FLIGHT SAFETY FOUNDATION

AeroSafety WORLD

BACK ON THE RADAR
Obesity's sleep apnea link

MAINTENANCE INSPECTORS
Grounding as last option

FEELING OF DETACHMENT
Fan cowling doors depart

OFF AND RUNNING

PAN AMERICAN INITIATIVES THRIVE

THE JOURNAL OF FLIGHT SAFETY FOUNDATION

NOVEMBER 2015

FSF, NEWSMAKERS and the Media

In October, Flight Safety Foundation relaunched the aviation Newsmaker Breakfast, a concept introduced by the Aviation Safety Alliance in 2002. These were popular monthly events that featured a notable aviation VIP, a number of aviation reporters and on-the-record questions and answers in an informal setting.

In 2006, the Foundation absorbed the Aviation Safety Alliance but wasn't able to continue the Newsmaker Breakfast series — until now.

We welcomed U.S. Federal Aviation Administration (FAA) Administrator Michael Huerta as the speaker for the relaunch, and he took this opportunity to discuss the FAA's new compliance philosophy and how this policy complements safety management systems. The Foundation endorsed the compliance philosophy in a statement to the news media, and our statement can be viewed on the FSF website.

Administrator Huerta reviewed the recent history of how airlines, other aviation industry entities and the FAA have worked together to address safety challenges, and how this cooperation has led to a dramatic decline in the commercial air transport accident rates in the United States and around the world.

The next predictive step in improving aviation safety is refining how we identify risk factors before they lead to an accident. I've written about the importance of this before, and aviation safety professionals everywhere are working in this area. The FAA's compliance philosophy reflects that regulators understand the importance of this as well.

To quote the administrator, "The compliance philosophy is the latest step in the evolution of how we work with those we regulate. It focuses on the most fundamental goal: Find problems in the National Airspace System before they result in an incident or accident, use the most appropriate tools to fix those problems, and monitor the situation to ensure that they stay fixed."

Huerta also explained how this works in practice, and I recommend you read his entire remarks from that day to learn more. We've included an online link to them in our statement to the news media endorsing the compliance philosophy, and you can find them and the national policy order on the FAA's website <www.faa.gov/news/updates/?newsId=83925>.

In recent months, I've talked about the Foundation's many "firsts," such as the first accident investigator course and the first aviation safety seminar. I've also talked about how the Foundation is continuing its tradition of serving as a neutral ground where competitors and allies can get together and talk about safety.

The Newsmaker Breakfasts, which we will hold on a quarterly basis in 2016, are another important aspect of the Foundation's outreach. As a respected independent organization, we're able to convene this forum for aviation VIPs, the "newsmakers" of our industry, to sit down with journalists covering aviation to discuss important, often complicated topics away from the pressure of breaking news and deadlines.

Jon L. Beatty
President and CEO
Flight Safety Foundation

AeroSafety WORLD

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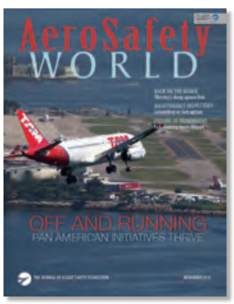

About the Cover
Six years of collaboration bind airlines and states in the Regional Aviation Safety Group–Pan America.
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If you have an article proposal, manuscript or technical paper that you believe would make a useful contribution to the ongoing dialogue about aviation safety, we will be glad to consider it. Send it to Editor-In-Chief Frank Jackman, 801 N. Fairfax St., Suite 400, Alexandria, VA 22314-1774 USA or jackman@flightsafety.org.

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GROWING AN Aviation Industry

As I write this editorial, I'm sitting in a hotel room near Georgetown, Guyana. Earlier today, I had the privilege to sit in on a four-hour discussion on the future of aviation in this country. The topics ranged from the difficulty of attracting large, international carriers to Guyana; to the infrastructure needed to develop the country's remote interior; to tourism; to search and rescue; to calls for a national aviation plan; to safety; to achieving U.S. Federal Aviation Administration Category 1 status; to compliance with International Civil Aviation Organization standards and recommended practices.

What most impressed me was not the scope of the discussion in what was described as a "national discourse" with stakeholders, or the passion with which issues were discussed, but the breadth and diversity of the stakeholders who took part. The event featured four government ministers, including one of the country's vice presidents, the acting director general of the Guyana Civil Aviation Authority, the CEOs of local and regional operators, the heads of both local international airports, entrepreneurs, pilots, regulators, air navigation service providers, the chairman of the Caribbean Aviation Safety and Security Oversight System, a representative of the U.S. National Transportation Safety Board, and local aviation legend and longtime Flight Safety Foundation member and supporter Capt. Malcolm Chan a Sue, a primary organizer of the event.

Everyone in the room recognized the importance of safe, efficient, reliable air transportation to the country's economic future — to growing tourism, attracting industry and business and providing a better life for Guyana's citizens, especially to people in remote towns and villages in the country's interior.

Safety wasn't the only topic discussed today, and it likely won't be the only one during the next two days as this conference continues, but it struck me while I was sitting there that I was taking part in an example of what we've been talking about in our Global Safety Information Project focus groups. Getting stakeholders together to talk through concerns, to share information and data, to analyze issues and develop and share strategies and best practices is key not only to continually improving aviation safety but also to growing an aviation industry and a country's economy.

Frank Jackman
Vice President, Communications
Flight Safety Foundation

Serving Aviation Safety Interests for More Than 65 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.

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NOVEMBER 2–4 ➤ 68th annual International Air Safety Summit. Flight Safety Foundation. Miami Beach, Florida, U.S. Namratha Apparao, <apparao@flightsafety.org>, +1 703.739.6700, ext. 101.

NOVEMBER 2–4 ➤ ATAC 81st Annual General Meeting and Tradeshow. Air Transport Association of Canada. Montreal. <atac.ca>.

NOVEMBER 3–4 ➤ AACO Technical Forum 2015. Arab Air Carriers Organization (AACO). Abu Dhabi, United Arab Emirates. <aaco.org/events/aaco/aaco_technical_forum>.

NOVEMBER 6 ➤ AsBAA Inaugural Industry Awards and Charity Gala Dinner. Asian Business Aviation Association (AsBAA). Kowloon, Hong Kong. <info@asbaa.org>.

NOVEMBER 8–12 ➤ Dubai Airshow. F&E Aerospace. Dubai, United Arab Emirates. <dubaiairshow.aero>.

NOVEMBER 12–13 ➤ AAPA 59th Assembly of Presidents. Association of Asia Pacific Airlines (AAPA). Bali, Indonesia. <ap@aapa.org.my>.

NOVEMBER 12–13 ➤ INAIR 2015 International Conference on Air Transport. Amsterdam University of Applied Sciences Aviation Academy. Amsterdam. <amsterdamuas.com/aviation/events/item/inair-2015.html>.

NOVEMBER 15–17 ➤ ALTA Airline Leaders Forum: Latin American and Caribbean Airlines Annual Meeting. Latin American and Caribbean Air Transport Association (ALTA). San Juan, Puerto Rico. <www.alta.aero/airlineleaders/2015/>.

NOVEMBER 16–18 ➤ HAI Firefighting Safety Conference. Helicopter Association International (HAI). Boise, Idaho, U.S. <rotor.org>.

NOVEMBER 17–18 ➤ Flight Data Management Course. AviAssist Foundation. Kigali, Rwanda. <2gether4safety.org>.

NOVEMBER 17–19 ➤ NBAA2015 Business Aviation Convention and Exhibition. National Business Aviation Association. Las Vegas. <nbaa.org>.

NOVEMBER 19 ➤ 2015 NBAA National Safety Forum. National Business Aviation Association (NBAA). Las Vegas. <nbaa.org/events/national-safety-forum/2015/agenda/>.

NOVEMBER 19–20 ➤ Safety in African Aviation Conference. AviAssist Foundation. Kigali, Rwanda. <2gether4safety.org>.

NOVEMBER 23–25 ➤ ICAO World Aviation Forum. International Civil Aviation Organization. Montreal. <icao.int>.

NOVEMBER 23–27 ➤ IATA Dangerous Goods Course. AviAssist Foundation and SCS Training and Consultancy. Kigali, Rwanda. <events@aviassist.org>.

NOVEMBER 26–27 ➤ Predicting the Fatal Flaws: Can We Do Things Differently in Aviation Safety? Royal Aeronautical Society Human Factors Group and the Chartered Institute of Ergonomics and Human Factors. Sussex, England, U.K. Rick Haybroek, <rph@raes-hfg.com>.

NOVEMBER 29–DECEMBER 1 ➤ AACO 48th AGM. Arab Air Carriers Organization (AACO). Jeddah, Saudi Arabia. <aaco.org/events>.

DECEMBER 2–3 ➤ Ninth Rotorcraft Symposium. European Aviation Safety Agency. Cologne, Germany. <rotorcraft@easa.europa.eu>, <easa.europa.eu/newsroom-and-events/events/ninth-rotorcraft-symposium>.

FEBRUARY 8–12 ➤ SMS Expanded Implementation Course. The Aviation Consulting Group. Honolulu, Hawaii, U.S. <tacgworldwide.com>.

FEBRUARY 16–21 ➤ Singapore Airshow 2016. Experia. Singapore. <singaporeairshow.com>.

FEBRUARY 23–24 ➤ 6th European Business Aviation Safety Conference (EBASCON). AMM Screening GmbH. Königstein, Germany. <info@ebascon.eu>, <ebascon.eu>.

FEBRUARY 29–MARCH 3 ➤ HAI Heli-Expo 2016. Helicopter Association International (HAI). Louisville, Kentucky, U.S. <heliexpo.rotor.org>.

MARCH 8–9 ➤ 2016 Air Charter Safety Symposium. Air Charter Safety Foundation. Dulles, Virgina, U.S. <acsf.aero/events/acsf-symposium/>.

MARCH 10–12 ➤ 27th Annual International Women in Aviation Conference. Women in Aviation International. Nashville, Tennessee, U.S. <wai.org/16conference/index.cfm>.

MARCH 14–15 ➤ Singapore Aviation Safety Seminars (SASS): Maintenance and Engineering. Flight Safety Foundation and Singapore Aviation Academy. Singapore. Namratha Apparao, <apparao@flightsafety.org>, +1 703.739.6700, ext. 101.

MARCH 16 ➤ Singapore Aviation Safety Seminars (SASS): Safety Management Information and Sharing. Flight Safety Foundation and Singapore Aviation Academy. Singapore. Namratha Apparao, <apparao@flightsafety.org>, +1 703.739.6700, ext. 101.

MARCH 17–18 ➤ Singapore Aviation Safety Seminars (SASS): Flight Operations. Flight Safety Foundation and Singapore Aviation Academy. Singapore. Namratha Apparao, <apparao@flightsafety.org>, +1 703.739.6700, ext. 101.

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

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

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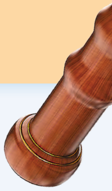
If you have a safety-related conference, seminar or meeting, we'll list it. Get the information to us early. Send listings to Frank Jackman at Flight Safety Foundation, 801 N. Fairfax St., Suite 400, Alexandria, VA 22314-1774 USA, or <jackman@flightsafety.org>.

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

BY GREG MARSHALL

Just Culture in ACCIDENT INVESTIGATION



During the early days of aviation, aircraft accidents were investigated using mainly records of the flight and evidence gathered at accident sites. Basic investigative techniques matured as experience was gained, and, with technological developments, investigations became more of a science.

The introduction of the flight data recorder (FDR) added an information source of immense value to the investigation process. Through the assessment of multiple FDR parameters, investigators could now "see" what the aircraft had been doing during the period before the accident itself. The addition of the cockpit voice recorder (CVR) provided further insight and aided the process by allowing the investigators to hear crew conversations, cockpit noises and alarms.

But CVRs introduced conflicts, originally around privacy and later regarding protection of data in the interest of everyone's safety. After years of advocacy by Flight Safety Foundation and other aviation safety professionals, it became accepted practice that, particularly in the case of fatal accidents, the audio recordings from these devices would be accessible only to an official body's investigators for the purpose of carrying out an investigation and preparing transcripts typically included in the final report. Within the aviation safety community, it is still widely held that CVR audio recordings should not be used to support adversarial proceedings, either criminal or civil. After all, with rare exceptions, pilots don't go to work with the intention of committing a malicious act. Accidents are often the product of system-based deficiencies that may include human factors errors of commission or omission.

The following ongoing case illustrates the conflict between maintaining privacy and a just culture in aviation accident investigation, and meeting the demands of a judicial system's investigators.

On Aug. 23, 2013, a Eurocopter (now Airbus Helicopters) AS332 Super Puma, operating in support of North Sea oil and gas installations, crashed into the sea while on approach to Sumburgh Airport in Scotland's Shetland Islands. Of the 18 passengers and crew, four failed to escape the helicopter and died. The accident investigation by the U.K. Air Accidents Investigation Branch is continuing, but preliminary reports said no technical fault with the helicopter had been found. A Scottish court is now hearing evidence in support of a coroner's inquiry.

In workplace-related accidents involving fatalities or injuries, the relevant authorities may be required to conduct an investigation to determine whether a criminal prosecution of any of the involved parties is warranted. In this accident, as noted, the ongoing AAIB investigation has yet to reveal any technical fault with the aircraft, and Police Scotland, in accordance with their statutory obligations, is investigating

to determine if any criminal negligence exists. To support their investigation, combined voice and flight data recorder (CVFDR) data are being sought as evidence.

In this case, the lord advocate, a lead prosecutor who is in charge of criminal prosecutions and death investigations in Scotland, petitioned the court to order the secretary of state for transport to hand over the CVFDR to Police Scotland following the AAIB's denial of a previous request for it.

Lord Jones, a judge of Scotland's Supreme Courts, agreed, ruling that, "in my judgment, there is no doubt that the lord advocate's investigation into the circumstances of the death of each of those who perished in this case is both in the public interest and in the interests of justice. The cockpit voice recording and the flight data recording which the lord advocate seeks to recover will provide relevant, accurate and reliable evidence which will enable SARG [the Safety and Airspace Regulation Group of the U.K. Civil Aviation Authority] to provide an expert opinion of value to assist him in his investigation of the circumstances of the death of the four passengers whose lives were lost, and his decision *whether and, if so, against whom to launch a prosecution*" (emphasis added).[1]

In a number of jurisdictions around the world, the law allows for the use of CVRs to support judicial inquiries with the express provision that the data contained within them is not to be used for the purpose of prosecuting flight crew, either in association with that inquiry or in any other case. However, in other jurisdictions, this prohibition is less clear.

This is not to say that flight crew are, or should be, held to be above the law. After all, the philosophy of a just culture, which recognizes a few exceptions in which deterrent punishments may be warranted, is no longer new and is becoming increasingly accepted. But the practice of using FDR/CVR recordings for purposes other than those for which they were intended is anathema to the principles embodied in current air safety investigations conducted in a just manner.

The judgment and order by the court in Scotland is the subject of an appeal by the British Air Line Pilots Association, the helicopter's captain and the first officer. The outcome will be of interest, especially with respect to work being undertaken by the Foundation and others to ensure the legal protection of safety information in the interests of aviation safety.

Greg Marshall is vice president, global programs, at Flight Safety Foundation.

Note

1. The full text of the decision is available on the Scottish Courts and Tribunals website at <www.scotcourts.gov.uk/search-judgments/judgment?id=0452dda6-8980-69d2-b500-ff0000d74aa7>.

BY BARRY C. DAVIS, JULIA POUNDS, PAUL KROIS AND MELISSA WISHY

Can Risk Be Managed If It Can't Be Measured?

The U.S. Federal Aviation Administration's (FAA's) new compliance philosophy[1] has introduced an oversight approach that proactively manages risks through the "identification and control of existing or emerging safety issues" and by concentrating resources on mitigating risk and problem solving. Traditionally, safety professionals focused on controlling known hazards while also trying to anticipate if or when unknown hazards would surface (Figure 1, p. 11). For example, a special issue of *Risk & Regulation* in 2010 devoted eight articles[2] to a discussion of risk management related to close calls, near misses and early warnings. The articles represented different industries and issues, ranging from oil refinery accidents to failures in physicians' clinical performance to vulnerabilities in nuclear reactors.

To complicate matters, many definitions of risk exist, depending on whether the word is used in everyday conversation or by experts in different domains. In an effort to standardize the definition, the International Organization for Standardization (ISO) defined risk simply as "the effect of uncertainty on objectives."[3] However, uncertainty may exist because of either potential events or their consequences, and whether information is ambiguous or missing. Further, uncertainty can either positively or negatively impact one's objective.

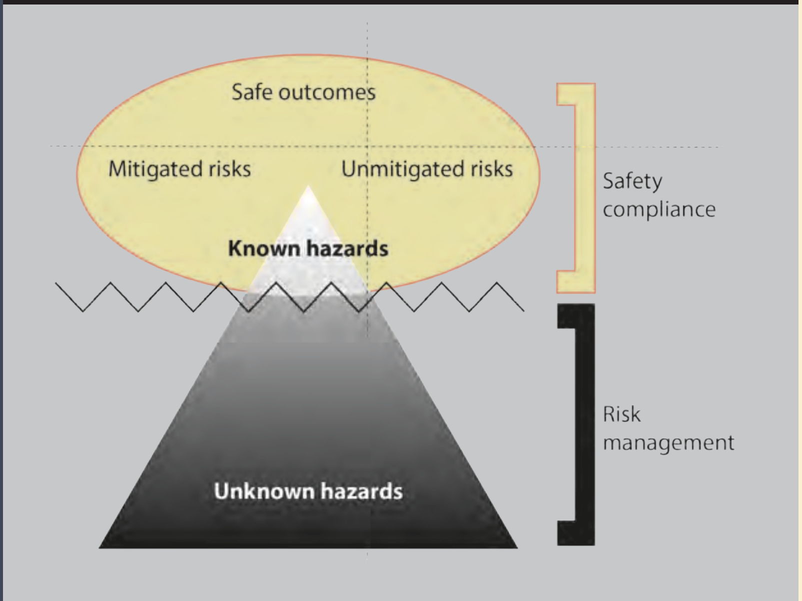
Today, an organization's capability to accumulate information about risk and to use that information to develop mitigations can be labeled *risk intelligence* (or *risk intel*), that is, generating previously unknown knowledge or understanding from data. However, gathering risk intelligence is dependent on correctly positioning and providing resources to people, processes, systems and tools, including processes for transforming data into useful information

for risk analysis, mitigation and planning purposes. The ability of an organization to gather risk intelligence increases the quality and quantity of information available for improved decision making.[4,5]

In the pursuit of safe outcomes, many aviation safety professionals have produced vast amounts of risk intelligence about the characteristics of known hazards. As illustrated by Figure 1, however, we need better methods to develop risk intelligence about unknown hazards. We cannot directly understand something we do not know, so are there new ways to capture characteristic signals or markers that can point out an underlying issue? This use of such indicators is very common in the medical field, where a full blood test, for example, provides an analytically valuable dashboard of chemical markers.

Our operational definition of risk is an effort to clarify the relationship between safety and risk so that both can be measured. The intent is for aviation safety professionals to be able to better recognize how and when the risk occurs, what influences it, etc.

Safety Compliance vs. Risk Management



Source: Barry C. Davis, Julia Pounds, Paul Krois and Melissa Wishy

Figure 1

Given that a common goal of the global aviation community is to continually increase the level of safety, we offer a very simple solution for the complex problem of identifying risk:

- We define risk as unintended variation; and,
- We believe that today's high level of safety can be increased by reducing unintended variation.

Aviation relies on a system of systems highly dependent on procedures to maintain flight safety and efficiency. Rules and regulations for all airspace users specify procedures containing best practices for executing safe operations. Like drivers of cars approaching head-on must know to stay on their own side of the road, safe aviation operations depend on the shared expectation that applicable procedures and best practices will be followed.

Maintaining safety requires controlling risk. However, safety is usually defined relative to absence of risk, a concept with no single agreed-upon definition. Instead, controlling risk often has involved various combinations of expectation, intent, opacity, action and outcome regarding either an entity's purposeful engagement with an unknown or the outcome of an entity's having encountered an unknown. This inconsistency poses problems for aviation professionals who are charged with identifying and reducing risk to improve safety levels. We suggest a common definition so that safety professionals can objectively identify, measure, study and reduce risk; identify changes in risk; and determine the effectiveness of risk mitigation strategies.

We defined risk as *unintended* variation because some intended variation among users of the National Airspace System must be tolerated to permit them to flexibly respond in unanticipated or uncontrollable circumstances. For example, some variation is tolerated and expected when users are allowed to exercise discretion and judgment to safely accomplish their goals. These situations are generally covered in safety controls within policies in phrases such as "the operator may discontinue the alerts if …" and "the documentation should include … ." Unintended variation means that which is outside approved and predetermined safe tolerance levels and is therefore not intended to occur.

In sum, alertness for unintended variation to identify risk provides an objective method for managers of aviation organizations in government and industry to address risk. Measuring the presence or absence of unintended variation is an objective approach to the more imprecise concepts of risk.

The scientific concept of variation is not new. To apply risk intelligence to aviation, however, involves understanding the nature of variation, whether variation is present and where none is intended. Our definition also aims to help safety professionals to take advantage of statistical methods For example, statistical process-improvement techniques have long been used to identify and remove the causes of variability in manufacturing. Processes have characteristic attributes that can be measured, analyzed, controlled and improved. Any variation during the process or in its outcomes can be identified and corrected by effective quality assurance and quality control programs. Stable and predictable results are attained by reducing variation in processes.

This insight into processes extends across many domains of human activity, including aviation safety, as illustrated by the examples below. It also can lead us to a better understanding about how, when and where unintended variation goes unnoticed in processes and systems. To appreciate the pervasive nature of the problem, we need only to begin asking questions like the following.

- Do we want unintended variation in machine parts that are used in safety-critical equipment?
- Do we want unintended variation in information that is used in critical safety decisions?

Is risk introduced if there is unintended variation in how we:

- Process information through systems;
- Format information to be used by systems;
- Identify hazards;
- Describe a hazard's characteristics;
- Describe hazards for developing mitigations;
- Evaluate hazards for prioritizing resources;
- Implement mitigations in systems;
- Distribute mitigations in systems;
- Make decisions;
- Implement security; and,
- Manufacture aircraft parts?

While this is not a complete list, unintended variation clearly is a marker that signals risk whether it involves a safety-related decision, mechanism, aircraft part or other element within the aviation system.

Barry C. Davis manages FAA's Air Traffic Safety Oversight (AOV) Information Standards. Paul Krois is involved with FAA human factors research. Julia Pounds, Ph.D., manages AOV's Research and Analysis. Melissa Wishy is a subject matter expert and senior policy analyst with AOV Information Standards.

This article represents the opinions of the authors and does not reflect FAA policy.

Notes

1. FAA. "National Policy: Federal Aviation Administration Compliance Philosophy." Order 8000.373. June 26, 2015.
2. ESRC Center for Analysis of Risk and Regulation. *Special issue on close calls, near misses and early warnings.* London, U.K.: London School of Economics and Political Science, July 2010.
3. ISO. *ISO 31000/ISOGuide 73. Risk Management — Vocabulary*, 2009.
4. Apgar, D. *Risk Intelligence: Learning to Manage What We Don't Know*. Boston: Harvard Business School Publishing, 2006.
5. Funston, F. *Surviving and Thriving in Uncertainty: Creating the Risk Intelligent Enterprise*. Hoboken, New Jersey, U.S. John Wiley and Sons, 2010.

InSight is a forum for expressing personal opinions about issues of importance to aviation safety and for stimulating constructive discussion, pro and con, about the expressed opinions. Send your comments to Frank Jackman, vice president, communications, Flight Safety Foundation, 801 N. Fairfax St., Suite 400, Alexandria VA 22314-1774 USA or jackman@flightsafety.org.

Safety News

FAA Compliance Philosophy

The U.S. Federal Aviation Administration (FAA) is implementing a new "compliance philosophy" to guide its strategic safety oversight of the aviation industry, Administrator Michael Huerta says.

Speaking at a Flight Safety Foundation Newsmaker Breakfast in October in Washington, Huerta said the agency's approach relies heavily on establishment of safety management systems at individual aviation operations, and on data collection.

"Our traditional approach to aviation safety was to look backward," Huerta said, referring to decades in which safety advances came only after accidents — and subsequent accident investigations — revealed critical safety hazards.

Wayne Rosenkrans

Huerta

The FAA said its new approach — outlined in National Policy Order 8000.373, published in June — is designed to "enhance our ability to find safety problems before they result in an incident or accident, use the best tools to fix those problems and then monitor the situation to ensure that no new problems develop."

Huerta said the compliance philosophy encourages openness between the FAA and the operators it regulates.

"The FAA wants safe operators, not operators who inadvertently make a mistake and then hide it because they're afraid they will be punished," the agency said.

Flight Safety Foundation President and CEO Jon Beatty praised the new compliance philosophy as "an important step forward for aviation safety," adding that the Foundation "has long called for the increased use of data from normal operations to identify precursors to risk."

Glide Path Disruption

The European Aviation Safety Agency (EASA), citing a 2012 occurrence in which the crew of an Airbus A320 rejected a landing because of a glide path signal disruption, is recommending that airport operators ensure that established runway-holding positions are located outside instrument landing system (ILS) critical areas.

In the March 28, 2012, occurrence, the A320 crew was forced to go around during an ILS Category I (CAT I) approach at Hamburg, Germany, because of a signal disruption attributed to a Boeing 737 that had been directed by air traffic control (ATC) to stop at the CAT I runway-holding position. The position was inside the critical area of the glide path, EASA said.

"The purpose of the critical areas that have to be established for ILS signals is to keep these signals protected, because any presence of an aircraft or vehicle within these areas is likely to create a disruption of the signals and therefore an unacceptable risk for aircraft operations," EASA said in Safety Information Bulletin 2015-20, issued in October.

EASA also recommended that air navigation service providers ensure that their procedures for ILS approaches "contain the unconditional requirement that ILS critical areas are kept clear during ILS approaches to avoid permanent infringements of these areas."

National aviation authorities should consider the recommendations during their safety oversight work, EASA said.

In the event cited by EASA, the 737 had just landed and was being taxied to the terminal when ATC told the flight crew to hold short on the taxiway. The subsequent disturbance in the glideslope signal led to the display of erroneous information on the A320's primary flight display, which showed that the airplane was on the glideslope; in reality, it had descended below the glideslope.

© Airbus SAS 2013

Battery Precautions

U.S. air carriers and other commercial operators should take extra steps to ensure the safe handling of spare lithium batteries in both carry-on and checked baggage, the U.S. Federal Aviation Administration (FAA) says.

"Lithium batteries present a risk of both igniting and fueling fires in aircraft cargo/baggage compartments," the FAA said in Safety Alert for Operators (SAFO) 15010, issued in October.

U.S. hazardous goods regulations, as well as technical instructions from the International Civil Aviation Organization, prohibit spare lithium batteries from being transported in checked baggage, with certain exceptions.

The FAA recommended that operators, "during ticket purchase and check-in processes, inform passengers that spare lithium batteries are prohibited from checked baggage (including checked baggage at the gate)," and added that additional information for passengers is available at <www.faa.gov/Go/Packsafe>.

If spare lithium batteries are being transported in carry-on baggage, each battery must be "individually protected so as to prevent short circuits (e.g., by placement in original retail packaging, by otherwise insulating terminals by taping over exposed terminals or placing each battery in a separate plastic bag or protective pouch," the SAFO said.

The document also said that spare batteries "must not come in contact with metal objects, such as coins, keys or jewelry" and steps must be taken "to prevent crushing, puncturing or pressure on the battery."

'Challenging Year'

Aviation safety data for 2014 depict "a very challenging year," European Aviation Safety Agency (EASA) Executive Director Patrick Ky says in his foreword to the agency's *Annual Safety Review — 2014*, issued in October.

EASA and aviation safety in general faced challenges, Ky said, citing, among other events, "radar interferences over Central Europe" and the "dramatic loss" of Malaysia Airlines Flight 17, which investigators say was shot down July 17 over eastern Ukraine by a Russian-made missile, killing all 298 passengers and crew.

These events, along with occurrences in other parts of the world, "have reminded us that the safety of passengers can never be taken for granted," Ky said.

He noted that in 2014, EASA began changing the way it operates "to allow for a more proportionate and performance-based approach to safety."

Among the changes, he said, is a simplified method of regulation and oversight of European general aviation, with an emphasis on "safety culture, safety promotion and … common sense. It should also be seen as the precursor of a better, lighter approach to aviation regulation in Europe, with the ultimate goal of increasing the level of safety" (*ASW*, 5/15, p. 16).

EASA created a new Strategy and Safety Management Directorate in 2014, with the goal of developing "a single, more transparent, evidence-based and data-driven strategy," Ky said.

The report noted that one fatal accident in 2014 involved an EASA member state's aircraft — the July 24 crash of a Swiftair McDonnell Douglas DC-83 in Gao, Mali. That crash killed all 116 people on board and destroyed the airplane.

Implementation Procedures

The European Aviation Safety Agency and the U.S. Federal Aviation Administration (FAA) say they have agreed to a new system of airworthiness and environmental certification designed to speed the installation of safety-enhancing equipment on airplanes.

The agreement, signed in mid-September, also aims to eliminate duplicate processes by allowing the two agencies to "rely on each other's regulatory systems," they said.

In a joint statement, the agencies added, "Strong partnerships are a key to establishing consistent standards of safety around the world. Based on more than a decade of cooperation … the authorities have established confidence in each other's regulatory systems. Rooted in that confidence, the new safety agreement allows reciprocal acceptance of the majority of technical standard order–approved articles."

The FAA said it also had reached a similar agreement with Transport Canada.

Gust Lock Retrofit

The U.S. Federal Aviation Administration (FAA) should require retrofitting of the gust lock system on Gulfstream G-IVs to limit the airplane's operation in case the system has not been disengaged before flight, the U.S. National Transportation Safety Board (NTSB) says.

The NTSB included the recommendation in its final report on a May 31, 2014, accident involving a G-IV that crashed when it overran a runway at Hanscom Field in Bedford, Massachusetts, U.S., during a rejected takeoff, killing all seven people on board.

The NTSB said the probable causes of the accident were the flight crew's "failure to perform the flight control check before takeoff, their attempt to take off with the gust lock system engaged and their delayed execution of a rejected takeoff after they became aware that the controls were locked."

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Contributing factors included the flight crew's "habitual noncompliance with checklists, Gulfstream Aerospace Corporation's failure to ensure that the G-IV gust lock/throttle lever interlock system would prevent an attempted takeoff with the gust lock engaged and the [FAA's] failure to detect this inadequacy during the G-IV's certification."

Other NTSB recommendations included:

- That the FAA "place increased emphasis on replacing nonfrangible fittings of any objects along the extended runway centerline up to the perimeter fence with frangible fittings";
- That the International Business Aviation Council amend the auditing standards of its International Standard for Business Aircraft Operations to include "verifying that operators are complying with best practices for checklist execution"; and,
- That the National Business Aviation Association "work with existing business aviation flight operational quality assurance groups … to analyze existing data for noncompliance with manufacturer-required routine flight control checks before takeoff and provide the results of this analysis to your members."

Safety Project for the Pacific

Airways, New Zealand's air navigation service provider, says it has agreed to conduct a two-year project surveying runways and developing satellite-based approach procedures to airports in eight Pacific countries.

The Pacific Aeronautical Charting and Procedures program is intended to "improve the ability of aircraft to land safely, especially in poor weather," Airways said in its mid-October announcement of the program.

Work was expected to begin in late October in Vanuatu and the Cook Islands and eventually will involve airfields in Niue, Kiribati, Samoa, Tonga and other Pacific nations, Airways said.

"Safe aeronautical procedures are critical to aviation safety," said Airways Chief Executive Ed Sims. "While these new procedures contribute to safer air travel, they also enable a far greater range of options and flexibility for the airlines and other commercial operators."

In Other News …

Eurocontrol and the General Civil Aviation Authority of the UAE have signed an agreement calling for an **exchange of flight data**, updated flight plan information and airport departure planning information. The agreement is aimed at addressing "the current lack of predictability of traffic between the Middle East and Europe," Eurocontrol said. … The Australian Civil Aviation Safety Authority is proposing new **safety regulations** for most passenger airplane flights, calling for the same rules to be applied to regular public transport flights and charter flights — a development that the agency says means safety standards will be tightened for some aspects of charter operations.

Compiled and edited by Linda Werfelman.

Safety Oversight

Embracing ICAO's approaches to collaborative risk mitigation, Pan American states and airlines mark six years of advances.

BY WAYNE ROSENKRANS

Almost as soon as the International Civil Aviation Organization (ICAO) established a new common framework in the mid-2000s for states and commercial air transport entities to coordinate safety policies and initiatives, one area of the world began moving to the forefront in executing the planning methodology and demonstrating world-class best practices.

The six-year experience of the Regional Aviation Safety Group–Pan America (RASG-PA) has validated several aspects of applying ICAO's framework to make air travel safer over time, according to documents and data published on the ICAO website <www.icao.int/rasgpa/pages/default.aspx>. State governments, commercial air carriers, air navigation service providers, pilot associations and other stakeholders have worked closely to transform themselves into early adopters of advanced systems, a model of how to prioritize long-term efforts and a success in focusing resources on the latest techniques of safety data analysis.

Recalling when RASG-PA was formed in November 2008, ICAO later called the group "the first initiative in civil aviation designed to

address the gaps between air navigation and operational safety implementation activities. … RASG-PA will serve as a focal point to ensure harmonization and coordination of safety efforts aimed at reducing aviation hazards and risks in North America, Central America, the Caribbean and South America."[1] Some participants expected at the outset that ICAO's framework would help them build a fair and effective safety reporting culture and improve civil-military cooperation in aviation safety.

At the group's first meeting, Günther Matschnigg, then senior vice president, safety, operations and infrastructure, International Air Transport Association (IATA), told attendees, "In 2008, the Pan American accident rate climbed to 2.55 accidents per million sectors flown, compared to 1.61 accidents in 2007. This is a serious concern and it demonstrates, in part, why the new RASG-PA initiatives and strategy need to begin to take effect quickly."

ICAO also cited group aspirations described by Gerardo Hueto, now chief engineer, aviation system safety, Boeing, and a member of its steering committee, who said, "We view the RASG-PA as an agent that can anticipate problems and opportunities that may arise, as well as promote important cross-sharing of safety best practices and data."

RASG-PA established at its beginning, and has continued, three working groups: a regional aviation safety team–Pan America, an aviation safety training team and an annual safety report team.

At the next year's meeting, RASG-PA's leaders held discussions on the possibility of benefiting quickly from existing research and development. Specifically, ICAO said they "investigated how to incorporate several [U.S.] Commercial Aviation Safety Team (CAST) initiatives [i.e., safety enhancements] and [to develop] tools for Pan American states that would provide them with the necessary legal framework to ensure the protection of safety information and therefore the enhanced ability to assess aviation system safety."

The launch of RASG-PA quickly led to publication of the world's first annual safety report by an ICAO RASG. The report was promoted as "a timely, unbiased and transparent source of safety-related information essential for all aviation stakeholders interested in having a tool to enable sound decision making on safety-related matters." The first-year prototype had been a simple working paper, but it led to cooperation by adding comprehensive analyses of regional data from Boeing Commercial Airplanes, ICAO and IATA. The annual safety report team has continued to produce the report, and its analyses and other content have been reflected in ICAO's global annual reports.

Global Context

ICAO's latest master plan for worldwide improvements[2] says, "With air traffic projected to double in the next 15 years, current and emerging safety risks must be addressed proactively to ensure that this significant capacity expansion is carefully managed and supported through strategic regulatory and infrastructure developments. It is therefore imperative that states and regions remain focused on establishing, updating and addressing their safety priorities as they continue to encourage expansion of their air transport sectors. [The *Global Aviation Safety Plan 2014-2016 (GASP)*] provides a familiar planning framework to assist states and regions to make improvements in safety through the use

of the four safety performance enablers: standardization, collaboration, resources and safety information exchange. … It is particularly vital that all states put in place, over the next decade, effective safety oversight systems (including proper governance arrangements) and fully implement the ICAO State Safety Programme (SSP) framework."

The first *ICAO Journal* of 2015 reported that the organization's High Level Safety Conference in February "delivered clear affirmations for the objectives now being pursued in every world region under the *[GASP]*. … Coordinating and supporting the regional implementation of the *GASP* has been entrusted to the RASGs, which have been established by ICAO in all regions."[3]

The work of RASG-PA, as well as that of other RASGs, is conducted in the context of expectations that all countries will implement an effective safety oversight system by 2017, and in that near-term time frame, will complete their introduction of technology, infrastructure and procedures for performance-based navigation (PBN). "[PBN] enhances safety by addressing a number of risks, including those associated with [controlled flight into terrain

(CFIT)], runway excursions and the loss of aircraft separation," the master plan says. Among their affirmations in the Montreal Declaration of 2015, ICAO member states committed to "expedite full implementation of [PBN] regulatory oversight."

By "effective oversight system," ICAO means adopting its standards and recommended practices (SARPs) for every state's approval, authorization, certification and licensing processes. A high priority in doing this is providing adequate resources — including legal, regulatory and organizational structures — to effectively perform universal state safety oversight obligations through a robust state safety program.

"[RASGs'] annual safety reports … provide regular updates on the level of progress achieved with respect to the [global] objectives through measurement of reactive, proactive and predictive safety indicators," ICAO said. RASG-PA has focused and prioritized actions to improve runway safety, reduce CFIT accidents and reduce loss of control–in flight (LOC-I) accidents and incidents. As of 2015, RASG-PA has added reduction of risk of midair collisions as a fourth safety priority.[4]

After RASG-PA's establishment, ICAO transitioned from conducting state assessments with long intervals for corrective action under its Universal Safety Oversight Audit Programme (USOAP) to the USOAP Continuous Monitoring Approach, designed to provide ongoing website reports of each state's effective implementation of eight critical elements of safety oversight (Figure 1).

"RASGs provide a formal reporting channel to enable monitoring of worldwide [performance-based safety system] implementation. … An added objective of the groups is eliminating

Effective Implementation of Eight Critical Elements of ICAO USOAP CMA

USOAP = Universal Safety Oversight Audit Programme; CMA = Continuous Monitoring Approach

Note: Software dashboards on the ICAO website enable viewing of safety data from subregions involved in the Regional Aviation Safety Group–Pan America.

Source: International Civil Aviation Organization (ICAO) <www.icao.int/safety/Pages/USOAP-Results.aspx>

Figure 1

the duplication of efforts through the establishment of more cooperative regional safety programmes [— an approach that] significantly lessens the financial and human resource burden on states," ICAO said.

Early Safety Projects

RASG-PA spearheaded a project called Effective Errors and Incident Reporting, which developed, proposed and, in 2010, distributed to all Pan American states a model legal framework to protect safety information. The project's participants subsequently worked on this with the ICAO Safety Information Protection Task Force, which involved Flight Safety Foundation.

Another early project called Use of Technology to Enhance Safety sought new ways to leverage the flight operational quality assurance (FOQA) programs of airlines in this region. "The objective is to share information between aircraft operators, air traffic services and state [civil aviation authorities] to facilitate early recognition of risks related to routine operations and how to manage and mitigate those risks," RASG-PA reported at the time. … Early data suggest a reduction of unstabilized approaches at the project airport [in Costa Rica] (see 'Sharing Data, Improving Safety,' p. 21)."

RASG-PA and the Latin American and Caribbean Air Transport Association (ALTA) also introduced the Pan American Aviation Safety Summit, accompanied in 2010 by training focused on risk mitigation related to runway excursions, CFIT and LOC-I.

Each of RASG-PA's annual safety reports has drawn distinctions between the current and long-term value of data in separate reactive, proactive and predictive sections.

The 2011 report noted that reactive data for "LOC-I and CFIT showed decreasing trends [comparing five-year averages]; meanwhile, system-component failure/malfunction (non-powerplant) … and unknown … occurrences are emerging categories in the region. The monitoring of the behavior of these occurrences should be maintained to determine the impact of mitigation strategies."

Proactive data that year enabled use of USOAP findings that showed "a high level of lack of effective implementation … of ICAO SARPs in some states of the region. Moreover, qualification and training of the technical staff became the most affected critical element in the region. … Technical personnel qualifications and training … is the top issue affecting the [implementation] percentage."

Specifically, the region's average effective implementation for the critical elements of state safety oversight was 65.21 percent. For more than half of member states audited by ICAO, the corresponding values were greater than 70 percent — that is, in a range exceeding ICAO's 70 percent target.

As for exploiting any predictive safety information, RASG-PA said in 2011 that this region "had not yet fully developed mechanisms for gathering and processing predictive safety information." Significantly, however, the group pointed to initiatives already under way that would "advance capabilities to produce predictive safety information."

The 2011 report added, "Accident rates in the [North American–Caribbean] region remained below the world average, but in the [South American] region, the accident rate was 4.196 [accidents per million departures]; higher than the world average (4.137)."

Fast Forward to 2015

Information published in this group's 2015 annual safety report (referring to 2014 data) — and, as examples, in its summary of a 2014 safety team meeting[5] and 2015 plenary meeting[6] — provides insights into how far RASG-PA has come through uninterrupted investment of time and resources, and constant focus on agreed priorities.

"The meeting reviewed … [midair collision as] the emerging area of concern based on the trend exhibited by [traffic-alert and collision avoidance system] (TCAS) resolution advisory (RA) data," the safety meeting summary said, noting also the assignment of the issue to the safety team for safety enhancement initiatives.

RASG-PA also recently set a specific goal for safety metrics. A plenary-meeting presentation by the ICAO Secretariat said that the group's safety goal now uses 2010 as a baseline reference, and "aims to reduce the operations fatality risk for [air carriers] to 50 percent [of 2010] for 2020 in Latin America and the Caribbean."

The corresponding RASG-PA risk analysis in part states the baseline (i.e., the five-year-average fatality risk) in 2010 as 0.6 in Latin America and the Caribbean; the RASG-PA goal as a fatality risk of 0.3 in 2020; and the calculated risk reduction due to implementation of its safety enhancement initiatives during 2010–2014 as 25 percent.

"The [2015 plenary] meeting was informed that the [Caribbean] and [South American] Regions face many challenges to improve safety levels;

however, both [subregions] have shown progress on safety in the recent years. The meeting agreed that RASG-PA is one of the key contributors of the progress," the report said.

RASG-PA also was tapped by ICAO to pilot-test in 2014 a method of measuring the institutional strength of civil aviation authorities using a survey instrument.

The plenary meeting also heard a broad description of the latest confidential shared data analyses, which have become routine because of memorandums of understanding among ALTA, the U.S. Federal Aviation Administration's Aviation Safety Information Analysis and Sharing (ASIAS) program, Boeing, CAST, IATA and RASG-PA.

Far advanced from the 2011 annual safety report, the 2015 report says the group now monitors the following accident/incident precursors using routine flight data monitoring and other sources: runway excursion precursor – unstable approach; CFIT precursor – events related to enhanced ground-proximity warning systems; and midair collision precursor – TCAS RA.

Also in contrast with the 2011 report, the following excerpts from the 2015 report indicate areas of progress: "The number of fatal accidents in 2013 in the Pan American Region for scheduled commercial air transport operations involving aircraft with maximum takeoff mass above 5,700 kg [12,566 lb] was higher than the previous year but slightly below the latest 10-year moving average (2003–2012). Nevertheless, the number of total accidents and total fatalities remained below the mentioned moving average.

"Notably, LOC-I, CFIT and [runway excursion] occurrences showed decreasing trends, especially at the end of the period; however, they continue to represent the highest fatality risk type of accidents, while midair collision … is an emerging category in the Pan American Region, according to this analysis. Precursors of [runway excursions] and CFITs, identified through the analysis of predictive safety data, show decreasing trends. By contrast, TCAS RA events, identified as a precursor of [midair collision] occurrences, is showing an increasing trend in the Pan American Region.

"The proactive safety data used in this report, extracted from the results of the [USOAP], showed 11 states in the Pan American Region that maintain low levels of effective implementation of ICAO SARPs. Moreover, lack of effective technical staff qualification and training continues to be the most significantly affected USOAP critical element … in the region. Of particular significance, the technical areas showing lowest levels of effective implementation were air navigation services … aerodromes and ground aids … and accident and incident investigation. Improvements in these areas should have priority in the [Caribbean subregion] and [South American subregion] due to the continuous growth of commercial air transport operations being forecast. …

"The average effective implementation [of critical elements of state safety oversight] in the Pan American Region … increased from 65.2 percent in 2010 to 69.18 percent as of February 2015. This was mainly due to improvement … achieved by the states audited since 2010. According to ICAO, states [in 2015] should target their efforts to increase and maintain effective implementation above 60 percent."

Some of the most advanced predictive metrics and analyses available to RASG-PA come from the agreements involving the ASIAS program and IATA. So far, U.S. airlines have contributed de-identified data from their flights to/from specific non-U.S. airports within the Pan American Region.

The 2015 annual safety report said, "ASIAS analysis was conducted using [three years of flight data] provided by … 30 North American airlines that included operations in aerodromes with the following criteria: at least two airlines, each operating with 360 flights or greater; runways with at least 95 percent [usage]; and airplane fleet groups of three or more airlines operating in the [Caribbean] and [South American] Regions. … IATA provided Flight Data eXchange (FDX) data, to show 2013 [Latin American and Caribbean] regional trends of some of the top accident categories' precursors from Latin American and Caribbean airlines."

In summary, RASG-PA has evolved in a relatively few years from being able to utilize mainly reactive safety data and proactive ICAO audits in 2009 — with limited or no data about precursors within airlines' or states' systems — to routinely working in 2015 with predictive data that set the stage for extensive use of state or subregion sources.

Notes

1. ICAO. *Regional Report: The Americas.* 2010. RASG-PA. *Annual Safety Report, Second Edition.* September 2011.
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4. RASG-PA. *Annual Safety Report, Fifth Edition.* May 2015.
5. RASG-PA. *Summary of Discussions: Sixth RASG-PA Aviation Safety Team Meeting.* Dec. 16–17, 2014.
6. RASG-PA. *Final Report: Eighth RASG-PA Annual Plenary Meeting.* Medellín Colombia, June 25, 2015.

Sharing Data, Improving Safety

BY FRANK JACKMAN

PASO, a flight operational quality assurance (FOQA) information sharing program, has had a demonstrable impact on safety at San José, Costa Rica's Juan Santamaría International Airport, and supporters would like to see the program expanded geographically and in terms of the type of data that is collected, analyzed and shared, according to interviews by *AeroSafety World,* International Civil Aviation Organization (ICAO) working papers and other documents.

PASO is the Spanish acronym for Programa de Acción de la Seguridad Operacional, or Safety Action Program. The pilot program that eventually became PASO was first discussed during an ICAO Global Aviation Safety

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Roadmap workshop in May 2008 in Bogotá, Colombia. In November, at the first ICAO Regional Aviation Safety Group–Pan America (RASG-PA) meeting, the project was discussed and approved, and COCESNA/ACSA (Central American Corporation for Air Navigation Services/Central American Agency for Aeronautics Safety) was selected to implement the program. Implementation resulted in a partnership involving COCESNA/ACSA, an air carrier operating in Costa Rica and the Dirección General de Aviación Civil (DGAC) of Costa Rica.[1,2]

The project initially was named RASG-PA Project 3, but was later changed to GSI-12 to reflect its alignment with Global Safety Initiative 12 — use of technology to enhance safety — from a then-current version of the *ICAO Global Aviation Safety Plan.* The project now usually is referred to as PASO.

While PASO had early backing from RASG-PA, as well as from Airbus and ALTA (Latin American and Caribbean Air Transport Association), initial support was not universal, according to Rodrigo Brenes, a former airline captain and now safety manager at ACSA, who — along with Frazier Rodríguez, safety coordinator, state safety program in Costa Rica's DGAC — recently discussed PASO with *ASW.* At that first RASG-PA meeting, "we said it was very important for operators to share" flight operations data with regulators, Brenes said. "I remember the reaction from some was 'over my dead body.'" Early obstacles that had to be overcome included the operators' mistrust of the DGAC and a lack of motivation among potential stakeholders to participate in the program.[3]

The fundamental objectives of the COCESNA/ACSA-DGAC-operator partnership are to share information among the parties; identify and mitigate operational safety hazards; monitor regional safety trends in aircraft operations; work in a cooperative, collaborative and coordinated fashion in partnership with stakeholders; and develop mutual trust among the stakeholders.[4]

The flight data used in PASO are de-identified. A memorandum of understanding (MOU) signed by the initial stakeholders in 2010 provides for nonpunitive reporting and stipulates that safety issues will be resolved through mitigation rather than through punitive or disciplinary actions. Overall, there is an effort to balance the interests of all the participants, according to COCESNA/ACSA documents.[5]

"We developed an MOU in which the operator we had at that time, the civil aviation authority and ACSA decided we can sit down and start looking at part of that [flight operations] information," Brenes said. "The two key words here are *trust* and *sharing.* We have been working this way little by little. … The state is not seen as a policeman, but as someone you can trust."

PASO was created not because of one particular event but because the authorities knew the operators were checking the data and learning lessons, and "we thought, 'why are these guys learning lessons and we are not? And why are they not sharing with us?'" Brenes said. Among the likely reasons was the possibility of punishment or sanction from the DGAC, he said, adding, "We decided that sharing this [information] is more important that giving a punishment."

As of late 2014, more than two dozen PASO meetings had been conducted to analyze and manage negative trends highlighted by operators participating in the program. According to Rodríguez, PASO meetings initially were held on a monthly basis, but that has been changed to every other month to give stakeholders more time to work on issues that are identified. Also, since 2012, PASO has worked in coordination with Costa Rica's runway safety team on issues identified at Juan Santamaría International Airport. In turn, the runway safety team has worked with senior management at the DGAC to raise awareness of identified hazards and associated risk mitigation measures, according to working papers presented by COCESNA/ACSA at the ICAO High Level Safety Conference (HLSC) in February and a RASG-PA executive steering committee meeting in March. [6, 7]

"Runway safety teams are a valuable partner," Rodríguez said. "This is part of the sharing. PASO is really a sharing program."

The working paper presented at the HLSC in Montreal outlined three safety issues that were, or are in the process of being, mitigated at Juan Santamaría. The first issue involved operator concern over the number and severity of traffic-alert and collision avoidance system (TCAS) resolution advisories (RAs) they were experiencing in the terminal area of Juan Santamaría. A number of mitigation measures were proposed, such as restructuring the Juan Santamaría terminal control area (TMA) by creating a visual flight rules corridor for general aviation traffic using the secondary San José airport — Tobías Bolaños International Airport, also known as Pavas International Airport after its location in the Pavas district of San José — and designing a new procedure for circling to land on Juan Santamaría's Runway 25.[8]

The results of the mitigation measures were positive, according to COCESNA/ACSA data, which show that the number of RAs declined from 13 in 2009 to four in 2010. The average number of TCAS RAs in the Juan Santamaría TMA has held steady at just under four per year since 2010, and the severity of events has declined as well. Most are now "adjust vertical speed, adjust" RAs.[9]

In a second example, the analysis of FOQA data for operators participating in PASO showed a large number of takeoffs and landings with excessive tail winds in operations at Juan Santamaría. Working with the runway safety team, PASO compared wind readings communicated from the control tower to flight crews with wind-related data extracted from the on-board aircraft communications addressing and reporting system (ACARS) and operators' flight data analysis systems. PASO also analyzed anemometer use and maintenance information; the anemometers, radio antennas and other equipment were checked for physical condition, and the civil aviation authority was asked to check that anemometer heights complied with ICAO Annex 3, *Meteorological Service for International Air Navigation*, Chapter 4.

The analysis showed a high range of error for data from meteorological stations located near the threshold of Juan Santamaría's Runway 07. These data are used in wind direction and wind speed readings in the control tower. It was also determined, using high-precision global positioning system equipment, that the actual locations of the anemometers did not match the published locations, and that the equipment heights did not comply with Annex 3. As a result, it was recommended that three anemometers — one at each end of the runway, and one at the center — be installed and that the new locations be published.[10]

The runway safety team in late 2013 was charged with carrying out the recommendations and submitting a report to PASO when completed. According to COCESNA/ACSA data, there were 185 excessive tail wind events in 2014, of which 115 involved excessive tail wind on takeoff and 70 involved excessive tail wind on landing. The number of events is not expected to decline until the recommended infrastructure changes are completed.

In the third example, operators in 2012 reported an issue with flight crews conducting instrument landing system (ILS) approaches to Runway 07. The operators detected a discrepancy between the electronic and visual glide paths when flying near the minimum descent altitude and when the flight crew have visual references and are transitioning to the precision approach path indicators (PAPIs). Crews following the PAPI lights were getting indications to stay above the glide path depicted on the approach profile view, resulting in situations in which the pilots would tend to pitch down the aircraft to fly the PAPI glide path, increasing vertical speed to 1,000 fpm or greater, possibly resulting in unstabilized approaches and increasing the risk of runway safety events in the form of hard landings, long landings, short landings and runway excursions.

After analyzing the information and performing an analysis, it was determined that the PAPI lights at Juan Santamaría were not calibrated correctly because their calibration had not been included in the contract for radio navigation and calibration services. The contract was amended and the calibration carried out, and since then, there has been a "considerable reduction" of related FOQA events.[11]

"As a state, we coordinated with COCESNA, which maintains the PAPI lights, and after they were calibrated, the operator saw a lot of improvement in their approaches," Rodríguez said.

'This new way of thinking means, little by little, we need to change the safety culture.'

In discussing PASO, Brenes said, "We thought maybe we were going to see a lot of errors on the part of the operators." Of course, there were errors, he said, but as investigations continued to find the root causes, it was discovered that in some cases, the errors were caused by the state having done or not done something in the past; he pointed specifically to the wind indicators and the PAPI lights as examples. As the regulator and airport worked to correct the issues, "we started gaining that trust" with the operator, said Rodríguez.

Since its inception, PASO has carried out its analysis and management of risks primarily through the use of FOQA data and information, but it has begun obtaining other types of information about safety-related events. "As a result, there is a need for this programme to evolve towards a more comprehensive coverage of events, beyond the scope of those detected through use of technology," according to a COCESNA/ACSA working paper that suggests voluntary reports from technical personnel also be considered. COCESNA/ACSA also would like to see the program extended to other countries.[12]

"Through the application of PASO, it has been demonstrated that the joint effort with the industry, authorities and other safety improvement groups, such as airport [runway safety teams] creates a synergy [resulting] in more effective and comprehensive risk mitigation, which … otherwise could not have been achieved by individual efforts."[13]

"Some places are resistant to change," Brenes said. "This new way of thinking means, little by little, we need to change the safety culture. This is one of our dreams, to have more groups like [PASO] in which the civil aviation authority can sit with the operator and share safety information."

Notes

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11. Ibid.
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13. Ibid.

British Airways (BA) has taken steps to mitigate human factors–related risk in its line maintenance operations by applying lessons learned during the investigation of a 2013 accident involving one of its Airbus A319s.

The airplane departed London Heathrow Airport (LHR) on May 24, 2013, with both sets of fan cowling doors on its two International Aero Engines V2500 engines unlatched, the U.K. Air Accidents Investigation Branch (AAIB) said in its final report on the accident.[1] The doors detached during takeoff, and the flight crew returned to LHR, shutting down the right engine to extinguish a fire fed by leaking fuel along the way. The aircraft arrived safely, with all 75 passengers and five crewmembers evacuating the aircraft after it came to a stop on the runway.

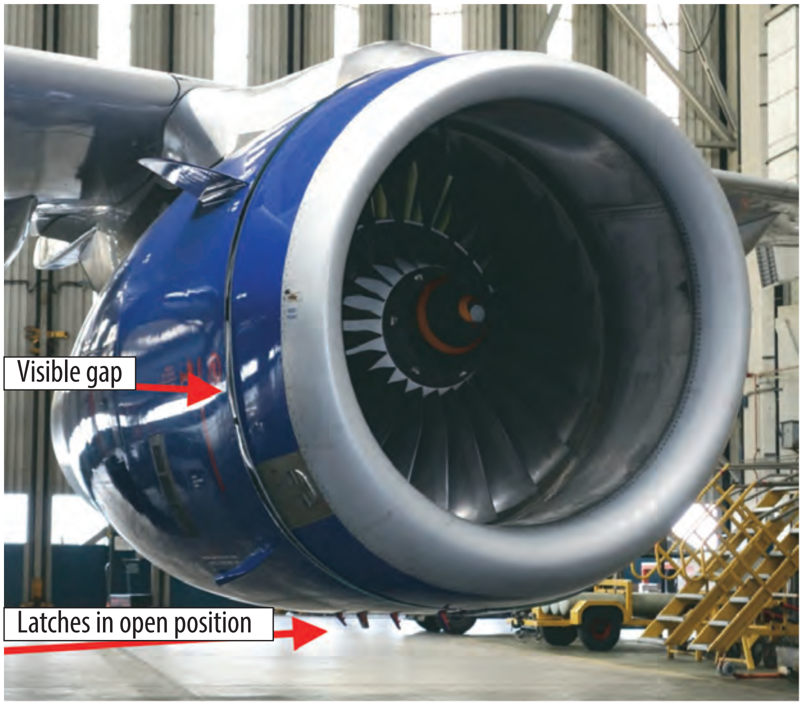
AAIB's probe pinpointed two primary causal factors in the accident: Two technicians who serviced the airplane "did not comply with the applicable AMM [aircraft maintenance manual] procedures," and pre-flight walk-around inspections by a tug driver and the flight's first officer "did not identify that fan cowl doors on both engines were unlatched."

The report also noted three contributing factors: the fan cowling door latch design; the position in which the technicians left the latches — a configuration that was intended to make follow-up maintenance easier but that made the

FAST Fixes

BY SEAN BRODERICK

U.K. AAIB cites maintenance human factors after Airbus A319 fan cowling doors detach during takeoff.



unlatched condition harder to notice; and faded paint on the airplane's latches that also made their position harder to detect.

AAIB made five recommendations that addressed the latch's design and certification standards, BA's crew training on in-flight damage assessments, the carrier's evacuation procedures and industrywide maintenance technician fatigue risk management systems.

Also, two general issues combined to create a series of maintenance human factors issues that laid the groundwork for the occurrence. One, which AAIB concluded was significant enough to be cited as a contributing factor, was the A320-family fan cowling door latch design. As a result of the probe and related incident analysis, Airbus is working on retrofits and forward-fit modifications on the system (see A320 Fan Cowling Latch, p. 28).

The other factor was BA's overnight line maintenance protocol. AAIB neither identified BA's organizational procedures as a contributing factor to the accident nor addressed any of its five recommendations to the carrier's maintenance and engineering division. But the investigation helped BA identify several areas that it determined needed to be strengthened based on AAIB's probe, and the airline has made changes, according to the AAIB's report.

First Flight

The fan cowling door loss occurred on the airplane's first scheduled departure on the day of the accident. The work that led to the fan cowling doors being left unlatched was part of a scheduled overnight maintenance check package.

The aircraft was one of six assigned to two BA maintenance employees—identified as Technicians A and B in AAIB's report — working their shifts as limited maintenance authority (LMA) technicians. Also assigned to the aircraft were B1 licensed aircraft engineers (LAEs), responsible for "scheduled and defect-driven mechanical maintenance outside the scope of LMA work," and B2 LAEs, responsible for avionics systems work certification. LAEs only worked on aircraft when needed, and "no one individual had effective oversight of the work undertaken on the aircraft as a whole," the AAIB report said.

The overnight shift in question was from 1845 local time on May 23 to 0645 on May 24. The pair was assigned work on six aircraft: two A319s, two A320s, an A321 and a Boeing 767. Each required daily maintenance checks, and two of them — the accident airplane and an A321 — also required weekly checks. Both technicians later told AAIB that the workload was not "unusual or excessive," and both considered it achievable.

Each of the six aircraft was parked within LHR's Terminal 5 complex. Four of them were at the main Terminal 5 building, one was at Terminal 5B, and one was at Terminal 5C. (One of the aircraft that the technicians worked on, an A320, was a late addition to their list when an aircraft originally assigned to them ended up not coming to LHR.) The two airplanes undergoing weekly checks were parked on the east side of the main Terminal 5 building, at stands 513 and 517, respectively.

Aircraft assignments did not come with ancillary information, such as "the number and scope of any recently incurred defects," AAIB found. "This encouraged technicians to prioritize those aircraft scheduled for weekly checks (or larger aircraft, such as 767s and A321s) early in their shift, to assess the magnitude of any additional work required that might impact the progress of their other tasks during the shift."

Technicians A and B began their work traveling in a single operations vehicle, and opted to start at Terminal 5B, with a daily check on the 767. They then moved to the accident airplane's stand. The aircraft arrived at 2138.

Shortly after the A319's engines were shut down, the technicians checked integrated drive generator (IDG) oil levels. Following AMM procedures, Technician A went to the left engine, unlatched the inboard fan cowling door, and raised it high enough to see the IDG oil level indicator. He concluded the IDG needed oil. Technician A lowered the door to its hold-open position — one of five possible positions for the door/latch combination — but did not close or latch it. Technician B performed the same check on the right engine, and determined that it needed oil as well. He also lowered the door to the hold-open position and left it there.

The oil and a special gun to service the IDGs were not in the technicians' service vehicle. While the IDG oil level inspection is part of all A320-family weekly checks, the oil rarely needs topping off, or "uplifting." This, Technician A told the AAIB, is why the oil and oil gun were not routinely carried on overnight service vehicles, even when A320 weekly checks were on the schedule. (A BA analysis done as part of the investigation found that adding oil was needed on about 3 percent of A320-family weekly checks.)

The technicians decided to finish the rest of the accident airplane's daily and weekly service, move on to other aircraft, and come back to the A319 later in the shift after obtaining the needed supplies. Technician A entered the airplane's flight deck and completed a technical log entry for the daily check, marking the time at 2300. He then made an open entry for the weekly check, but did not make a required entry for the IDG work.

"If an IDG oil uplift was required, an open defect entry relating to the required uplift had to be entered in the technical log, and could only be closed and certified when the oil uplift had been completed, and the additional oil quantity determined," AAIB said.

BA's AMM did not require a separate entry to record the opening of fan cowling doors. But it did call for warning notices to be placed in the cockpit before doors are opened. No notices were placed in the cockpit.

"Such warning notices would have been seen by the flight crew … during their preparation for the flight and would have been considered abnormal, requiring follow-up action," AAIB noted.

After their initial stop at the accident airplane, next on the technicians' list was the A321's daily and weekly checks. They then moved on to daily checks on another A319 and an A320. Following a break, the technicians collected a second vehicle and headed back to work.

During the break, Technician B checked the BA engineering materials stores near the break room in Terminal 5A, but could not find the needed IDG oil and gun. When the break ended, Technician B drove his vehicle to an ancillary stores location located on the other side of Terminal 5C to find the oil and gun. Technician A requested that they meet at the final aircraft of the night, an A320 on stand 509, on the same side of Terminal 5 as the accident airplane.

After completing the stand 509 A320's daily check, the technicians set off for the accident airplane, with Technician A leading and Technician B following. But instead of stopping at stand 513, they proceeded to stand 517 and the A321 that had its weekly check.

Upon pulling up to the stand, the technicians did not verify the aircraft's registration before attempting to complete the IDG servicing. When they found the fan cowling doors closed, they thought it was "strange," the

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A320 Fan Cowling Latch

This 2013 Heathrow accident was the 35th instance of in-flight fan cowling door detachment on Airbus A320-family aircraft — including 21 events for aircraft fitted with IAE V2500 engines and 13 events for aircraft fitted with CFM International CFM56 engines — according to the U.K. Air Accidents Investigation Branch (AAIB), underscoring an issue that can be traced to the aircraft's certification.

The certification basis applied to the A320 family categorized fan cowling doors as structural elements. This meant the manufacturer had to demonstrate the cowlings could sustain any loads likely to be experienced in service without rupturing or permanent deformation.

"Once this has been satisfactorily demonstrated by testing, the theoretical probability of failure is zero, and does not need to be considered further," AAIB explained in its final report on the accident.

Systems certification standards, on the other hand, do not permit eliminating systems failures as possibilities. Applicants therefore must determine the risk of failure using system safety assessment (SSA). Once risk probabilities are determined, mitigation techniques are adopted, ranging from regular maintenance checks to flight deck warnings.

Other exterior openings — such as access panels, fuselage doors and hatches — are systems subject to SSAs. But because fan cowling doors are considered structural, their certification testing did not include evaluating the ramifications of a maintenance error that would leave doors open.

In 2000, AAIB recommended that France's Direction Générale de l'Aviation Civile (DGAC) and Airbus consider a flight deck warning system to detect unlatched fan cowling doors. But DGAC, concerned about unintended consequences such as false alarms that might result in rejected takeoffs, opted to mandate latching system modifications. Over the next decade, several changes were either recommended or mandated, including "hold open" devices that — when used — created a visible gap between an open cowling door and the engine, and fluorescent paint on the latches to make them more visible when not flush against the cowling, indicating they are unlatched. Airbus also revised the A320 *Aircraft Maintenance Manual* to warn against closing fan cowling doors without latching them if a maintenance task is interrupted, and incorporated changes on the production line.

The changes didn't sufficiently reduce the risk. Three more fan cowling door events occurred after the Heathrow accident and before AAIB's release of the final report.

As part of the probe, Airbus took its most detailed look yet at the problem and concluded that more changes were needed to mitigate the risk of the fan cowling doors being left open.

Airbus is introducing a new latch with a key, which will be installed on A320neo aircraft starting in 2016 and made available as a retrofit. Airbus said the A320neo "will incorporate a mechanical solution to indicate the fan cowl doors are unlatched," as well as a cockpit warning system.

— SB

AAIB report said. But Technician B relayed an instance in which he took a break while working on an engine, only to find the cowling doors closed when he returned.

The technicians opened the A321's fan cowling doors and double-checked the IDG oil. It did not need servicing. The technicians — still believing they were back at the accident airplane — reasoned that the engines had cooled in the three hours since their original check, allowing residual oil to drain back into the oil sump.

Concluding that their work was done, the technicians closed and latched the cowling doors on both engines, following required procedures. The aircraft's technical log had been taken to an engineering office for a routine weekly administrative check, a task that was in line with the carrier's Terminal 5 short-haul line maintenance procedures for weekly checks.

When they returned to the crew room, their tasks included completing the weekly check worksheet and technical log for the accident airplane. The technicians also relayed their story about finding the fan cowling doors closed and the change in oil levels. Nobody questioned whether the technicians had returned to the correct aircraft.

AAIB's report identifies the technicians' failure to follow the AMM, as noted, as one of the two causal factors in the accident. But BA recognized that many factors endemic to its procedures — or not accounted for in the procedures — set the stage for the technicians' mistakes. In the months after the accident, BA made a concerted effort to change its system.

The most significant change was organizing line maintenance teams. "Through the recruitment of 26 additional staff, the line maintenance team structure has been altered to form individual teams" of [LMA], B1 and B2 staff "operating under the oversight of a maintenance supervisor," the AAIB report explained. "Aircraft assigned for maintenance will be processed by a single team providing improved supervision and oversight of maintenance tasks."

The carrier's A320 line maintenance procedures have been updated to require open technical log entries whenever fan cowling doors have been opened. BA also has staggered IDG checks during weekly checks "to prevent the possibility of both sets of fan cowl doors having to be opened on any one occasion," AAIB said.

BA also created special "wet" and "dry" kits especially for A320 daily and weekly checks. "The non-availability of equipment … nearby to [the accident airplane] may have played a role" in the technicians leaving the fan cowling doors open "by inciting the technicians to postpone completion of the work until they had an opportunity to collect the IDG gun from stores," the AAIB report said. "The company's vehicles have been modified to carry the kits and a replenishment process established to enable engineering staff to collect serviceable kits prior to commencing maintenance work," the report said.

BA has taken steps to boost general awareness of aircraft undergoing line maintenance. It mandates that technicians performing line maintenance on any short-haul aircraft place a red card marked "AIRCRAFT IN MAINTENANCE" along with the aircraft's registration on the flight deck pedestal. It also requires special gaiters, or high-visibility covers, to be placed over the nosewheel of any aircraft on which "there has been a break in an airworthiness-related task," AAIB said. Each gaiter includes an identification number belonging to the maintenance team working on the aircraft.

During its probe, BA discovered that aircraft "swap errors" (mistakes in which maintenance personnel confuse one airplane for another) occasionally occurred during line maintenance, but these events were rarely reported. Several factors played a role here: the fact that the errors were considered routine and usually discovered before leading to any notable ramifications, and that BA's occurrence reporting system did not have a category for tracking swap errors. In the case of the accident airplane, the fact that the same technicians were assigned to both aircraft removed the possibility that other workers assigned to service the other airplane would detect the errors.

"The low level of reporting of aircraft swap error events stemmed from these behaviors having become accepted as a 'norm' within the line maintenance operation," AAIB noted. "As a result, there was limited opportunity to introduce mitigating actions."

BA has added a category in its reporting scheme for recording aircraft swap errors.

AAIB noted that Technicians A and B had several opportunities to detect their swap error, but failed to follow proper procedures. Perhaps the greatest chance for them to catch their mistake — placing the technical logbooks in every aircraft with open tasks — was taken from them by BA's logbook review practice. "This working practice inadvertently removed the main safety barrier for trapping the aircraft swap error, as it is probable that the error would have been discovered had the technicians attempted to sign for [the accident airplane's] weekly check in [the other airplane's] technical log on board the aircraft." AAIB's probe found different logbook protocols within BA, even at LHR. The short-haul line maintenance team was the only one that removed logbooks for administrative checks. BA now keeps technical logs in all aircraft during line maintenance activity.

BA's application of lessons learned from the accident go beyond its procedures. The carrier's human factors training has been updated to reflect what it gleaned from the occurrence and subsequent investigation.

The carrier also created an engineering safety culture team "to conduct on-the-job competence assessments of maintenance staff across all production areas on an unannounced, random basis," the accident report said. "The assessment includes checking interpretation of procedures, observation of tasks accomplished and attitudes toward safety. Where areas of improvement are identified, the team will focus on improvement of procedures and supporting systems."

Sean Broderick, a former editorial staff member of the American Association of Airport Executives and the civil aviation–maintenance, repair and overhaul team of Aviation Week & Space Technology *magazine, is a freelance aviation journalist.*

Note

1 AAIB. "Report on the Accident to Airbus A319–131, G-EUOE; London Heathrow Airport; 24 May 2013." Aircraft Accident Report 01/2015, July 2015.

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Risk-Based Decision Making

BY WAYNE ROSENKRANS

FAA maintenance inspectors will be trained to favor well-reasoned risk mitigations, if possible, instead of grounding aircraft fleets.

Several factors have prompted principal maintenance inspectors in the U.S. Federal Aviation Administration (FAA) to avoid precipitous enforcement action against air carriers, such as grounding an aircraft fleet, if alternative corrective action resolves the safety issue. According to Keith Frable, FAA principal maintenance inspector for United Airlines, *risk-based decision making,* is being introduced as "a new way forward … a new path where we are not inconveniencing passengers but we're still having continual operational safety at the airlines," he said. Frable spoke in April at the World Aviation Training Conference and Tradeshow (WATS 2015) in Orlando, Florida, U.S.

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The policy shift considered poor decisions about grounding airline fleets[1] based on non-risk-related practices, reductions in the number of FAA maintenance inspectors, reductions in the number of maintenance professionals at airlines, and the numbers of new maintenance engineers added in the context of required qualifications and employee turnover. "It was an initiative about a year and a half ago to get a team together and start this process; however, the training [for some categories of inspectors] is not out yet," he said in April.

Risk-based decision making involves FAA flight standards district offices, principal maintenance inspectors and their ongoing relationship with the airline counterparts that they oversee. This means airline maintenance leaders and maintenance technicians — as representatives of the regulated entity — will play an important role in adjusting local safety cultures, in communicating and in providing information that enables the newer process to work as intended, he said.

Prescriptive Culture

Before being hired to oversee airline maintenance operations under Federal Aviation Regulations (FARs) Part 121, FAA maintenance inspectors had been indoctrinated for years in prescriptive system safety. "We teach the regulations [under that philosophy]. We teach people to follow the regulations. … We teach people to follow a prescribed procedure in the aircraft maintenance manual. … We teach people to follow the airworthiness directive [AD]. … We teach people to follow the checklists and to stick to prescriptive language. … This culture of … adherence to rules and regulations was developed way before [most of today's aviation safety inspectors, with average age in their 50s and 60s, were hired]," he said.

Frable's presentation objective, he noted, was explaining "why risk-based decision making is so new for Flight Standards and why [it is] such a struggle to change the culture of Flight Standards. … This is very foreign to [principal operations inspectors] to be able to make those decisions of not grounding an airplane because an airworthiness directive isn't accomplished on an airplane. Their initial reaction is ground it, then fix it, then fly it."

To launch the process while training catches up with policy, Frable made other requests of the attendees. "As an operator, you can also provide risk-based analysis to your [principal maintenance inspectors]. … You need to be in the forefront … I told United [Airlines], 'It's your operation. You have the problem. … You operate the airplanes. Tell me the risk analysis you performed, the SMS [safety management system] process you used, what the initial risk assessment is [and] what the mitigations are going to be. … We don't always know [at FAA] the proper mitigation and then what's going to be the [post-mitigation action]."

Principal maintenance inspectors need all the relevant information to determine what the level of risk would be in continuing to operate affected airplanes, whether flight operations should be shut down and whether FAA and the operator need to put fixes in place right away, he said, noting that FARs Part 135, commuter and on-demand operations, and Part 145 repair stations, are not required to have a safety management system (SMS) but stand to benefit from incorporating SMS components into their operations.

"The better you get [with SMS,] the better you're going to help the FAA inspector help you make … sound decisions based on identified risk. … If you come up with a risk-based decision [and] a risk-based mitigation, you have to stick to that plan," Frable said. "You'll want to make that decision based on the likelihood and severity of the event, and what that really means to your company."

Gradual Implementation

Frable said this cultural shift will take time and experience, as well as training of FAA principal maintenance inspectors. "[The question now is,] 'How can we get them past initial reactions to violate you [i.e., to allege airline noncompliance with a regulation or a requirement] or to ground your airplanes without having severe consequences to the flying public and to your operation?' … How do we get in there and change the way they think about this entire process?"

Examples of how the process works — as part of Flight Standards' transition from the Air Transportation Oversight System to the Safety Assurance System (SAS) of risk-based analysis — were taken from real-life stories of FAA experiences at United Airlines, "where we've worked through these issues and they've let me release this information … because it was done in a methodical, thorough process," he said.

"For the Part 135 inspector and the Part 145 inspector, it incorporates decisions based on risk, so they have to go out and do their inspection, bring that data back and then decide what implications that has on the operation of your fleet or in the operation of your certificate. There's no training for them on that, so it's a … very big gap."

Thrust Reverser Example

Regarding the FAA–United Airlines relationship while implementing risk-based decision making, Frable said, "We have [real-time] feedback, we have meetings. [We ask,] 'Where are we on the project?' if they put a mitigation in place. 'Are we seeing the event [recur]? Has [your] mitigation worked?'" (See "Nonpunitive Interviews Yield Insights Into Aircraft Ground Damage," p. 34.)

The new process came into sharp focus in the case of noncompliance with an AD concerning thrust reversers. The stated intent in the AD was to prevent a thrust reverser from deploying in flight, he said, and the wording of the intent itself implied high risk.

Frable said, "They didn't perform an AD task, so their initial conversation was, 'We missed the AD cycle on these airplanes because the [task] card wasn't done, whatever the reason. And now we have airplanes flying out there with the potential of a thrust reverser opening up in flight because we didn't accomplish the AD.'"

He said that, historically, a principal maintenance inspector's immediate reaction likely

'If you come up with a risk-based decision [and] a risk-based mitigation, you have to stick to that plan.'

Nonpunitive Interviews Yield Insights Into Aircraft Ground Damage

To investigate an uptick in aircraft damage in the ground environment, United Airlines recently cross-referenced its internal safety-intelligence sources, including data from flight operational quality assurance (FOQA), aircraft-damage databases, injury databases, line operations safety audit (LOSA) observations, data on compliance with standard operating procedures (SOPs), quality assurance audit data, and employees' voluntary reports to aviation safety action programs (ASAPs).

The results led to insightful, nonpunitive interviews with employees involved in aircraft damage events, said Lisa Crocket, senior manager, quality assurance for line operations safety assessment, United Airlines. "The data I have so far already give a completely different picture of what [SOP] compliance looks like and why. We're going from [assuming] complacency to [saying,] 'Holy smokes, they didn't have the materials they needed!' That is … a completely different way to mitigate the issue." She spoke in April at the World Aviation Training Conference and Tradeshow (WATS 2015) in Orlando, Florida, U.S.

"We collected data and used that data to point to very specific systemic fixes. ASAP can tell you what's wrong. LOSA can tell you how often it happens in the real world. I hope you use this example to look beyond the 'who' and get to the 'what' — and find a model that works for you, that helps you get to risk-based decision making," Crocket told the audience. "I hope [trainers and training content developers] actually incorporate [our example] into some of your training so you can see these underlying factors where people are not compliant, [and] find a way to train those out of your organization. … We always want get to the 'why.' How did it happen?"

She described her study as involving an unidentified organization within the airline that had resisted previous efforts to resolve this ground-damage trend, and some employees had told her that the problem seemed too large to fix. "They didn't necessarily see it as a high risk or they didn't understand the 'why' [of] it. [They were] great at telling us what the problem was and how often it happened, but [they] weren't getting to the correction."

Previous attempts had recognized that equipment failures and malfunctions sometimes were factors in a specific case, Crocket said. "But largely, the problem … was that employees failed to follow standard operating procedures. … They were being complacent. …Complacency [seemed to be] a big issue, but how do we know it's really complacency? Is it an assumption? Can we measure it? … We also wondered if there were other factors underneath that were causing people to not comply with procedures.

"When we found nonconformances by employees, we would fix them. [We told ourselves,] 'So this employee didn't follow the SOP and we worked with that employee, we trained them, we disciplined [them]. Whatever the path was — that employee is fixed. Then [at another] location, the same thing happened: aircraft damage, nonconformance to the standard operating procedures, [and] we fixed that one."

She became dissatisfied with the prospect of repeating this cycle without resolving issues at one time for the entire airline. "We decided to look at the problem systemically — when we found factors, we would map them to a human factors model [that] encourages us to look not only at 'what happened' and 'why it happened' on the employee level, but also look for factors higher in the organization," Crocket said. "It's a little harder to [turn] that ship, but you're fixing [the issue] across the organization."

To look deeper into causal factors, she proposed a hybrid of well-established, peer-to-peer LOSA techniques and a quality assurance audit. "When we found a nonconformance, our goal was to interview the employee nonpunitively. … Something happens in the real world that prevents employees from following that procedure [learned in training,] or something impacts their work out in the organization that causes them to make different decisions. … We visited 19 locations and collected 225 observations [and] great interview notes from people who didn't conform to SOP. [I told interviewees,] 'Listen, we have something to learn [and] I'm gathering data. [Can you] help me understand why you took this path instead of this path?' … I cannot tell you how rich the data are when you don't 'hammer' the person … when you give them free reign to talk."

Several factors driving SOP nonconformance emerged from these interviews and the related sources of factual information. "The first driver of nonconformance … was called a *decision error* — when the employee consciously decides to vary from that procedure. It's the wrong decision, but it's a decision. [Some said,] 'I did it this way because I was in a hurry. I did it this way to get the plane out because we were behind.

"The second [driver was called] a *skill-based error.* … It's something you do time after time, and you hardly even have to think about it. It's the same thing as 'being on autopilot.' We would approach an employee and say, 'We noticed you missed a step … and they would say, '[No,] I did that.' And we said, 'You didn't, actually. … That's part of your checklist, and you missed that. So we dug deeper to ensure that they weren't just kind of smoking us [i.e., trying to mislead investigators]. If they really believed that they had completed

Continued on p. 35

would be to say, "Let's shut down 85 airplanes around the world, inconvenience passengers and shut the operation down until we get that checked out."

In the risk-based decision making paradigm, inspectors make a more cautious and deliberate assessment first. In the example, United Airlines brought a sound decision to the discussion derived from detailed analysis of the thrust reverser situation, he said.

"The [uncompleted] task was an ancillary task; it wasn't part of the AD. It was a task that was done on a secondary backup system that had a 4,000-hour flight-cycle check [interval] on it. … Where's the criticality on a 4,000-hour check? [It's] pretty minor. [The maintenance task is not done] to prevent the [in-flight thrust reverser deployment]. It is there as a backup check. You [check] a pin [on a circuit board and] make sure [you don't] have voltage at a certain spot. … Even if voltage is there, it wouldn't contribute to what the AD was for."

Instead of grounding aircraft, FAA permitted a staged-but-rapid assessment of the risk factors by United Airlines, starting on a Friday night with

Nonpunitive Interviews Yield Insights Into Aircraft Ground Damage

the checklist, that was a skill-based error, and we classified it as that.

"The third driver of nonconformance … was called a *routine violation*. … It's a variance from the rule [because I know] I'm not going to get in trouble and they let me [deviate]. We found that was a high driver."

Compared with these insights, attributing aircraft-damage events to the vague category of complacency fails to explain or solve correctable issues. "[As to deliberate choices in] decision making, the skill-based error, being on autopilot and routine violations, we can train and we can set up processes to engineer those out of our company," Crocket said.

Investigators recognized another causal level in some interviews. These background factors — overconfidence, lack of proficiency and complacency — came into play by influencing the employee to decide not to comply with the SOP. "Overconfidence [is apparent if the person says,] 'I've been doing this job for 30 years; nothing bad ever happened. I've never hit an airplane; I'm fine. … [Or they say,] 'I haven't worked in this area for a while.' Largely, in training [on belt loaders, for example, or] whatever the procedure is, they should be familiar with it. [They've done] it 1 million times, they should know how even if they haven't done it in three months."

Because of these beliefs, the airline had not recognized the actual risks of taking people out of their normal area of operation or out of their normal job position, then returning them several months later to their original position, although some struggled at first to meet the required level of communication and coordination of the team.

"We [also] did find complacency in the study. … It didn't even make it past 5 percent [of causes of aircraft damage]," she added.

With the human factors model, supervision also was addressed. Regarding inadequate supervision, the study noted cases in which supervisors were not adequately monitoring maintenance employees' work or, when monitoring, they were not reinforcing the employee's training on how to correct a known problem. "When I did the study, I was taken aback by [some supervisors'] failure to correct a known problem, which actually relates back to my routine violation."

At the highest level of the scope of the study, the LOSA staff identified aircraft damage causal factors at the organization level. "What we found in that category was either that there was no accountability or weak accountability for standard operating procedures," she said, recalling her recommendations to senior management. "We should be making sure that supervisors are out in the operation more, and that they have the tools they need to ensure that people are adhering to SOP consistently. In addition, the leadership needs to provide those supervisors with the structure to accomplish this. … Now, we have actually trained our LOSA observers to interact with the person who didn't conform to SOP so that they can grab those interview notes and use [them] so we can give 'color commentary' [i.e., background details as] to the reasons why people aren't following SOP. We just implemented this April 1, and it already has transformed how we look at what's wrong out there."

Crocket said such LOSA data are considered to be 'owned' by each stakeholder entity, such as the maintenance division, station operations or ground operations. "They own their data, and we've given them a really easy tool that — literally, in three clicks [of a computer mouse] inserts the data and ranks it by risk. … I do it on a system-wide basis so that I can take that information and roll it up to leadership as a system compliance."

In sum, noncompliance with SOPs cannot be presumed to occur solely because people are complacent or because they don't care, Crocket said, adding, "We have to find those reasons so that we can make better decisions — [through] risk-based decision making — on how to mitigate them."

— WR

four airplanes already in "remain overnight" status, including one in a hangar for a heavy maintenance check.

"If on Saturday [morning,] those four airplanes had voltage [present and so] met the … required-maintenance [criteria], then … this would raise the likelihood and, in my opinion, raise the severity. That would tell me that [United Airlines] needed to do more of those checks quicker," Frable said. "On Saturday morning, all four checked out 'good.' On Sunday, they [planned to check] another 10 [but instead of continuing checks for four to five days], all were checked [in three days, which brought them into AD compliance]. … Our risk assessment was valid, and we proved it was valid. There was no risk to the flying public, and there was no risk that [noncompliance with] this AD was going to cause the catastrophic loss of an airplane."

A similar situation at United Airlines occurred when FAA inspectors discovered that a manufacturer of auxiliary power units (APUs) had discontinued a process called the third bearing wash. FAA's immediate theoretical concern was that, potentially, this practice could have a life-limiting effect on bearings — essentially a type of damage that could lead to bearing failure and an uncontained failure of the APU.

"[We found] out that that the third bearing wash was required as a result of a [another manufacturer's] maintenance task card vetted by United Airlines," and apparently APUs were being returned to line service without the benefit of this process, although still specified in the aircraft maintenance manual. Frable worked with United Airlines engineers to check for bearing discrepancies and to rate the risk based on checking bearings from a sample of APUs.

The engineers' report at the end of this work led to a risk-based decision that potential severity was high but that probability of an unsafe outcome was extremely remote. Frable ruled that no grounding would be required, and further analysis justified the risk-based decision making. The engineers ultimately concluded that performance or nonperformance of the third bearing wash actually had no effect on safety, and that ironically, all the APUs of initial concern were in maintenance parts stores at the time. "We could have grounded airplanes. We could have made that decision based on a knee-jerk reaction," Frable said.

Hangar Nose Drop

Another event raised similar initial concerns of potentially catastrophic outcome. In this case, Frable received a late-night message saying that the nose of a United Airlines aircraft had dropped to the hangar floor during maintenance. No one was injured or killed in this ground accident. "So again … you don't shut everything down. You let the company work the process. The airplane is safe. It's in the hangar," Frable said. He visited the site to observe whether the nose gear safety pins had been inserted, and assisted otherwise in the airline's investigation the next morning.

"[Critics] could say, 'You're letting them fly around with AD noncompliances. You're letting them drop airplanes on the nose, and you're not shutting them down. You're not stopping [their investigation] process. You could say that, but in reality — if you have decisions based on risk and you have a great relationship — [this] is going to help [the airline] and it is going to help the FAA make those calls. [Airlines still] do get violated [but] that's the last thing we want to do. As a [principal maintenance inspector], am I going to violate the company [because an airplane was dropped on the nose]? Typically, I'd say no," he said.

"If you put a different person in the same position, would they make the same mistake? If the answer is 'no,' the procedures are there, the task cards are written properly, the requirement to pin the nose gear when [the airplane] comes into the hangar is there. … The company has established a protocol, everything is there. …

"So you go to the individual who made a conscious decision not to follow the procedures set forth by the company. I want [the airline] to fix the guy who was not following them … to fix that culture. I don't want [them] to fix what's already in place and what's already working. … We have an ASAP [aviation safety action program, and this situation] would be handled through ASAP."

Ultimately, post-mitigation analysis by the airline is critical in all such situations, he said. "Did it work? Was it effective? What were the lessons learned? Is there something else we should have done for that event? … If it wasn't a good, comprehensive fix and it was ineffective, how can we make it effective and what follow-up do we need to do to make that mitigation effective?" he said.

Note

1. In 2008, for example, the FAA was involved in grounding of airplanes by American Airlines, Southwest Airlines and Delta Air Lines, Frable said, adding, "[Delta's McDonnell Douglas MD-88] fleet was grounded for basically the routing of wiring in the landing gear and for [cable-sheath] tie wraps. … If you risk-rate that, was it a high risk? I would say no. The likelihood of a catastrophic event would be low and the severity would be low. … However, the decision was made based on it being [noncompliance with] an airworthiness directive and an airworthiness directive alone."

CRACKDOWN

BY LINDA WERFELMAN

The FAA has proposed its largest civil penalty ever against a UAS operator accused of unauthorized operations in congested airspace.

U.S. authorities are intensifying efforts to stop the illegal operation of unmanned aircraft systems (UAS) and model aircraft near airports and in restricted airspace, proposing a high-tech campaign to detect the aircraft and a stiff penalty against one operator.

"Education and enforcement must go hand-in-hand," said Michael G. Whitaker, deputy administrator of the U.S. Federal Aviation Administration (FAA). "Our preference is for people to voluntarily comply with regulations, but we won't hesitate to take strong enforcement actions against anyone who flies an unmanned aircraft in an unsafe or illegal manner."

Whitaker made the remarks during testimony in early October before a U.S. House of Representatives aviation subcommittee that met

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Drone in title: Federal Aviation Administration

to consider methods of ensuring aviation safety as UAS aircraft are integrated into the National Airspace System (NAS).

A day earlier, the FAA proposed what it said was the largest civil penalty ever against a UAS operator for "endangering the safety of our airspace."

The agency proposed a $1.9 million civil penalty against SkyPan International, alleging that the company conducted 65 unauthorized operations between March 21, 2012, and Dec. 15, 2014, "in some of our most congested airspace and heavily populated cities, violating airspace regulations and various operating rules. … These operations were illegal and not without risk."

In announcing the proposed penalty in October, the FAA said that the flights — photographic missions conducted over New York and Chicago — were conducted "in a careless or reckless manner so as to endanger lives or property."

All 65 flights were operated without a required airworthiness certificate and effective registration, the FAA said, adding that SkyPan also lacked a certificate of waiver or authorization for the flights. Forty-three of the flights were operated in New York's controlled airspace without an air traffic control clearance, which is required to operate in that airspace; the aircraft also lacked the required two-way radio, transponder and altitude-reporting equipment, the FAA said.

"Flying unmanned aircraft in violation of the Federal Aviation Regulations is illegal and can be dangerous," said FAA Administrator Michael Huerta. "We have the safest airspace in the world, and everyone who uses it must understand and observe our comprehensive set of rules and regulations."

SkyPan has 30 days after receiving the FAA's enforcement letter to respond to the agency's allegations.

'Clear Message'

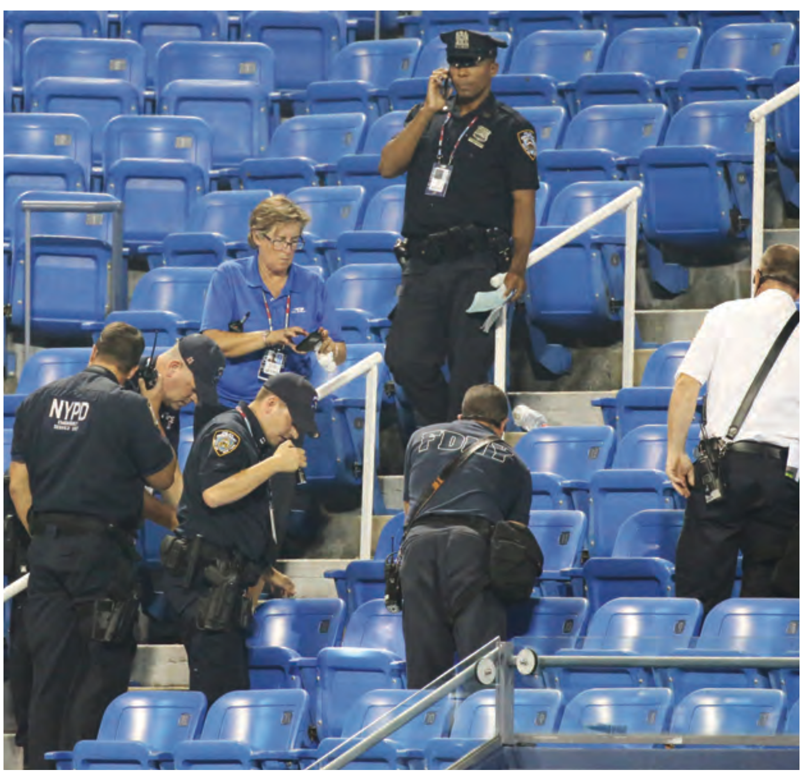
In his testimony before the House Committee on Transportation and Infrastructure's aviation subcommittee, Whitaker said that the proposed civil penalty "sends a clear message to others who might pose a safety risk — operate within the law or we will take action."

The SkyPan occurrences were among hundreds of incidents that the FAA has investigated regarding reports of UAS being operated outside existing regulations. In August, the agency released data on 765 reported UAS aircraft sightings from Nov. 13, 2014, through Aug. 20, 2015, and noted that, although most of the events were simple sightings of UAS aircraft, 27 could be considered near-midair collisions (*ASW*, 10/15, p. 30). A number of the events involved small UAS aircraft being flown in restricted airspace.

Whitaker said that — unlike SkyPan, which he said "knowingly conducted dozens of unauthorized flights" — many operators of these small UAS are "completely new to the aviation experience" and, as such, "unaware that they are operating in shared airspace."

He added, "The vast majority of these operators do not have the basic aviation training or experience required for pilots of traditional aircraft. They have no knowledge that they may be flying in controlled airspace. Some may have no recognition that their actions could have serious consequences. They are simply having fun with a toy."

The New York Police Department investigates an occurrence involving an unmanned aircraft during the US Open Tennis Championships in September 2015.



In response to lawmakers' questions, Whitaker said that the FAA is considering proposals calling for registration of UAS, but no decisions have been made. Rich Hanson, director of government and regulatory affairs for the Academy of Model Aeronautics, said that members of his organization "understand that registration at some level certainly makes sense."

Whitaker told the subcommittee that the FAA and other government agencies are reviewing their authority to identify and penalize operators of unmanned aircraft that are being flown in prohibited airspace and that they have determined that the problem is not a lack of authority to punish rogue operators.

Instead, he said, "One of the challenges with this issue is actually locating UAS operators. It's less a question of authority or magnitude of penalty. … If you look at the pilot reports, they tell us where the UAS [aircraft] is, but they don't tell us where the operator is. If you contrast that with laser strikes, the pilot usually knows exactly where that strike is coming from … which is why our emphasis has been on education."

The FAA and several organizations representing operators of model aircraft and small UAS have joined forced forces for the Know Before You Fly program, designed to provide guidance on the responsible operation of unmanned aircraft, with an emphasis on avoiding manned aircraft.

Other programs such as the No Drone Zone campaign remind operators not to take unmanned aircraft to large public gatherings such as football games and outdoor concerts, as well as other sensitive areas, including within 15 mi (24 km) of Reagan Washington National Airport — an area where a small unmanned aircraft crashed near the White House two days after the subcommittee hearing. News reports said that the operator of the quadcopter was cited by police and faces a possible fine. The report quoted the U.S. Park Police as saying that, to their knowledge, the incident marked the ninth time in 2015 that an unmanned aircraft had been flown in a national park in the Washington area.[1]

Because the educational efforts alone might not be sufficient, the FAA said in October that it has reached an agreement with information technology firm CACI International to evaluate the company's prototype UAS sensor-detection system, using it to identify unmanned aircraft being operated within 5 nm (9 km) of airports.

"Safety is always the FAA's top priority," Whitaker said, "and we are concerned about the increasing number of instances where pilots have reported seeing unmanned aircraft flying nearby."

The FAA added that an unmanned aircraft flown near a busy airport presents "an unacceptable hazard."

John Mengucci, CEO and president of U.S. operations for CACI, said that the agreement with the FAA "provides a proven way to passively detect, identify and track UAS … and their ground-based operators, in order to protect airspace from inadvertent or unlawful misuse of drones near U.S. airports."

The program "will help ensure a safe, shared airspace while supporting responsible UAS users' right to operate their aircraft," Mengucci said.

Officials are still working to finalize program details, including when the system will be tested and at which airports, Whitaker said.

He added that the agency also will evaluate the use of geo-fencing — using global positioning system information to establish areas that are off-limits to UAS flight. Manufacturers of model aircraft have begun to incorporate geofencing features into their aircraft, the Academy of Model Aeronautics says.

Many operators of these small UAS … 'have no knowledge that they may be flying in controlled airspace.'

The CACI program is part of the UAS Pathfinder Program, announced by the FAA earlier this year as a plan for the agency and the industry to "explore the next steps" in UAS operations.

The FAA's other partnerships in the Pathfinder Program are with three companies, including CNN, which is determining how UAS might be used within the operator's line of sight in newsgathering operations in urban areas.

The two other partnerships involve flights of unmanned aircraft in rural areas:

- PrecisionHawk, which is exploring how UAS flights "outside the pilot's direct vision" might allow for expanded use of unmanned aircraft in monitoring agricultural crops; and,
- BNSF Railroad, which is determining how unmanned aircraft might be used beyond the operator's line of sight to inspect rail infrastructure.

The FAA's regulatory framework 'needs to keep pace with technology.'

Regulatory Framework

In his testimony, Whitaker said that the FAA's regulatory framework "needs to keep pace with technology" and that, to accomplish that goal, the agency was continuing to review 4,500 public comments on its proposed small UAS regulations in preparation for issuing final rules.

"The rulemaking approach we are using seeks to find a balance that allows manufacturers to innovate while mitigating safety risks," Whitaker said. "We also recognize the need to be flexible and nimble in how we respond to the emerging UAS community. As technologies develop, and as operations like beyond line of sight are researched, we want to be able to move quickly to safely integrate these capabilities."

The FAA has said that it expects to issue a final rule in 2016. That rule, first proposed in February, will apply only to small UAS aircraft — those that weigh less than 55 lb (25 kg) — and is designed to allow routine use of small UAS in the aviation system.

Under the proposed rule, small UAS aircraft being flown for non-recreational purposes could be operated only during daylight, only within the operator's line of sight, at altitudes no higher than 500 ft and at speeds no faster than 100 mph (161 kph).

The proposed rule also said that UAS operators would be required to be at least 17 years old, pass an initial FAA aeronautical knowledge test and recurrent tests, obtain an unmanned aircraft operator certificate with a rating for small UAS aircraft and be vetted by the Transportation Security Administration.

The proposal included the FAA's request for public comments on whether the agency should establish a new category for "micro" UAS — systems with aircraft weighing less than 4.4 lb (2.0 kg) — that could be flown only in Class G uncontrolled airspace and only if they are at least 5 nm from any airport.

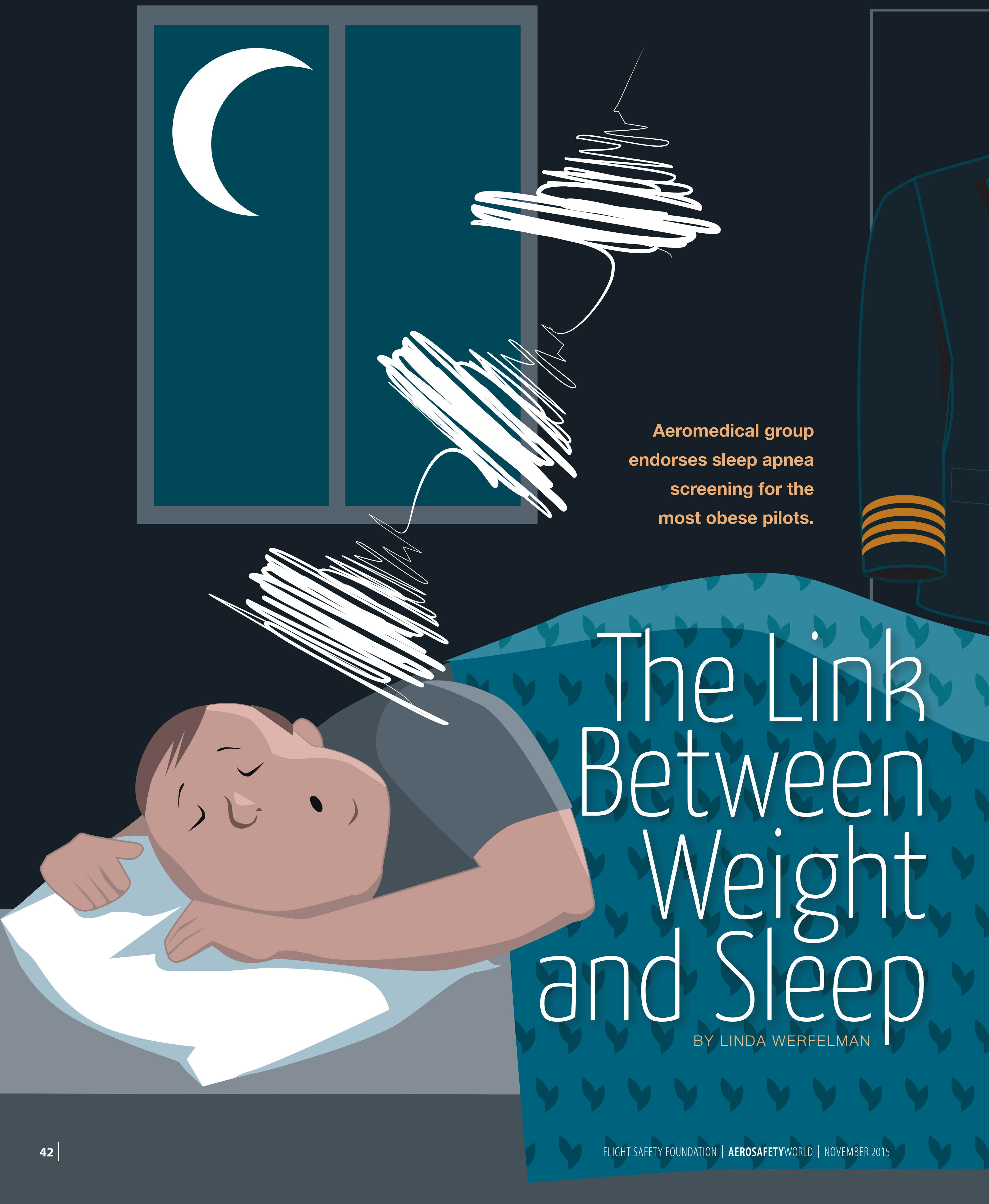
The final rule will not apply to model aircraft operators, who are subject to another law that requires them to avoid interfering with manned aircraft, to keep their models within the operator's line of sight at all times and to fly them only for recreational purposes. Operators of model aircraft who fly their aircraft within 5 nm of an airport must notify the airport operator and air traffic control tower.

Whitaker told the subcommittee that the timing of the subsequent development of rules for larger UAS would depend on commercial demand and technology.

"The primary goal of the FAA is to integrate this new class of aircraft and their operators safely and efficiently into the NAS, regardless of whether the operations are recreational or commercial in nature," he said. "Because this new branch of aviation is changing at the pace of human imagination, the FAA believes a flexible framework is imperative. … Our goal is to provide the basic rules for operators, not identify specific technological solutions that could quickly become outdated."

Note

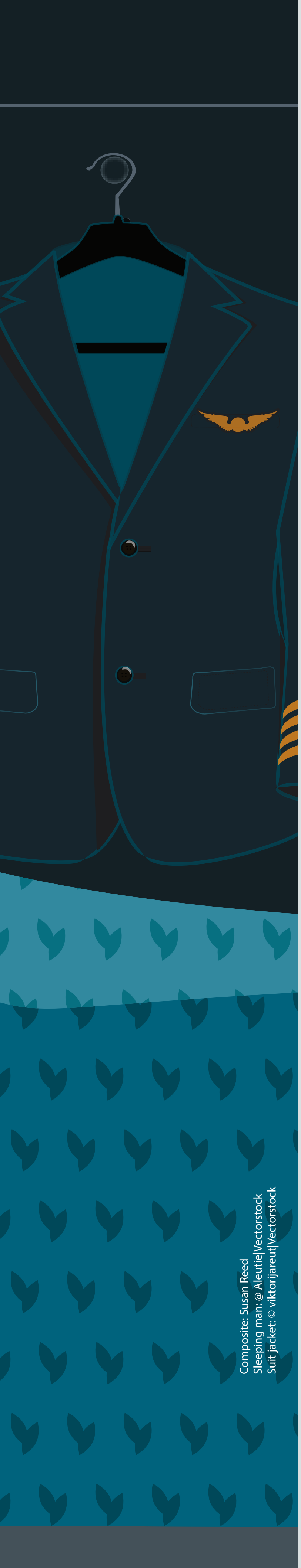
1. Hermann, Peter; Norwood, Candice. "Police Cite District Man After Drone Lands on Ellipse Near White House." *The Washington Post.* Oct. 9, 2015.



Aeromedical group endorses sleep apnea screening for the most obese pilots.

The Link Between Weight and Sleep

BY LINDA WERFELMAN



Specialists in sleep and aviation medicine have revived a controversial proposal to screen extremely obese pilots for obstructive sleep apnea (OSA) and to treat those who are found to have the disorder.

OSA is "strongly associated with impaired cognitive performance and daytime performance," a team of sleep specialists said in a report that was approved as a position paper of the Aerospace Medical Association (AsMA).[1]

In turn, the report said, "There is a very strong relationship between elevated BMI [body mass index, a gauge of body fat that takes into account a person's height and weight] and presence of sleep apnea" (see "Calculating BMI," p. 44).

The report, published in the September issue of AsMA's *Aerospace Medicine and Human Performance*, said that OSA screening should be required for pilots whose BMIs are in the "morbidly obese" category — that is, those with a BMI of at least 40. That would mean, for example, a 6-ft-tall (2-m-tall) pilot who weighed 295 lb (134 kg) or a 5-ft 5-in (1.7-m) pilot who weighed 245 lb (111 kg); both would have BMIs at or just over 40.

Studies have found that OSA plays a role in motor vehicle accidents, but there is "a paucity of pilot-specific data," the report said, adding that, although OSA has never been named as a causal factor in an aviation accident, the disorder has occasionally been mentioned in official accident reports.

As an example, the AsMA report cited a Feb. 13, 2008, incident in which the captain and first officer of a go! Bombardier CL-600 both fell asleep during a midmorning flight from Honolulu to Hilo, Hawaii, and overflew Hilo by 26 nm (48 km). According to the U.S. National Transportation Safety Board (NTSB) report on the incident, air traffic control tried repeatedly to contact the flight crew but received no response. After 18 minutes, the crew contacted a controller and turned back to Hilo.[2]

The NTSB report said that, soon after the incident, the captain was diagnosed with severe OSA.

"Symptoms (such as snoring) and risk factors (such as obesity) were present before the incident," the NTSB said, adding that the disorder "likely caused him to experience chronic daytime fatigue and contributed to his falling asleep during the incident flight."

The U.S. Federal Aviation Administration (FAA) has said that an analysis of the NTSB's database indicated that sleep apnea was mentioned in its reports on 34 accidents and incidents, including 32 fatal accidents, as being present in the pilot's medical background. Sleep apnea was not listed as a factor in any of those accidents, the FAA said.[3]

Motor Vehicle Data

The AsMA report said that sleep apnea has been studied more frequently in motor vehicle accidents, adding that a review of 40 studies of noncommercial drivers found that those who had been diagnosed with OSA were "at increased risk for a traffic accident."

In 2008, the U.S. Federal Motor Carrier Safety Administration recommended OSA screening for commercial driver license candidates with a BMI of more than 30, the report said.

The AsMA report said that "extrapolation from the motor vehicle data (a setting likely to be less cognitively demanding) strongly suggests that screening and treatment for OSA should be considered in this [morbidly obese pilot] population. While the approach to the optimal screening of the general pilot population is being debated and refined, individuals who are morbidly obese and in whom OSA is highly likely should undergo screening."

Similar reasoning was paired with a similar policy proposal in 2013 when Fred Tilton, then the U.S. federal air surgeon, said that FAA medical examiners should be required to calculate the BMI of every pilot and that pilots with BMI scores of 40 or more should be referred to sleep specialists and required to undergo treatment for OSA before receiving a medical certificate (*ASW*, 2/14, p. 34).

By early 2015, the FAA had backed away from that plan, and instead issued guidance to medical examiners, calling on them to screen for OSA by conducting an "integrated assessment" of a pilot's medical history, symptoms and clinical findings and not by relying solely on the pilot's BMI.

The FAA requires pilots who have been diagnosed with OSA to obtain medical certificates by special issuance — a requirement that is satisfied after the pilot demonstrates, usually by submitting sleep records and other information about what action he takes to eliminate daytime sleepiness, that the disorder does not interfere with performance of pilot duties.

Risk Factors

The authors of the new report endorsed by AsMA said their conclusions were based on a review of major risk factors for sleep apnea, as well as treatment of the disorder and information about its effects on "performance in transportation-related occupations."

OSA — the most common form of sleep apnea — occurs when muscles in the throat relax enough to block the airway, interrupting breathing for 10 to 20 seconds at a time. These interruptions may lower the oxygen level in the blood. The brain "senses this impaired breathing and briefly rouses you from sleep so that you can reopen your airway," the Mayo Clinic says in its discussion of OSA.[4] "This awakening is usually so brief that you don't remember it."

The interruptions can occur 30 times or more an hour, preventing normal restorative sleep and increasing the likelihood of sleepiness during normal waking hours.

People with OSA "often experience severe daytime drowsiness, fatigue and irritability," the Mayo Clinic says. "They may have difficulty concentrating and find themselves falling asleep at work, while watching TV or even when driving."

OSA causes "significant stress" on the cardiovascular system, with the heart rate and blood pressure increasing during the sleep interruptions and decreasing to normal levels as the person goes back to sleep, the AsMA report says. "This may ultimately result in hypertension [high blood pressure], congestive heart failure and other cardiovascular complications." Among those other complications are heart attack, stroke and arrhythmias (abnormal heart rhythms).

OSA Risk Factors

A number of factors put people at risk of developing OSA, including smoking tobacco; drinking alcohol; being male, black, overweight or between the ages of 18 and 60; having chronic nasal congestion; and having a large neck (with a circumference greater than 17 in [43 cm] for men or 16 in [41 cm] for women). At the top of the list, however, is overweight or obesity, which the AsMA report described as "the most important modifiable risk factor for developing obstructive sleep apnea."

About half of all people with OSA are overweight, the Mayo Clinic said, adding that deposits of fat around the upper airway may obstruct breathing. Nevertheless, not everyone with OSA is overweight, and the disorder also occurs in thin people, the clinic said.

'Nearly Universal'

The AsMA report, however, noted that, among people with BMIs of 40 or higher, sleep apnea is "nearly universal," citing data that show the

Calculating BMI

Body mass index (BMI) — a widely used method of measuring overweight and obesity — is determined by using an online calculator[1] or by dividing weight in kilograms by height in meters squared, or weight in pounds by height in inches squared and multiplying by a conversion factor of 703.

Someone with a BMI between 18.5 and 24.9 is considered to be at a normal weight. Those below 18.5 are considered *underweight*. A person is considered *overweight* with a BMI between 25.0 and 29.9, or *obese* if the BMI is 30.0 or higher. An additional category of *morbidly obese* applies to BMI scores of 40 and higher.

For example, a pilot who is 6 ft (2 m) tall and weighs 175 lb (79 kg) would have a normal BMI of 23.7. At 195 lb (88 kg), he would have a BMI of 26.4, in the overweight category; at 230 lb (104 kg), his BMI would be 31.2 and he would be considered obese; and at 300 lb (136 kg), he would have a BMI of 40.7 and be considered morbidly obese.

—LW

Note

1. Online BMI calculators are available on many health-related websites, including the U.S. National Institutes of Health at <www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm>.

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disorder in an estimated 98 percent of that group.

"Body weight in the general population has been rising at a rapid rate since the 1980s," the report said, citing U.S. and worldwide data. "Worldwide, the prevalence of being overweight [according to BMI criteria] increased from 25 [percent] to 34 percent, and of being obese … increased from 6 [percent] to 12 percent between 1980 and 2008."

Screening for OSA usually begins during a general physical examination, with the patient answering questions about whether he or she snores loudly, whether he feels refreshed upon waking and whether daytime sleepiness is a problem. The BMI also is considered, along with such factors as morning headaches and the presence of high blood pressure, both of which are among the symptoms of OSA.

People initially found at high risk of OSA typically are sent for clinical evaluation by a sleep specialist, who often recommends a sleep study — an overnight sleep session designed to monitor the patient's breathing, pulse, heart and brain activity, and movement.

The AsMA report said that in recent years, an at-home test has been developed for OSA. Although home tests are less expensive than a laboratory sleep test, they require interpretation by a specialist and "can only be used to rule in sleep apnea," the report said. "A negative home test means that the patient must start the process again in the laboratory."

If results of a home test are positive, however, treatment can be prescribed.

The report said that continuous positive airway pressure (CPAP) therapy — in which a device blows a steady stream of air through a tube and into a mask that covers the patient's nose, or both the nose and mouth — "remains the gold standard" for OSA treatment. The air flow is designed to keep the airway open.

In addition to CPAP, other treatments — typically designed for people with mild to moderate sleep apnea — involve surgery or the use of a specially designed oral appliance.

"Although many real-world constraints may prevent every person in a safety-sensitive occupation from receiving consistent, high-quality sleep in all situations, ensuring that these personnel are free from treatable disorders that prevent high-quality sleep is an achievable objective," AsMA said. "With proper screening and follow-up … the risks associated with sleep apnea can be reasonably managed in the modern occupational environment."

Notes

1. Ruskin, Keith Jonathan; Caldwell, John A.; Caldwell, J. Lynn; Boudreau, Eilis Ann. "Screening for Sleep Apnea in Morbidly Obese Pilots." *Aerospace Medicine and Human Performance* Volume 86 (September 2015): 835–841.

2. NTSB. Accident report no. SEA08IA080. Feb. 13, 2008.

3. FAA. *Fact Sheet — Sleep Apnea in Aviation*. Feb. 2, 2015. <www.faa.gov/news/fact_sheets/>

4. Mayo Clinic. *Obstructive Sleep Apnea*. <www.mayoclinic.org/diseases-conditions>.

A less common form of sleep apnea is central sleep apnea, which occurs when the brain fails to transmit signals to the muscles that control breathing. Breathing is either interrupted or it becomes so shallow that insufficient oxygen reaches the lungs and bloodstream. Central sleep apnea typically occurs because of heart failure, stroke, sleeping at a high altitude or as a side effect of some medications, according to the Mayo Clinic.

BY LINDA WERFELMAN

Rising Fatalities

Boeing's annual commercial aviation accident data show a jump in fatalities in 2014, with a total still below the 10-year average.

Western-built commercial jets were involved in 29 accidents in 2014, down from 31 the previous year, but the number of fatalities more than quadrupled to 279, up from 62 in 2013 (Table 1), according to data from Boeing Commercial Airplanes.[1,2]

In its annual *Statistical Summary of Commercial Jet Airplane Accidents*, published in August, Boeing noted three fatal accidents, two of which killed a total of 278 people — everyone in both airplanes. In the third accident, a Boeing 737 landing in Libreville, Gabon, struck and killed a person on a runway; all 137 passengers and crewmembers survived.

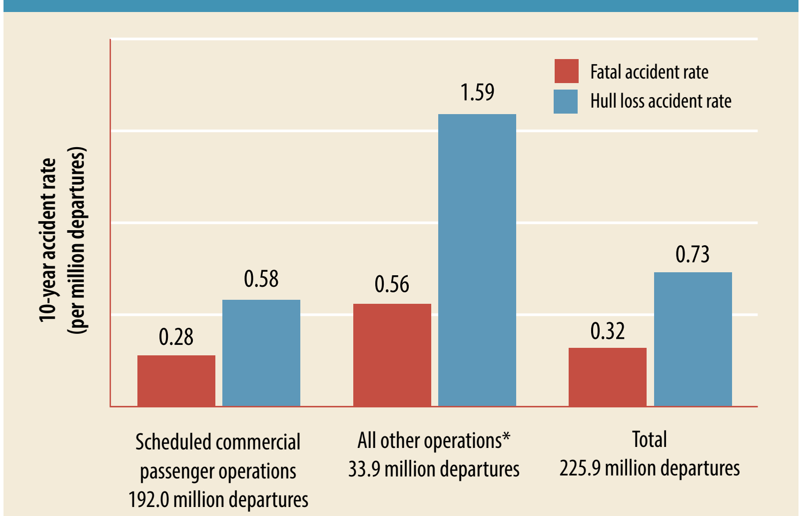
Malaysia Airlines Flight 370, a Boeing 777 that disappeared during a March 8 flight from Kuala Lumpur, Malaysia, to Beijing with 239 people aboard, did not meet Boeing's definition of an accident and was not included on the list.[3] Debris from the 777 has washed ashore on Réunion Island, but the main wreckage has not been found.

The 2014 fatality count of 279 compared with an annual average of 399 over the previous 10-year period (from 2004 through 2013), Boeing said.

Of the 29 accidents, Boeing classified three as *major* — a classification that means "the airplane was destroyed, [or] there were multiple fatalities, [or] there was one fatality and the airplane was substantially damaged." Ten accidents were considered *hull loss* accidents — accidents in which an airplane is "totally destroyed or damaged and not repaired" — compared with a 10-year average of 17 per year.

During the most recent 10-year period, from 2005 through 2014, there were 404 accidents, including 165 hull loss accidents and 72 fatal

10-Year Accident Rates, by Type of Operation, Worldwide Commercial Jet Fleet, 2005–2014



* Charter passenger, charter cargo, scheduled cargo, maintenance test, ferry, positioning, training and demonstration flights.

Source: Boeing Commercial Airplanes

Figure 1

2014 Airplane Accidents, Worldwide Commercial Jet Fleet

Event Date	Airline	Model (Age in Years)	Type of Operation	Accident Location	Phase of Flight	Event Description	Damage Category
Jan. 5	Saudia	767-300(17)	1	Medina, Saudi Arabia	Landing	The airplane landed with right main landing gear retracted. There were injuries during the evacuation.	Substantial
Jan. 5	Air India	A320 (20)	1	Jaipur, India	Landing	While landing in dense fog, the airplane veered off the runway and collided with an object. There were no injuries.	Substantial
Jan. 18	Aeronaves TSM	DC-9 (46)	2	Saltillo, Mexico	Landing	The nosewheel landing gear collapsed during landing, and the airplane veered off the runway. Minor injuries were reported.	Substantial
Jan. 26	Airwork NZ	737-300 (26)	2	Honiara, Solomon Islands	Landing	The right main landing gear collapsed during landing. There were no injuries.	Substantial
Feb. 1	Lion Air	737-900ER (7)	1	Surabaya, Indonesia	Landing	The airplane sustained damage during a hard landing.	Substantial
Feb. 2	East Air	A320 (20)	1	Kulob, Tajikistan	Landing	The airplane landed on a poorly prepared runway and struck a snow bank; the nosewheel landing gear collapsed. There were no injuries.	Substantial
Feb. 17	Jet2.com Ltd.	737-800 (15)	1	Funchal, Portugal	Landing	A tail strike occurred during landing. There were no injuries.	Substantial
Feb. 17	Ural Airlines	A321 (14)	1	Dubai, United Arab Emirates	Load/ Unload	A ground vehicle collided with the A321 while the passenger door was open, causing a flight attendant to fall from the airplane.	Minor
Feb. 22	Travel Service	737-800 (2)	1	Terceira, Portugal	Landing	The airplane was damaged during a hard landing in gusting winds. There were no injuries.	Substantial
March 4	LAN Airlines	A320(11)	1	Buenos Aires, Argentina	Taxi	The airplane's tail was struck during taxi by the wingtip of another airplane. There were no injuries.	Substantial
March 13	US Airways	A320 (14)	1	Philadelphia, U.S.	Takeoff	The airplane contacted the runway during a rejected takeoff, and the nosewheel landing gear collapsed; the airplane veered off the runway. There were no injuries.	Substantial
March 28	Avianca	F-100 (21)	1	Brasília, Brazil	Landing	The crew was unable to extend the nosewheel landing gear due to a hydraulic failure. There were no injuries.	Substantial
April 11	Kenya Airways	ERJ 190 (2)	1	Dar es Salaam, Tanzania	Landing	The airplane veered off the runway during landing; both engines failed. There were injuries during the evacuation.	Substantial
April 29	Air Contractors (Ireland) Ltd.	737-400 (24)	2	East Midlands, United Kingdom	Landing	The left main landing gear collapsed during landing. There were no injuries.	Substantial
May 8	Ariana Afghan Airlines	737-400 (21)	1	Kabul, Afghanistan	Landing	The airplane overran the end of the runway and came to a stop; all landing gear collapsed. There were no injuries.	Destroyed*
May 9	Avior Airlines	737-400 (25)	1	Panama City, Panama	Takeoff	During a high-speed rejected takeoff, tires burst and mechanical parts separated from the airplane. There were no injuries.	Substantial
May 10	Iran Aseman Airlines	F-100 (21)	1	Zahedan, Iran	Landing	The left main landing gear would not extend on approach, and the crew conducted a partial gear-up landing. There were minor injuries during the evacuation.	Substantial
May 10	IRS Airlines	F-100 (24)	3	Kano, Nigeria	Landing	The nosewheel and right main landing gears failed during an emergency landing in the desert. There were no injuries.	Substantial
May 12	Aegean Airlines	A320 (6)	1	Moscow, Russia	Load/ Unload	After removal of the stairs, a flight attendant stepped out to close the passenger door and fell from the airplane.	None
June 20	Omni Air International	767-300 (15)	4	Kabul, Afghanistan	Landing	A tail strike occurred during a hard landing. There were no injuries.	Substantial
June 28	Ryanair	737-800 (8)	1	Stansted, United Kingdom	Tow	During pushback, the 737's tail was struck by the wingtip of another airplane. There were no injuries.	Substantial
July 7	AirAsia	A320 (4)	1	Bandar Seri Begawan, Brunei	Landing	During landing, the A320 veered off the runway onto soft ground, and both engines ingested mud. There were no injuries.	Substantial
July 17	Eastern SkyJets	737-300 (23)	1	Libreville, Gabon	Landing	During landing, the airplane struck and killed a person on the runway. All 137 people in the airplane survived.	None†
July 24	Swiftair	MD-83 (18)	1	Gao, Mali	Cruise	In cruise, the crew lost control of the airplane and it struck the ground, killing all 116 people on board.	Destroyed*†
Nov. 7	Ariana Afghan Airlines	737-400 (21)	1	Kabul, Afghanistan	Landing	The main landing gear collapsed during landing. There were no injuries.	Substantial
Nov. 24	Cargolux Airlines	747-8F (3)	5	Libreville, Gabon	Landing	The airplane was damaged in a hard landing. There were no injuries.	Substantial
Dec. 28	PT. Indonesia AirAsia	A320 (6)	1	Java Sea	Cruise	In cruise, the crew lost control of the airplane and it struck the Java Sea, killing all 162 people on board.	Destroyed*†
Dec. 30	Shaheen International	737-400 (21)	1	Lahore, Pakistan	Landing	The airplane struck a bird during landing and ran off the side of the runway; the left main landing gear collapsed. There were no injuries.	Substantial
Dec. 30	Zest Airways Inc.	A320 (8)	1	Kalibo, Philippines	Landing	The A320 overran the runway during landing and the landing gear sank into soft ground. There were no injuries.	Substantial
	29 total accidents; 278 onboard fatalities; 1 external fatality						

Type of operation: 1 = scheduled passenger 2 = scheduled cargo 3 = charter passenger 4 = positioning 5 = charter cargo
* Major accident † Fatal accident

Source: Boeing Commercial Airplanes

Table 1

Accidents, Worldwide Commercial Jet Fleet, by Type of Operation

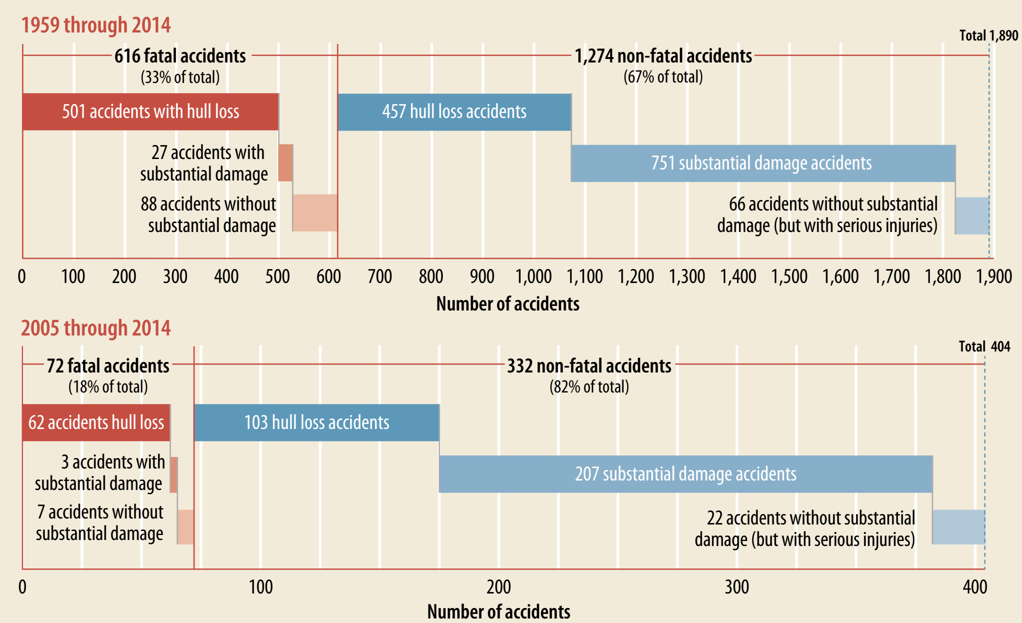
Type of operation	All Accidents 1959–2014	All Accidents 2005–2014	Fatal Accidents 1959–2014	Fatal Accidents 2005–2014	On-board Fatalities (External Fatalities)* 1959–2014	On-board Fatalities (External Fatalities)* 2005–2014	Hull Loss Accidents 1959–2014	Hull Loss Accidents 2005–2014
Passenger	1,501	327	493	56	29,165 (792)	3,888 (124)	704	118
Scheduled	1,380	302	447	53	25,039	3,872	634	111
Charter	121	25	46	3	4,126	16	70	7
Cargo	265	65	79	13	273 (342)	41 (15)	178	39
Maintenance test, ferry, positioning, training and demonstration	124	12	44	3	208 (66)	17 (0)	76	8
Totals	**1,890**	**404**	**616**	**72**	**29,646 (1,200)**	**3,946 (139)**	**958**	**165**
U.S. and Canadian operators	564	75	182	12	6,202 (381)	26 (7)	227	25
Rest of the world	1,326	329	434	60	23,444 (819)	3,920 (132)	731	140
Totals	**1,890**	**404**	**616**	**72**	**29,646 (1,200)**	**3,946 (139)**	**956**	**165**

*External fatalities include ground fatalities and fatalities on other aircraft involved, such as helicopters or small general aviation airplanes, that are excluded.

Source: Boeing Commercial Airplanes

Table 2

Accidents, by Injury and Damage, Worldwide Commercial Jet Fleet



Source: Boeing Commercial Airplanes

Figure 2

accidents that killed 3,946 passengers and crewmembers and 139 people on the ground, Boeing said (Table 2).

The data showed that the accident rate for that period was 0.73 per million departures, and the fatal accident rate, 0.32 per million departures (Figure 1, p. 46). For scheduled commercial passenger operations, the rates were slightly lower — 0.58 accidents and 0.28 fatal accidents per million departures.

From the time Boeing's data collection began in 1959 through 2014, there were 1,890 accidents, including 958 hull losses and 616 fatal accidents (Figure 2).

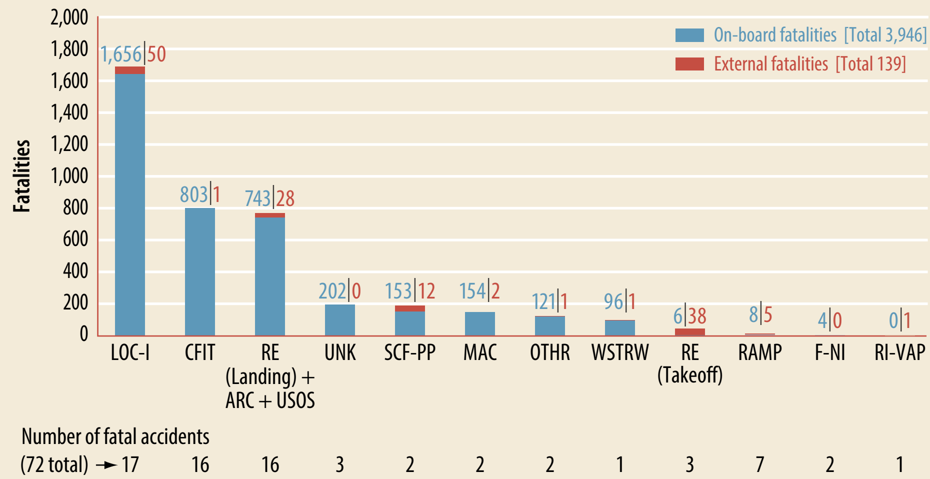
Breaking down accidents according to terminology developed by the U.S. Commercial Aviation Safety Team (CAST) and the International Civil Aviation Organization (ICAO), the data showed that 17 accidents from 2005 through 2014 resulted from loss of control–in flight — a greater number than were attributed to any other cause (Figure 3). Sixteen accidents each were attributed to controlled flight into terrain and to runway excursions on landing — a category that includes the subcategories of abnormal runway contact and undershoot/overshoot. Six additional runway excursion accidents occurred during takeoff, the report said.

The data also showed that, in 2005 through 2014, nearly half of all fatal accidents occurred during final approach and landing — significantly more than any other phases of flight. Seventeen fatal accidents (24 percent) during that period occurred during final approach, and another 17 occurred during landing, the report said. Nine fatal accidents (13 percent) occurred during cruise flight.

During the same time frame, more on-board fatalities occurred in fatal crashes during cruise than in any other phase of flight, the report said. Data showed that 1,052 people (27 percent) were killed in those accidents, 848 (21 percent) were killed in accidents during final approach, and 681 (17 percent) were killed in landing accidents.

Western-built commercial jets have flown 1.26 billion flight hours — or 686 million departures — since Boeing began collecting data in 1959, the report said. In 2014 alone, flight hours totaled 56.5 million, and departures totaled 25.6 million.

Fatalities by CAST/ICAO Taxonomy Accident Category, Worldwide Commercial Jet Fleet, 2005–2014



CAST = U.S. Commercial Aviation Safety Team; ICAO = International Civil Aviation Organization; ARC = abnormal runway contact; CFIT = controlled flight into terrain; F-NI = fire/smoke (non-impact); LOC-I = loss of control – in flight; MAC = midair/near-midair collision; OTHR = other; RAMP = ground handling; RE = runway excursion; RI-VAP = runway incursion – vehicle, aircraft or person; SCF-PP = system/component failure or malfunction (powerplant); UNK = unknown or undetermined; USOS = undershoot/overshoot; WSTRW = wind shear or thunderstorm.

No accidents were noted in the following principal categories: aerodrome; abrupt maneuver; air traffic management/communications, navigation, surveillance; bird strikes; cabin safety events; evacuation; external load-related occurrences; fire/smoke (post-impact); fuel related; ground collision; icing; low altitude operations; loss of control – ground; runway incursion – animal; security related; system/component failure or malfunction (non-powerplant); turbulence encounter; wildlife.

Note: Principal categories are as assigned by CAST. Airplanes manufactured in the Commonwealth of Independent States or the Soviet Union are excluded because of lack of operational data. Commercial airplanes used in military service are also excluded.

Source: Boeing Commercial Airplanes

Figure 3

Notes

1. Boeing Commercial Airplanes. *Statistical Summary of Commercial Jet Airplane Accidents: Worldwide Operations 1959–2014*. August 2015. <www.boeing.com/news/techissues/pdf/statsum.pdf>.
2. The data include commercial jet airplanes with maximum gross weight of more than 60,000 lb (27,217 kg). Airplanes manufactured in the Commonwealth of Independent States or the Soviet Union are excluded because of insufficient operational data. Also excluded are commercial airplanes in military service and those in events involving military action, sabotage and terrorism.
3. Boeing defines an accident as "an occurrence associated with the operation of an airplane that takes place between the time any person boards the airplane with the intention of flight and such time as all such persons have disembarked, in which: The airplane sustains substantial damage; the airplane is missing or is completely inaccessible (an aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located); death or serious injury results from being in the airplane, direct contact with the airplane or anything attached thereto [or] direct exposure to jet blast."

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Cabin Fire Traced to ELT

Short circuit caused a thermal runaway of the emergency locator transmitter's lithium battery.

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

Crossed Wires

Boeing 787-8. Substantial damage. No injuries.

After an early morning landing at London Heathrow Airport on July 12, 2013, the 787 was towed to another stand in preparation for a scheduled flight later that day. The ground handling agent turned off ground power at the stand's control box but did not disconnect the power cables from the aircraft. However, an engineer aboard the aircraft confirmed that ground power no longer was available to the 787.

The engineer secured the aircraft and disembarked at 0730 local time. About eight hours later, an employee in the air traffic control (ATC) tower saw smoke emanating from the aircraft and activated the crash alarm.

About one minute after the alarm was sounded, aircraft rescue and fire fighting (ARFF) personnel arrived and sprayed water and foam on the aircraft. "One fire fighter removed the power umbilical cables from the aircraft as a precaution," said the report by the U.K. Air Accidents Investigation Branch (AAIB).

ARFF personnel encountered thick smoke inside the aircraft and saw signs of a fire between two overhead luggage bins near the rear of the cabin. They removed some ceiling panels and doused the fire with water.

There were no injuries, but "the aircraft suffered extensive heat damage in the upper portion of the rear fuselage, in an area coincident with the location of the emergency locator transmitter (ELT)," the report said. "The absence of any other aircraft systems in this area containing stored energy capable of initiating a fire, together with evidence from forensic examination of the ELT, led the investigation to conclude that the fire originated within the ELT."

Investigators found wires crossed and trapped beneath the ELT battery compartment cover plate. They concluded that contact between one of the wires and the cover plate likely created a short circuit that caused one of the five cells in the lithium manganese dioxide (non-rechargeable lithium metal) battery to discharge rapidly.

"Neither the cell-level nor battery-level safety features prevented this single-cell failure, which propagated to adjacent cells, resulting in a cascading thermal runaway, rupture of the cells and consequent release of smoke, fire and flammable electrolyte," the report said.

The flames caused the resin within the composite fuselage crown near the vertical stabilizer to decompose and ignite. The slow-burning fire continued to propagate after the energy from the battery thermal runaway was exhausted, the report said.

AAIB safety recommendations based on the investigation led to several industry actions, including operator bulletins by Boeing and Honeywell, the ELT manufacturer, calling for inspections of 787 ELT battery wiring. The bulletins subsequently were incorporated in airworthiness directives issued by U.S. and European aviation authorities.

The U.S. Federal Aviation Administration (FAA) and other aviation authorities also launched a safety review of lithium-powered ELTs in other aircraft models and the certification standards for the devices.

Approach Briefing Omitted

Boeing 737-400. Minor damage. No injuries.

En route on a scheduled flight from Jakarta to Pontianak, Indonesia, the afternoon of Oct. 19, 2012, the flight crew learned from ATC that weather conditions at the destination included heavy rain, thunderstorms, a 1,700-ft ceiling, 6 km (4 mi) visibility and surface winds from 270 degrees at 5 kt.

The pilots selected a higher autobrake setting (medium) but otherwise did not conduct an approach briefing or review their landing distance calculations before they were vectored to join the instrument landing system approach to Runway 15, according to the report by the Indonesian National Transportation Safety Committee (NTSC). The crew reported the runway in sight at 800 ft and were cleared to land. "While on final approach, the pilot noticed on the navigation display that the wind was calm, while on short final the wind changed and the pilot felt the aircraft shaking," the report said.

Indicated airspeed was 13 kt above the reference landing speed at 50 ft, and a 10-kt tail wind increased groundspeed further to 163 kt. "This particular condition was classified as an unstabilized approach and requires the pilot to go around," the report said.

The crew continued the approach, and the 737 bounced once on touchdown. The pilot deployed the thrust reversers but did not feel the aircraft decelerate. He disengaged the autobrake system and applied manual braking. Investigators determined that the deceleration rate then began to decrease.

The 737 stopped with its main landing gear on the edge of the departure end of the 7,382-ft (2,250-m) runway, and the nose landing gear sank into soft terrain. No one was hurt, and ARFF personnel assisted the 166 occupants in deplaning.

Damage to the main landing gear tires and white tire marks on the runway indicated that the aircraft had experienced reverted-rubber hydroplaning on the wet runway.

The NTSC concluded that the probable cause of the accident was that "the absence of an approach briefing, particularly on reviewing landing distance, might have decreased the pilot's [situational] awareness."

Wrong Handle

Cessna Citation 550. Minor damage. No injuries.

The pilot said that he flew the final approach to Key West (Florida, U.S.) International Airport at 106 kt and that the Citation touched down at 95 to 100 kt and 800 ft (244 m) from the approach threshold of Runway 09 the afternoon of Nov. 3, 2011.

"At touchdown, he extended the speed brakes, and, after traveling another 800 feet, he began to apply wheel braking, but the brake pedals felt 'hard' and would not move," the report from the U.S. National Transportation Safety Board (NTSB) said. The copilot also attempted unsuccessfully to apply manual braking.

"The pilot felt that he had to stop and could not go around," the report said. He engaged the emergency braking system but found that it, too, was ineffective. "Examination of airport security camera images and deceleration values (determined by using time, distance and velocity calculations) indicated that the airplane's deceleration was consistent with a lack of braking," the report said.

The Citation ran off the end of the 4,801-ft (1,463-m) runway and came to a stop after entering a 340-ft (104-m) engineered material arresting system (EMAS). The overrun resulted in minor damage to the nose landing gear, left main landing gear door and forward fuselage, but there were no injuries among the five occupants.

"Examination of the normal hydraulic braking system and antiskid system did not reveal any malfunctions or failures that would have precluded normal operation of the brakes," the report said. "Examination of the cockpit revealed that the T-handle for the emergency [landing] gear extension system had been activated. This handle is located immediately to the right of the emergency braking handle and was most likely pulled during the incident landing instead of the emergency brake handle."

The report noted that the EMAS had been installed to meet FAA requirements for a runway safety area (RSA) because the proximity of a mangrove swamp precluded a standard 1,000-ft (305-m) RSA off the end of Runway 09.

TURBOPROPS

Battered by Hail

Beech King Air F90. Substantial damage. No injuries.

The aircraft was en route from Beira, Mozambique, to Lanseria, South Africa, the afternoon of Nov. 28, 2013, when the pilot requested clearance from ATC to alter course to circumnavigate a thunderstorm.

The controller approved the deviation and told the pilot to fly directly to Lanseria when able. After flying about 15 nm (28 km), he turned toward the destination.

"Although the aircraft was equipped with weather radar and the pilot utilised it, he miscalculated the size of the storm and turned too soon," said the report by the South African Civil Aviation Authority. "The aircraft experienced heavy wind shear and hail.

"Once the aircraft was out of the thunderstorm, the pilot advised radar control that his aircraft had suffered hail damage." He diverted to Johannesburg and landed the King Air without further incident.

Examination of the aircraft revealed hail damage to the wing leading edges, fuselage, propeller spinners and engine exhaust stacks.

Life Limits Neglected

Fairchild Metro 3. Minor damage. No injuries.

Night visual meteorological conditions prevailed as the Metro neared Minneapolis-St. Paul (Minnesota, U.S.) International Airport on a cargo flight on Nov. 9, 2012. The pilot confirmed that all three landing gear indicator lights were green before landing the airplane.

Shortly after touchdown, the left main landing gear collapsed, and the airplane veered off the left side of the runway. Examination of the airplane revealed two loose electrical connections on the landing gear hydraulic power pack and "several anomalies in the hydraulic shuttle valve," the NTSB report said.

Investigators determined that the power pack had not been replaced at the life limit established by the manufacturer. "It is likely that the hydraulic issues allowed for a movement in the landing gear shuttle valve, which resulted in an uncommanded gear unlock and subsequent collapse of the left main landing gear," the report said.

Mistaken Landing Site

Saab 340B. No damage. No injuries.

The weather was clear, but daylight was fading as the aircraft neared Newcastle Airport in Williamstown, New South Wales, Australia, during a scheduled flight the evening of Nov. 8, 2012. The airport tower controller cleared the flight crew to conduct a right traffic pattern to Runway 12.

The captain previously had experienced difficulty in sighting the airport during visual approaches from the south and was guiding the first officer, the pilot flying, toward buildings he perceived as associated with the airport, according to the report by the Australian Transport Safety Bureau (ATSB).

The buildings actually were on a coal-storage facility 6 nm (11 km) south of the airport. The facility had ground structures and lighting features similar to the airport, as well as a long line of coal aligned almost identically with Runway 12.

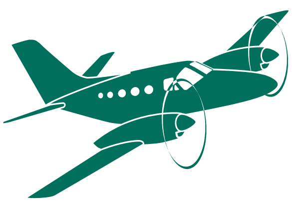
The first officer became increasingly unsure of the aircraft's position as he was guided onto a right downwind leg and a right base leg, and transferred control to the captain. The captain, who "could not see the runway" but "had formed a strong belief that they were in the airport environment," continued to descend while establishing the aircraft in landing configuration, the report said.

Meanwhile, the approach controller had continued to monitor the aircraft's progress on radar and had become concerned about its position and track. He called the airport traffic controller and suggested that he query the crew about their intentions. "In response to the [tower] controller's query if they were still visual, the crew responded that they had just 'lost' the runway and were continuing the right turn," the report said.

Using binoculars, the tower controller spotted the aircraft and advised the crew that they were 6 nm south of the airport. "When told they were not at the airport, the captain immediately requested radar vectors to resolve the uncertainty," the report said.

The controller suggested a heading toward the airport and increased the intensity of the runway lights. The crew subsequently landed the Saab without further incident.

"This occurrence highlights the possibility of crews misidentifying ground features for the airport environment during visual approaches, especially in conditions of poor light," the ATSB said. "To avoid misleading visual cues during visual approaches, crews should confirm that they have correctly identified and are tracking to the intended destination by cross-checking with the aircraft's navigation equipment."



PISTON AIRPLANES

Refueled With Jet-A

Cessna 421B. Substantial damage. One serious injury, two minor injuries.

After a previous flight, the pilot had asked the fixed-base operator (FBO) in Lufkin, Texas, U.S., to refuel the airplane, but he did not observe the fueling. "The FBO employee who fueled the airplane … mistook it for a similar airplane that uses Jet-A [turbine engine] fuel," the NTSB report said. "He brought the Jet-A truck over and fueled the airplane."

The report said that the fuel nozzle on the Jet-A truck had been changed to facilitate the fueling of military helicopters that frequented the airport. They were round and smaller than the J-shaped nozzles used to dispense Jet-A, according to the report.

Moreover, the airplane's filler ports had not been fitted with restrictors, as required by an airworthiness directive intended to prevent the misfueling of piston aircraft with turbine fuel.

The next morning — April 17, 2015 — the pilot signed a receipt showing that the airplane had been fueled with 53 gal (201 L) of Jet-A. The pilot said that during his preflight inspection of the airplane, the fuel samples appeared to be blue, like 100LL aviation gasoline, and that no anomalies occurred during the engine run-ups.

However, shortly after takeoff, he noticed a slight vibration and decreased climb performance. Both engines lost power as the 421 climbed through 2,100 ft. The pilot was seriously injured and his two passengers sustained minor injuries during the subsequent forced landing on a highway median.

Landing Checklist Neglected

Piper Chieftain. Minor damage. No injuries.

The pilot flying was receiving pilot-in-command supervision by another pilot during a charter flight with seven passengers to Townsville, Queensland, Australia, the afternoon of Jan. 9, 2015. During a visual approach, both pilots conducted the pre-landing checks from memory, rather than using the checklist, said the ATSB report.

The pilot neglected to extend the landing gear. "The supervising pilot confirmed the mixture, fuel pumps and landing lights had been set correctly, and assumed the rest of the checks had been similarly completed," the report said.

Neither pilot recalled hearing the landing gear warning horn, but investigators later found that the system was operational.

After the aircraft was flared for landing, both pilots sensed that the landing gear did not touch the runway as expected. The pilot initiated a go-around at the same time the supervising pilot called "go around."

A radio antenna separated when the fuselage scraped the runway, but the pilots were able to complete the go-around and land the Chieftain without further incident.

Miscalculated Fuel Reserve

Piper Aztec. Substantial damage. No injuries.

The pilot departed from Destin, Florida, U.S., with a partial fuel load, estimating that the Aztec would have about 4 gal (15 L) of fuel in its tanks after landing in Quincy, Illinois, on Oct. 26, 2014.

"The pilot [later] acknowledged that he failed to account for the 6.8 gallons [26.0 L] of unusable fuel within the fuel system," the NTSB report said.

The Aztec was descending through 3,500 ft about 7 nm (13 km) from the destination airport when the right engine lost power. "The pilot feathered the right propeller, secured the right engine and continued toward the planned destination," the report said. "Shortly thereafter, the left engine lost total power, and the pilot feathered the propeller and secured the engine."

The pilot was unable to extend the landing gear normally and did not activate the emergency gear-blowdown system before conducting a forced landing in a soybean field. The Aztec was substantially damaged, but the pilot and his three passengers escaped injury.

HELICOPTERS

Blinded by a Movie Light

Bell 206B. Substantial damage. Three fatalities.

The JetRanger was engaged in the filming of a movie sequence at a ranch in Acton, California, U.S., the night of Feb. 10, 2013. "During the first flight … several of the pilot's comments indicate that he was trying to be amenable to the production company's requests, [but] he repeatedly remarked on the limited visibility and the brightness of a flexible light pad affixed to the center windshield frame in the cockpit," the NTSB report said.

Before the second flight, in which the helicopter was to ascend to a plateau from an unlighted riverbed, the cameraman in a rear seat showed the actor, who was in the left front seat, how to operate the light pad.

The light was set to its lowest brightness level for takeoff. While the helicopter was being maneuvered over the riverbed, the actor continued with scripted dialogue for about a minute until he was interrupted by the pilot, who said that he needed the light pad turned off.

"The camera operator acknowledged him and informed the actor to turn off the light by pressing a button twice," the report said. "The actor cycled through the light's settings and eventually turned it off while the pilot stated 'okay, okay, I can't ….' The camera operator interrupted, saying 'pull up, pull up.'"

All three occupants were killed when the JetRanger struck the riverbed. The NTSB concluded that the probable cause of the accident was "the pilot's decision to conduct a flight in dark night conditions with an illuminated cockpit light that degraded his visibility and his ability to identify and arrest the helicopter's descent while maneuvering."

Rushed Into Clearing

Robinson R44. Substantial damage. No injuries.

The pilot said that he radioed his position regularly while flying the landing pattern at Beaumont, Texas, U.S., the evening of Sept. 15, 2014. While flaring to land at midfield, he heard an airplane pilot radio that he was departing on the same runway.

"The [R44] pilot attempted to depart the runway area for the taxiway," the NTSB report said. "As he turned the helicopter toward the taxiway, he felt it 'swing hard and turn,' then begin to spin. The pilot stated that he lost control and landed hard, crushing the skids."

The NTSB concluded that the probable cause of the accident was "the pilot's loss of tail rotor effectiveness while attempting a taxiway side-step during landing" and said that a contributing factor was "another pilot's failure to ensure the runway was clear before occupying the runway for takeoff."

Preliminary Reports, August 2015

Date	Location	Aircraft Type	Aircraft Damage	Injuries
Aug. 1	Santa Paula, California, U.S.	Cessna P337G	substantial	1 fatal
Instrument meteorological conditions (IMC) prevailed when the Skymaster struck mountainous terrain shortly after takeoff.				
Aug. 1	Georgetown, Kentucky, U.S.	Beech King Air C90	substantial	2 serious, 2 minor
The pilot diverted to Georgetown after the right engine lost power during cruise flight. The King Air veered off the runway on landing.				
Aug. 7	Saranac Lake, New York, U.S.	Piper Malibu Mirage	destroyed	4 fatal
Visual meteorological conditions (VMC) prevailed when the airplane struck terrain about 0.5 nm (1.0 km) from the runway on takeoff.				
Aug. 8	Vereda Guarigua Cajicá, Colombia	Cessna 402B	substantial	3 fatal
VMC prevailed when the 402 struck terrain during a training flight.				
Aug. 8	Istra, Russia	Cessna U206F, Robinson R44	destroyed	9 fatal
The five occupants of the airplane and the four occupants of the helicopter were killed when the aircraft collided while maneuvering over a reservoir.				
Aug. 9	Clovis, New Mexico, U.S.	Cessna 421B	destroyed	1 serious
The 421 struck terrain after the left engine lost power on final approach.				
Aug. 12	Ninia, Indonesia	Pacific Aerospace 750XL	NA	1 fatal, 5 serious
The copilot was killed when the aircraft overran the runway while landing in strong winds.				
Aug. 12	Saba, Netherlands Antilles	Cessna 208B	destroyed	1 none
The aircraft was on a cargo flight from Puerto Rico to Saint Kitts when the pilot diverted to Saba for an emergency landing. The 208 was unable to reach Saba, and the pilot ditched the aircraft offshore.				
Aug. 15	Charlotte, North Carolina, U.S.	Airbus A321-231	substantial	159 none
The A321 struck approach lights and experienced a tail strike after encountering wind shear on final approach. The flight crew conducted a go-around and subsequently landed the airplane without further incident.				
Aug. 16	Cape Town, South Africa	Cessna 441	destroyed	5 fatal
Marginal VMC prevailed when the air ambulance struck a mountain on approach.				
Aug. 16	Oksibil, Indonesia	ATR 42-300	destroyed	54 fatalities
IMC prevailed when the aircraft struck a mountain while descending to land at Oksibil.				
Aug. 16	San Diego, California, U.S.	Sabreliner 60SC, Cessna 172M	destroyed	5 fatal
The pilots and two passengers aboard the Sabreliner, and the pilot of the 172 were killed when the airplanes collided in VMC about 1 nm (2 km) northeast of Brown Field.				
Aug. 20	Dubnica, Slovakia	Let 410MA, Let 410UVP	destroyed	5 fatal, 15 none
Fifteen skydivers were able to bail out, but both pilots and three other skydivers were killed when the aircraft collided during an airshow practice flight.				
Aug. 23	Les Bergeronnes, Quebec, Canada	de Havilland Beaver	destroyed	6 fatal
VMC prevailed when the Beaver descended out of control and struck mountainous terrain during a sightseeing flight.				
Aug. 26	Charallave, Venezuela	Cessna Citation SII	destroyed	8 NA
The flight crew rejected their first landing attempt and then touched down at about the midpoint of the 2,000-m (6,562-ft) runway. The Citation overran the runway and traveled down an embankment. No fatalities were reported.				
Aug. 28	Wamena, Indonesia	Boeing 737-300	substantial	2 none
The freighter touched down short of the runway and came to a stop on a taxiway.				
Aug. 28	Aguni, Japan	Viking Air Twin Otter	substantial	14 NA
Some of the occupants sustained minor injuries when the aircraft veered off the 800-m (2,625-ft) runway and struck a fence and trees while landing.				
Aug. 28	Cheyenne, Wyoming, U.S.	Robinson R44	substantial	3 serious, 3 minor
A low-rotor-speed warning was generated during approach, and the R44 touched down hard while landing.				
Aug. 29	Casale Monferrato, Italy	Technoavia SM-92	destroyed	11 NA
All the occupants were injured, some seriously, when the single-turboprop struck terrain after an engine problem occurred on initial climb.				
Aug. 29	Kaduna, Nigeria	Dornier 228-212	destroyed	7 fatal
The aircraft, operated by the Nigerian air force, crashed into a house shortly after takeoff.				

NA = not available

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

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