed safety risk.

State safety promotion — An effective safety promotion program is essential to support the core operational objectives of the United States, and, as part of their missions and responsibilities, both the FAA and the NTSB provide safety-related training and communicate safety information to their employees to support the development of a culture that fosters an effective and efficient SSP. The agencies also provide education and relevant safety information to support a positive safety culture among aviation service providers.

Conclusions

The U.K. and U.S. case studies have involved considerable resources and commitment. However, this scale of involvement is not always necessary to start a program of safety management at the state level. For example, smaller states or those just starting on this journey, might consider the following:

- If a state has no safety data available, authorities may wish to use the published data on worldwide accidents and causal factors, as those are likely to be similar, and to consider how their state may differ (e.g., it may be more mountainous or have severe weather seasons, or most aviation operations may involve smaller aircraft types).
- While a formal SMS is useful, a small multidisciplinary group can hold workshop-type meetings to identify the important hazards or risks in their particular environment, based on the published data and their own professional experiences locally.
- Many free safety information sources and aids are available and could be selected and implemented with little cost to the regulator. For example, training material, tools and best practice documents are available on websites of Flight Safety Foundation, CAST, ICAO, the European Aviation Safety Agency, FAA, and CAA and Safety Management International Collaboration Group.

While some states with a large established aviation industry may invest significant resources and manpower in safety management at the state level, this activity is very scalable to smaller states or to states that are now beginning to establish safety management at the national level. This should not be a task that can only be undertaken on a grand scale, and almost any state could undertake a suitable activity without a major disruption to its normal work.

Dr. Hazel Courteney recently stepped down as chairman of the ICAO Safety Management Panel and as head of strategy and safety assurance at U.K. CAA.

Amer Younossi is deputy division manager for Safety Management and Research Planning for the U.S. FAA Aviation Safety Organization, which is responsible for managing the transformation of FAA to a safety management construct and for considering SMS requirements for the U.S. aviation industry. He is also the U.S. representative to ICAO's Safety Management Panel.

Note

1. The current ICAO Universal Safety Oversight Audit Programme, Continuous Monitoring Approach, for states focuses on the following eight auditing areas: primary aviation legislation and civil aviation regulations, civil aviation organization, personnel licensing and training, aircraft operations, airworthiness of aircraft, aircraft accident and incident investigation, air navigation services, and aerodromes and ground aids.

Favorable Comparisons

BY LINDA WERFELMAN

One commercial air transport airplane from a European Aviation Safety Agency (EASA) member state was involved in a fatal accident in 2014 — a Swiftair-operated Air Algerie McDonnell Douglas MD-83 that crashed in Mali on July 24, killing all 116 passengers and crew, according to EASA's *Annual Safety Review, 2014* (Figure 1).[1]

Twenty-six commercial transport airplanes from EASA member states were involved in nonfatal accidents in 2014, said the report, released in October 2015. In addition, 66 EASA commercial transport airplanes were involved in serious incidents.

No more than one fatal accident has occurred involving EASA commercial transport airplanes in any year since 2005, the report said, noting that there were no fatal accidents in 2010 and 2013.

The 116 fatalities in 2014 were considerably more than the 2004–2013 annual average of 52.4, the report said (Figure 2).

Nevertheless, the report added, "the increase does not signify a deterioration in the level of safety but demonstrates the variability in terms of fatalities between individual accidents."

The most critical risk area for fatal accidents, in Europe as well as worldwide, was loss of control–in flight, the report said.

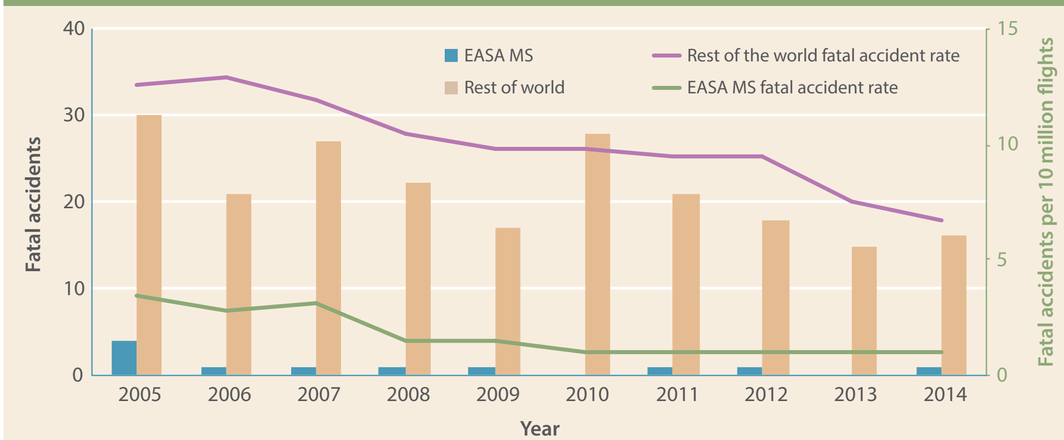
"From the analysis performed by the agency, the top contributing safety issues for loss of control are the implementation of management systems and oversight, communication and decision making, knowledge of aircraft systems and associated procedures, crew awareness, and the management of adverse weather conditions," the report said.

The report identified technical failure as the most frequent cause of accidents and serious incidents, adding that technical failure is also the second-highest cause of fatal accidents.

The report also said that, although no midair collisions have occurred in recent years in Europe, AIRPROX-related occurrences — events in which an aircraft is reported in dangerously close proximity to another aircraft — are considered the second-most critical risk area for nonfatal accidents and serious incidents.

Data show that of the 32 EASA member states, eight had air operator certificate (AOC) holders that were involved in no accidents from 2011 through 2014 (Table 1). Twenty-four had

EASA MS Fatal Accidents, 2005–2014*



EASA MS = European Aviation Safety Agency member state

*In commercial passenger and cargo operations in aircraft with a maximum takeoff mass of more than 5,700 kg (12,566 lb)

Source: European Aviation Safety Agency

Figure 1

AOC holders that were involved in at least one accident in that time period. In six states, AOC holders were collectively involved in more than five accidents, including one state with AOC holders that were involved in 21 accidents. The states were not named in the report.

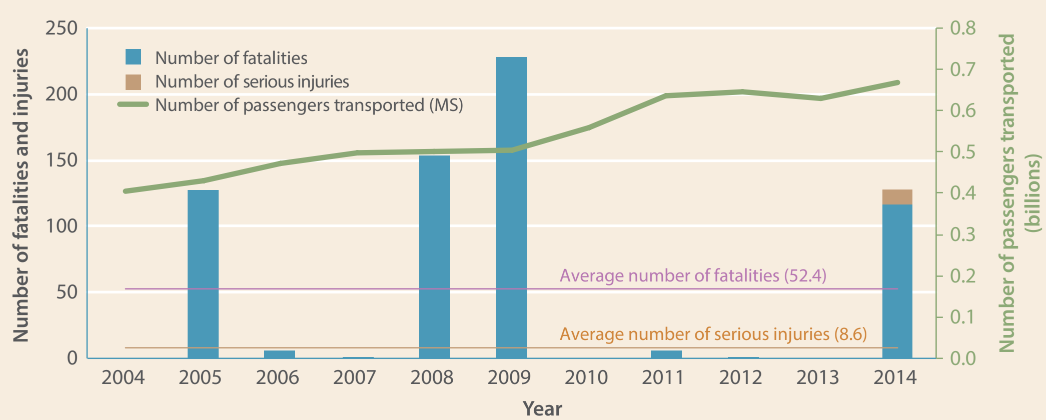
In business aviation, one airplane from an EASA member state was involved in a fatal accident in 2014 — one of only three fatal accidents during the 10-year period that ended in 2014 (Table 2).

Commercial air transport helicopters from EASA member states were involved in one fatal accident — with two fatalities — in 2014, down from three fatal accidents and 11 fatalities in 2013, the report said (Table 3).

Note

1. EASA. *Annual Safety Review, 2014*. October 2015. Available at <www.easa.eu>.

EASA MS Fatalities and Injuries, 2004–2014*



EASA MS = European Aviation Safety Agency member state

*In commercial passenger and cargo operations in aircraft with a maximum takeoff mass of more than 5,700 kg (12,566 lb)

Source: European Aviation Safety Agency

Figure 2

Accidents by EASA MS, 2011–2014

Number of States	Number of Accidents Involving AOC Holders in Each EASA MS
8 states	AOC holders that were not involved in any accidents
9 states	AOC holders that were collectively involved in 1 accident
6 states	AOC holders that were collectively involved in 2 accidents
3 states	AOC holders that were collectively involved in 3, 4 or 5 accidents
6 states	AOC holders that were collectively involved in more than 5 accidents

AOC = air operator certificate; EASA MS = European Aviation Safety Agency member state

Source: European Aviation Safety Agency

Table 1

EASA MS Business Aviation Accidents, Incidents and Fatalities*

	Fatal Accidents	Nonfatal Accidents	Serious Incidents
2014	1	2	3
2004–2013 average	0.3	1.2	3.3
	Fatalities	**Serious Injuries**	**Minor Injuries**
2014	4	0	2
2004–2013 average	0.4	0.4	0.5

EASA MS = European Aviation Safety Agency member state

*Air taxi, corporate and owner-operated business operations

Source: European Aviation Safety Agency

Table 2

EASA MS Helicopter Accidents, Incidents and Fatalities*

	Fatal Accidents	Nonfatal Accidents	Serious Incidents
2014	1	5	1
2004–2013 average	2.6	7.6	3.4
	Fatalities	**Serious Injuries**	**Minor Injuries**
2014	2	3	3
2004–2013 average	11.6	5.4	8.2

EASA MS = European Aviation Safety Agency member state

*Commercial air transport helicopters

Source: European Aviation Safety Agency

Table 3

GSIP

GLOBAL SAFETY INFORMATION PROJECT

IMPROVING SAFETY ON BEHALF OF THE WORLDWIDE AVIATION COMMUNITY

"It is increasingly clear that the collection, analysis and sharing of safety data and information represents the greatest potential for continued, long-term improvement of the aviation industry's already stellar safety performance. It is also clear that realizing that potential on a global scale requires a coordinated, international effort among industry and government stakeholders."

— Jon Beatty, President and CEO, Flight Safety Foundation

A FIRST-OF-ITS-KIND EFFORT

The Global Safety Information Project seeks knowledge related to safety data collection and processing from aviation industry stakeholders in two key regions: Asia-Pacific and Pan America.

The key outcomes expected from the study include:

- Identifying how many entities collect safety data
- Learning how the data is processed
- Learning how the results of data collection and processing are applied to promote aviation safety

Join a Global Safety Information Project focus group

Help determine the strengths and current capabilities of each region. Visit **fsfgsip.org,** email **GSIP@flightsafety.org** or call **703-739-6700** to learn how you can participate.

Focus group locations and dates

Pan America

Mexico City, Mexico: July 20–21
Panama City, Panama: July 23–24
Brasilia, Brazil: August 18
Lima, Peru: August 20
Caribbean, location TBD

Asia-Pacific

Wellington, New Zealand: July 2
Sydney, Australia: July 6
Singapore: July 8
Tokyo, Japan: August 5
Hong Kong: August 7
Delhi, India: August 10
Jakarta, Indonesia: August 12
Manila, Philippines: August 14
Taipei, Taiwan: September 9
Kuala Lumpur, Malaysia: September 11

Information sessions

Medellín, Colombia: June 22–25
Lima, Peru: July 9–10

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Cabin Crew Fights Fire

A short circuit resulted from insulation that rubbed off improperly installed galley wiring.

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

Foot-Long Electrical Arc

Boeing 737-800. Minor damage. No injuries.

The 737 was cruising at 36,000 ft, en route from Yangon, Myanmar, to Taipei, Taiwan, the afternoon of April 11, 2014, when a flight attendant in the forward cabin heard a "bang" and smelled something burning. A passenger near the left front cabin door reported smoke emerging from the ceiling.

The flight attendant saw something dripping from a dark spot on a ceiling panel and felt an electrical shock when she touched the panel, said the report by the Aviation Safety Council of Taiwan (ASC).

She reported the situation to the cabin manager and retrieved a hand-held fire extinguisher. Suspecting a hidden fire behind the panel, the cabin manager switched off electrical power to the equipment in the forward galley.

The report said that there was an "aperture" in the ceiling panel, but it was too small to allow identification of the source of the fire. The cabin manager informed the flight crew of the situation and received permission from the captain to use the axe stored in the cockpit.

The flight attendant retrieved the axe from the cockpit and began to chop a hole in the ceiling panel. The captain was watching when an electrical arc 30 cm (12 in) long emerged from the hole. The arcing ceased when the flight attendant sprayed fire retardant into the hole.

Although the fire appeared to have been extinguished, the captain decided to divert the flight to Bangkok. The precautionary landing in Bangkok was completed without further incident, and none of the 155 passengers and eight crewmembers was hurt.

Investigators found that vibration had caused the galley wiring routed above the panel to chafe against the panel. Ultimately, insulation on the wiring rubbed off, exposing the conductors, which came into contact with graphite fibers chafed free of the panel.

"The short circuit happened between the left hand side of the panel and a metal beam" in the ceiling, the report said. "The metal beam was melted and discolored."

The ASC concluded that the probable cause of the incident was improper reinstallation of the galley wiring and a clamp during maintenance eight years earlier. A maintenance technician had not been taught to mark the positions of various components before their removal. During the subsequent reinstallation of the components, the technician had placed a wiring clamp in the wrong place, causing the wires to be "compressed" against the ceiling panel, the report said.

Near Collision Over Runway

Boeing 737, Embraer 145. No damage. No injuries.

Visual meteorological conditions prevailed at Newark (New Jersey, U.S.) Liberty International Airport the afternoon of April 24, 2014. Traffic was departing on Runway 04R and arriving on Runway 29. The runways intersect at the northeast side of the airport, near the departure threshold of 04R and the approach threshold of 29.

The flight crew of the 737-800 was following a 717 on a visual approach to Runway 29. Shortly after clearing the 737 to land, the airport traffic controller advised the crew that they were "starting to bunch up with the 717" and told them to conduct a "slightly wider" right turn from base to final approach, said the report by the U.S. National Transportation Safety Board (NTSB).

The 717 was on short final when the controller cleared the crew of the ERJ145 to line up and wait on Runway 04R, and told the 737 crew, who had purposely overshot the extended runway centerline to widen their turn, that they could turn back toward the final approach course.

The controller then told the ERJ crew to "be ready in about 20 seconds, up on the power." The crew acknowledged the instruction. The 717 crossed the runway intersection about 24 seconds later, and the controller cleared the ERJ crew for an immediate takeoff.

"At that time, the Boeing 737 was about 3 miles [5 km] from the Runway 29 threshold," the report said. "However, the Embraer did not actually begin its takeoff roll until the Boeing 737 was about 1 mile [2 km] from the Runway 29 threshold at 200 ft."

Recognizing the conflict, the controller told the 737 crew to go around and advised that there was departing traffic to their left. The crew acknowledged the instruction and initiated a go-around.

The controller then told the ERJ crew, "Traffic on your right. Do you have him in sight? Maintain visual." The crew replied, "Yeah, we put the nose down. … He was real close."

Recorded radar data showed that the 737 had passed 400 ft above the ERJ when both airplanes were over the runway intersection.

The NTSB concluded that the probable cause of the near-midair collision was "the local controller's failure to comply with Federal Aviation Administration separation requirements for aircraft operating on intersecting runways."

Rapid Depressurization

Boeing 737-800. No damage. Thirteen minor injuries.

En route from Bergamo, Italy, to East Midlands, England, the 737 was climbing through 30,800 ft over the Alps near Lugano, Switzerland, the morning of April 4, 2012, when the flight crew noticed a sudden change in cabin pressure.

"They reported it had manifested through a draft, a decrease in temperature and pressure in the ears," said the report by the German Federal Bureau of Aircraft Accident Investigation (BFU).

The master caution and cabin altitude warnings activated as the cabin rate of climb reached the maximum indication of 4,000 fpm and indicated cabin altitude exceeded 10,000 ft.

The crew donned their oxygen masks and completed the "Cabin Altitude Warning/Rapid Depressurization" checklist. However, they found the manual pressurization control system ineffective and decided to conduct an emergency descent.

The crew declared an emergency and told air traffic control that they were descending to 10,000 ft and diverting the flight to Frankfurt, Germany. The descent rate initially was more than 6,000 fpm and then decreased to 4,000 fpm. The 737 was landed at Frankfurt without further problems.

"The purser stated she [also] had noticed a sudden change in pressure and reduction of temperature in the cabin," the report said. "Ten to 20 seconds later, the oxygen masks in the cabin had deployed. A few passengers had had brief problems putting their masks on."

One passenger suffered a ruptured eardrum during the incident, and 12 others were treated for earaches after landing. The other 121 passengers and six crewmembers were not hurt.

Investigators found that the cabin pressure controller had been replaced the night before the scheduled flight. The maintenance technician had performed some of the work from memory, rather than referring to the written procedure, and had forgotten to remove a shipping cap covering the static port on the controller.

The report noted that a yellow tag, which warned that the cap must be removed after installation of the controller, had detached from the cap and that the cap, itself, was the same color as the controller (black) and "not easily recognisable."

The BFU also found that ground tests of the pressurization system after replacement of the controller were not sufficient to detect the plugged static port.

'A Little Long'

Cessna Citation CJ-3. Minor damage. No injuries.

The pilot told investigators that he touched down "a little long" on the 4,000-ft (1,219-m) runway at Port Orange, Florida, U.S., the morning of

April 26, 2014. "He then realized that he was not going to be able to stop the airplane on the remaining runway," the NTSB report said.

"The pilot considered performing a go-around; however, he believed that a go-around would have posed a greater hazard at that point in the landing."

The CJ overran the runway, traveled across a grassy area and came to a stop in a freshwater pond about 600 ft (183 m) from the threshold. There was minor damage to the airplane's landing gear, wings and flaps, and none of the three occupants was hurt.

"The pilot reported that there were no mechanical malfunctions with the airplane," the report said. "He further reported that the incident could have been prevented if he had made a longer final approach, was more familiar with the airport and had rejected the landing attempt at a safe stage of the approach."

TURBOPROPS

Misconfigured for Takeoff

Kodiak 100. Destroyed. Two fatalities, five serious injuries.

The pilot was making his fourth flight of the day — a one-hour air taxi flight with six passengers from Doyo Baru to Ninia in Papua, Indonesia, on April 9, 2014. The pilot resided near Doyo Baru and had substantial experience in operating the single turboprop at the airstrip.

Although the pilot typically extended the flaps 20 degrees for takeoff, as recommended by the aircraft flight manual, he inadvertently began the takeoff with the flaps retracted, according to the report by the Indonesian National Transportation Safety Committee.

The report said that the pilot likely realized the mistake when the aircraft did not lift off at the usual rotation speed. According to performance calculations, the Kodiak could have been stopped on the runway if the pilot had immediately rejected the takeoff. However, he decided to continue, applying emergency power and moving the flap selector to the full-down position (35 degrees).

The Kodiak did not lift off, and it struck several objects before coming to a stop 30 m (98 ft) from the end of the airstrip. One passenger and the pilot were killed on impact; the other five passengers sustained serious injuries and were pulled from the wreckage by company staff and local residents before the forward section of the aircraft was consumed by fire.

Investigators determined that the pilot had selected flaps down when the aircraft was about 125 m (410 ft) from the departure end of the 520-m (1,706-ft) runway. The flaps had extended only 6 degrees before the impact occurred.

The report said that under the existing conditions — which included an ambient temperature of 28 degrees C (83 degrees F) and the aircraft near gross takeoff weight — the required takeoff distances were 336 m (1,102 ft) with the flaps extended 20 degrees and 559 m (1,834 ft) with the flaps retracted.

Not Like the Sim

Bombardier Q400. Substantial damage. No injuries.

Shortly after departing with 31 passengers and two flight attendants from Little Rock, Arkansas, U.S., the morning of April 7, 2012, the pilots saw indications that the nose landing gear had not retracted and heard unusual slipstream noises.

After performing the appropriate checklist actions, the pilots heard a "thump" and the abnormal indications ceased. They continued the flight to Houston, Texas, and used the "Alternate Landing Gear Extension" checklist on approach.

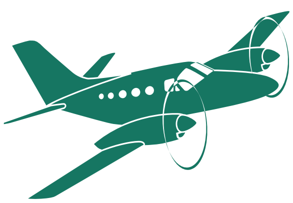
The first officer pulled the release handles for the main and nose landing gear. The main landing gear extended, but the nose gear did not. "The flight crew conducted a low approach, and air traffic control tower personnel advised them that the nose gear doors appeared to be open but the nose gear did not appear to be down," the NTSB report said.

The flight crew then landed the airplane. After touching down on the main gear, the captain held the nose off the runway until the Q400 slowed to about 80 kt. "Once the nose touched down, there were sparks and smoke resulting from the fuselage scraping the runway [until] the airplane came to a stop," the report said. "The passengers and crew evacuated through the forward cabin door."

Subsequent examination of the landing gear system revealed minor anomalies in the nose gear door actuator and several sensors, but the report did not specifically state what caused the nose gear problems when the crew used the normal retraction and extension procedures.

However, investigators determined that the first officer did not pull the nose landing gear handle with sufficient force or to a sufficient distance to release the uplocks. "According to the manufacturer's design requirements, the pull length on the alternate release handle should be approximately 11 inches [28 cm] with a force of 90 pounds [41 kg]," the report said.

The pull force required in the flight simulator in which the crew trained was found to be significantly lower, and this was cited as a factor that contributed to the accident. "Subsequent to the accident, the manufacturer added details to the alternate landing gear extension procedure in the airplane flight manual regarding the maximum pull forces that a pilot may experience when the alternate extension handle is pulled," the report said.



PISTON AIRPLANES

Excessive Evasion

Beech B55 Baron. Destroyed. Three fatalities.

A flight instructor was administering instrument proficiency checks of two pilots the afternoon of Feb. 22, 2014. After refueling at LaGrange, Georgia, U.S., the pilots switched seats and departed from the 5,599-ft (1,707-m) Runway 31 to conduct a practice instrument approach to the same runway.

At the time, glider-tow operations were being conducted on intersecting Runway 03 at the uncontrolled airport. Witnesses said that the tow pilots were making "constant" reports on the airport's common traffic advisory frequency (CTAF), the NTSB report said.

However, although the witnesses heard one of the Baron pilots report on CTAF that the airplane was inbound on the instrument landing system (ILS) approach to Runway 31, they did not hear the tow pilot report that he was taking off on Runway 03.

"One witness … stated that the airplane was 'sort of hot and landing long,'" the report said. "About 2,000 feet [610 m] past the runway threshold, the airplane was still airborne, 'bobbing' and 'searching for the ground,'" the report said.

The engines then rapidly accelerated as the airplane pitched up about 60 degrees and banked steeply to the left. The Baron apparently stalled, rolled inverted and descended to the ground in a steep nose-down attitude. All three pilots were killed.

The NTSB concluded that the pilot likely lost control of the Baron while "overreacting" to a perceived conflict with the tow plane.

"The accident pilot's observed reaction, as evidenced by the sudden application of full engine power followed by the airplane's abrupt increase in both pitch and bank angle, suggest that he may have been surprised by the appearance of the glider and tow plane in his field of vision and perceived an imminent collision," the report said.

The NTSB said that the failure of the glider-tow operator to comply with airport regulations was a factor in the accident. The glider operations were being conducted without a spotter, who is required to be in position where he or she can view the runways and ensure that there is no conflict with other aircraft. The regulations require tow pilots to receive approval from the spotter before takeoff.

Control Confusion

Piper Twin Comanche. Substantial damage. One minor injury.

The pilot said that the airplane encountered severe turbulence while landing at Bullhead City, Arizona, U.S., the afternoon of April

21, 2014, and that he initiated a go-around shortly after touching down on the 3,700-ft (1,128-m) runway.

"However, he noted that 'it seemed like the airplane would not fly' and that it was 'like it was being pushed down,'" the NTSB report said. "He added that he was not sure if the engines completely failed or not but that 'I just know I didn't have any power.'"

The wings and empennage were substantially damaged when the airplane struck terrain about 1/4 mi (1/2 km) from the end of the runway. The pilot sustained minor injuries.

The pilot, who had 9,000 flight hours, later told investigators that he had extensive experience in a Beech Baron, in which the throttles and propeller levers are located in positions opposite to those in the Twin Comanche. He said that he inadvertently had pulled the prop levers to the feather position, rather than retarding the throttles, upon touchdown at Bullhead City and that he had advanced the prop levers, rather than the throttles, during the attempted go-around.

HELICOPTERS

Confusing Cautions

Sikorsky S-92. No damage. No injuries.

Due to forecasts of marginal visibility, the S-92 was carrying extra fuel for a scheduled instrument flight rules flight to transport 12 passengers from Sola, Norway, to a North Sea oil rig the afternoon of Oct. 4, 2013.

Arriving at the destination, the flight crew rejected the approach when they were unable to establish visual contact with the rig at the published approach minimums.

The crew decided to return to Sola. En route at 3,000 ft, they received cautionary messages that both main gearbox oil pumps had failed. However, the indications "did not make sense [because] a failure in both oil pumps … would indicate a total loss of oil pressure, which was not the case," said the report by the Accident Investigation Board of Norway (AIBN).

The commander transferred control to the first officer and consulted the checklists. He noticed that oil pressure had decreased from the normal 58 psi to 49 psi and that oil temperature was increasing.

"This was considered a confirmation that something had happened to the main gearbox," the report said. "However, the emergency checklists did not provide an answer to what had happened or what action to take."

Uncertain of the situation but considering the possibility of a serious gearbox malfunction, the crew decided to try landing at the closest site, a decommissioned and unmanned oil rig about 40 nm (74 km) away. The sea was too rough to consider ditching.

The crew decreased airspeed to reduce the load on the gearbox and eventually descended to 100 ft to maintain visual contact with the sea. Although they received additional cautionary messages about gearbox oil temperature and pressure, "these cautions did not provide any further information to understand the situation," the report said. The oil temperature and pressure indications remained within limits, and there were no warning messages.

Visibility was about 2 mi (3,200 m), the cloud bases were between 100 and 200 ft, and wind velocity was 35 kt when the crew landed the S-92 without incident on the decommissioned oil rig. The pilots and their passengers later were hoisted aboard a rescue helicopter.

Examination of the helicopter revealed that the cautionary messages the crew had received were false and had been triggered by a faulty high-temperature switch. After the switch was replaced, the S-92 was flown back to Sola without incident.

The report noted that, following the incident, Sikorsky "initiated a process to improve the warning/caution system on the helicopter." The AIBN also recommended that the company revise the emergency checklist to increase its user-friendliness.

Preliminary Reports, January 2016

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Jan. 2	Anaktuvuk Pass, Alaska, U.S.	Cessna 208B	substantial	5 serious, 3 minor
The pilot and four passengers were seriously injured when the Caravan struck terrain 500 ft below a 2,500-ft ridge during a scheduled commuter flight under visual flight rules. The pilot said that the airplane encountered icing and flat-light conditions.				
Jan. 3	Rio de Janeiro, Brazil	Beech King Air C90	destroyed	4 fatal
The King Air struck trees and crashed in hilly terrain on approach to Paraty Airfield.				
Jan. 3	Chicago, Illinois, U.S.	Bombardier CRJ700	substantial	2 minor
A flight attendant and an airport vehicle operator sustained minor injuries when the vehicle struck the CRJ's right wing tip.				
Jan. 5	Tres Esquinas, Brazil	Basler Turbo 67	substantial	2 NA
The turboprop-converted Douglas DC-3 veered off the runway on landing and struck a ditch.				
Jan. 6	Savannah, Georgia, U.S.	Pilatus PC-12	substantial	2 minor
The PC-12 lost power while departing on a positioning flight and struck a ditch during a forced landing in an open field.				
Jan. 8	Akkajaure Lake, Sweden	Bombardier CRJ200	destroyed	2 fatal
The CRJ200 was on a night cargo flight from Oslo to Tromsø, Norway, when the flight crew declared an emergency. The aircraft then entered a rapid descent and struck mountainous terrain in a near-vertical attitude.				
Jan. 9	Rondonópolis, Brazil	ATR 72-500	substantial	NA
No injuries were reported when the ATR touched down 300 m (984 ft) short of the runway, traveled 30 m (98 ft) through crops and struck a barbed-wire fence before the flight crew conducted a go-around and subsequently landed without further incident.				
Jan. 13	Ritter Butte, Oregon, U.S.	Enstrom F-28F	substantial	1 serious, 1 none
The pilot was seriously injured when the helicopter lost power and struck terrain while returning to refuel during a predator-control flight.				
Jan. 14	Windhoek, Namibia	Airbus A319	substantial	110 none
The A319 struck a bird on approach, incurring a large hole in the fuselage just forward of the right wing root.				
Jan. 17	Hanalei, Hawaii, U.S.	Airbus EC-130	substantial	4 serious, 3 minor
Four passengers were seriously injured when the air-tour helicopter touched down hard during an autorotative landing on a beach after losing power.				
Jan. 18	Scottsdale, Arizona, U.S.	Dassault Falcon 20F	substantial	4 none
The Falcon was substantially damaged after veering off the runway while landing.				
Jan. 18	Cedar Fort, Utah, U.S.	Cessna CitationJet	destroyed	2 fatal
The CitationJet was cruising at 31,000 ft during a private flight from Salt Lake City, Utah, to Tucson, Arizona, when the pilot reported that the flight management system (FMS) had failed. He then declared an emergency, advising that he was having difficulty with the backup FMS and was hand flying the airplane. Significant airspeed fluctuations were recorded before radar contact was lost. The airplane apparently broke up while descending and crashed in open terrain.				
Jan. 19	Wichita, Kansas, U.S.	Socata TBM-700	substantial	2 none
The pilot said that shortly after breaking out of the clouds on approach, the airplane shuddered and developed a high sink rate. He applied full power, but the TBM touched down 1,463 ft (446 m) from the runway and skidded 460 ft (140 m).				
Jan. 28	Whitsunday Island, Australia	Cessna 208	substantial	6 minor, 5 none
Six passengers sustained minor injuries when the float-equipped Caravan bounced several times while landing on rough water and struck a tree-covered hillside.				
Jan. 28	Mashhad, Iran	McDonnell Douglas MD-83	destroyed	154 none
Low visibility in snow was reported when the MD-83 veered off the runway on landing.				
Jan. 29	Windhoek, Namibia	Cessna 425 Conquest	destroyed	3 fatal
The Conquest was on a local training flight when it struck terrain after a loss of control on approach.				

NA = not available

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