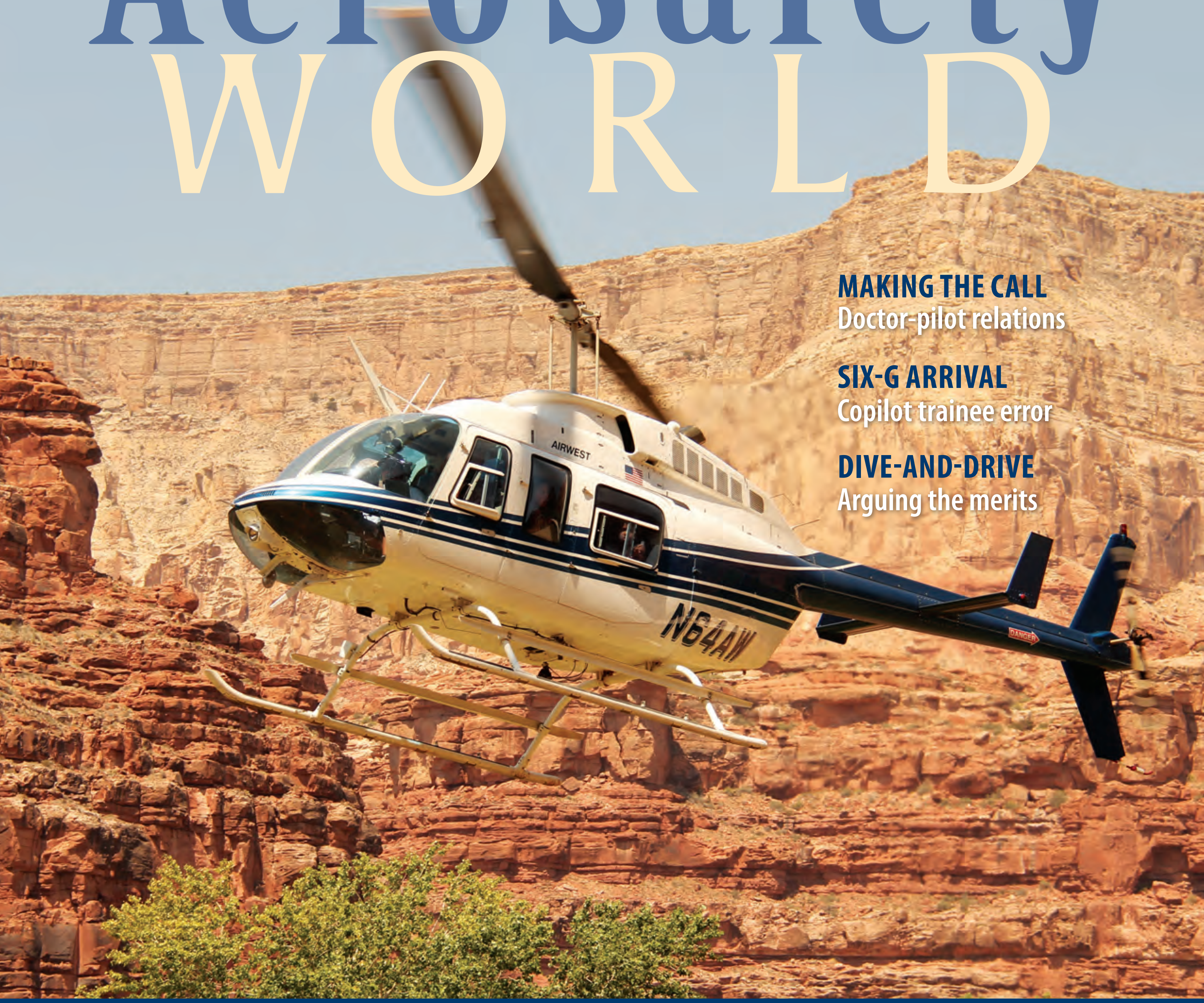
AeroSafety WORLD



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DIVE-AND-DRIVE
Arguing the merits

AIR TOURING
SAFETY ISSUES LINGER

THE JOURNAL OF FLIGHT SAFETY FOUNDATION

JUNE 2014

NEXT Move

When the position of president and CEO of Flight Safety Foundation became available, it was immediately appealing to me. I recently had retired from International Aero Engines and was debating my next move. I've spent my entire career in aviation, in roles that focused on safety and quality as well as positions in marketing and sales. The opportunity to work at the Foundation and lead this team was irresistible.

As anyone who has spent time in aviation knows, Flight Safety Foundation is the voice of safety. It is the conscience of the industry. While many great organizations work on safety, there is not another group out there whose sole focus is on aviation safety. Safety is the mission of the Foundation and has been since its founding in 1947.

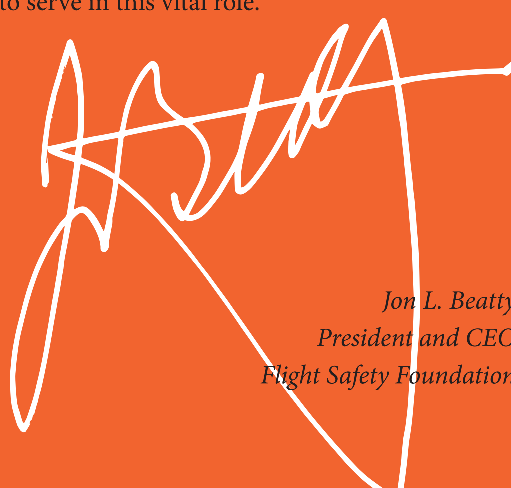
One of our challenges in 2014 and in the future is the belief that the industry has succeeded in its safety mission. We are safe. I won't argue about that, and we all should be proud of our industry's record. But we cannot lose our focus. As we await the final reports on Asiana 214 and UPS 1354, and as the tragedy of Malaysia 370 continues to unfold, we are reminded that safety is never "done."

FSF is teaming up with the International Civil Aviation Organization and the International Air Transport Association to hold a symposium on global aircraft tracking. It isn't acceptable to lose an airplane, especially with the technology available and in development. We don't have the answers as to what should be done, but we do know that if we bring together the technological experts with groups representing governments, airlines and safety, we will come up with a practical solution.

FSF recently published the *Duty/Rest Guidelines for Business Aviation,* which updates the landmark "Principles and Guidelines For Duty and Rest Scheduling in Corporate and Business Aviation," published by the FSF Fatigue Countermeasures Task Force in 1997. The *Duty/Rest* update is the culmination of a joint effort by FSF and the National Business Aviation Association Safety Committee's Fatigue Task Force, led by Leigh White. This is available on our website at <flightsafety.org/dutyrest2014>.

We also are due to finish our go-around study within the next few months, and we will release a report outlining the results of the study and including recommendations to the industry. We'll soon be determining the next steps for this project and how the findings can best be used.

We have great challenges ahead of us, but FSF has always been there as the voice of safety, and with the support of our members, we'll continue to serve in this vital role.



Jon L. Beatty
President and CEO
Flight Safety Foundation

AeroSafety WORLD

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Report says U.S. air tour industry must address problem areas.

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If you have an article proposal, manuscript or technical paper that you believe would make a useful contribution to the ongoing dialogue about aviation safety, we will be glad to consider it. Send it to Director of Publications Frank Jackman, 801 N. Fairfax St., Suite 400, Alexandria, VA 22314-1774 USA or jackman@flightsafety.org.

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 ISSN 1934-4015 (print)/ ISSN 1937-0830 (digital). Published 11 times a year.

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CHILD RESTRAINT Devices

As parents, we'd all like to think that there is nowhere safer for our children than in our arms, particularly when our kids are very young. And from a nurturing or development standpoint, this is probably true. But is it true during a high-speed rejected takeoff, clear air turbulence or a runway excursion when acceleration g-forces come into play?

When traveling by air, parents generally are allowed to hold the smallest children, those under the age of 2 years, on their laps, obviating the need to buy an additional seat. However, in the United States there are no restraining devices for lap-held children that are approved for use during takeoff and landing, so parents are expected to secure these children using only their arms.

In a speech April 21 at the National Press Club in Washington, Deborah Hersman, then the outgoing chairman of the U.S. National Transportation Safety Board (NTSB), made the issue of lap-held children one of the focal points of what were essentially her farewell remarks. "Some people say the risk is small," Hersman said. "I tell them, 'No, a baby is small.' We secure laptops and coffeepots, yet we do not secure our most precious cargo, our children."

In the late 1970s, NTSB recommended that the Federal Aviation Administration research and initiate a rulemaking on the restraint of small children. After the crash of United Airlines Flight 232 at Sioux City, Iowa, 25 years ago, NTSB recommended restraints for lap-held children, "and we have been recommending it ever since," Hersman said.

During the question-and-answer session following her speech, she said, "I couldn't have imagined in 2004 [when she joined the NTSB] that we'd still be talking about this issue in 2014." She described it as one of the "great disappointments" of her tenure on the board.

As soon as we wrap up this issue of *AeroSafety World*, I will be headed to Madrid to attend the International Air Transport Association's (IATA's) Cabin Operations Safety Conference. Among the conference activities are two workshops — half a day each — on child restraint devices. In its conference materials, IATA said it is seeking an "internationally recognized solution on accepted child restraint devices with a solution that is practical, affordable, operationally realistic, feasible and harmonized globally."

I'm looking forward to the discussion, and I hope that a solution to the issue is on the horizon.

Frank Jackman
Editor-in-Chief
AeroSafety World

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 non-profit 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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JUNE 10–11 ➤ 2014 Safety Forum: Airborne Conflict. Flight Safety Foundation, Eurocontrol, European Regions Airline Association. Brussels, Belgium. <tzvetomir.blajev@eurocontrol.int>, <skybrary.aero>.

JUNE 16 ➤ International Progress Toward a Just Culture — Proactive Use of Data. Air Line Pilots Association, International. Washington, D.C. <justculturesymposium.alpa.org>.

JUNE 24–25 ➤ 6th annual Aviation Human Factors and SMS Seminar. International Society of Safety Professionals. Dallas. <isspros.org>, +1 405.694.1644.

JUNE 30–JULY 2 ➤ Safe-Runway Operations Training Course. JAA Training Organisation. Abu Dhabi, United Arab Emirates. <jaato.com>, +31 (0) 23 56 797 90.

JULY 3 ➤ Technology: Friend or Foe? The Introduction of Automation to Offshore Operations (Annual Rotorcraft Conference). Royal Aeronautical Society. London. <conference@aerosociety.com>, +44 (0) 20 7670 4345.

JULY 14–20 ➤ 49th Farnborough International Airshow. Farnborough Airport. Farnborough, Hampshire, England. <enquiries@farnborough.com>, <farnborough.com>, +44 (0) 1252 532 800.

JULY 16–17 ➤ Evidence-Based Training Meeting. International Air Transport Association in collaboration with International Civil Aviation Organization. Lima, Peru. Marcelo Ureña, <murena@icao.int>.

AUG. 11–14 ➤ Bird Strike Committee USA Meeting. Bird Strike Committee USA. Atlanta. John Ostrom, <john.ostrom@mspmac.org>, <www.birdstrike.org>, +1 612.726.5780.

SEPT. 3–5 ➤ ALTA Aviation Law Americas 2014. Latin American and Caribbean Air Transport Association. Miami. <www.alta.aero>, +1 786.388.0222.

SEPT. 8–12 ➤ Aviation Safety Summit 2014. Latin American and Caribbean Air Transport Association. Curaçao. <www.alta.aero>, +1 786.388.0222.

SEPT. 23–24 ➤ Asia Pacific Airline Training Symposium (APATS 2014). Halldale. Bangkok, Thailand. <halldale.com/apats>.

SEPT. 23–25 ➤ International Flight Crew Training Conference 2014. Royal Aeronautical Society. London. <conference@aerosociety.com>, +44 (0) 20 7670 4345.

SEPT. 29–OCT. 3 ➤ Aircraft Accident and Incident Investigation: ICAO Annex 13 Report Writing. Singapore. Singapore Aviation Academy. <saa@caas.gov.sg>, <saa.com.sg>, +65 6543 0433.

OCT. 6–9 ➤ 2014 Public Safety and Security Fall Conference. Airports Council International–North America. Arlington, Virginia, U.S. <aci-na.org>.

OCT. 13–17 ➤ ISASI 2014 Seminar. International Society of Air Safety Investigators. Adelaide, Australia. <www.isasi.org>.

OCT. 21–23 ➤ NBAA2014 Business Aviation Convention and Exhibition. National Business Aviation Association. Orlando, Florida, U.S. <info@nbaa.org>.

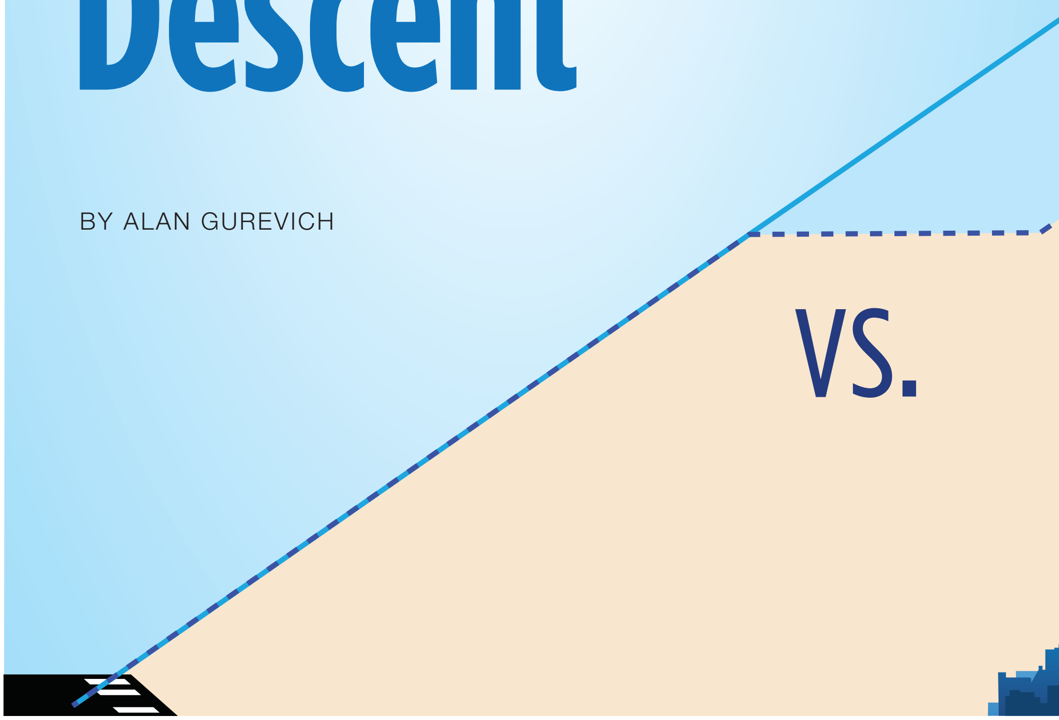
OCT. 28–29 ➤ European Airline Training Symposium (EATS 2014). Halldale. Berlin. <halldale.com/eats>.

NOV. 3–5 ➤ 52nd annual SAFE Symposium. SAFE Association, Orlando, Florida, U.S. <safe@peak.org>, <www.safeassociation.com/index.cfm/page/symposium-overview>, +1 541.895.3012.

NOV. 11–13 ➤ 67th annual International Air Safety Summit. Flight Safety Foundation. Abu Dhabi, United Arab Emirates. Namratha Apparao, <apparao@flightsafety.org>, +1 703.739.6700, ext. 101.

Continuous Descent

BY ALAN GUREVICH



VS.

In an article comparing constant-angle, nonprecision, straight-in instrument approach procedures (IAPs) with "dive-and-drive" (stepdown) IAP designs ("Continuous Descent," *ASW*, 7/13, p. 38), the article's source makes a case against airline flight crews' continued use of dive-and-drive IAPs.

In dive-and-drive, the pilot flying passes the depicted final approach fix (FAF) — or, if not depicted, the point where the aircraft is established inbound on the final approach course — at a specified altitude. He or she then typically descends, possibly with one or more stepdown fixes, to arrive at the minimum descent altitude (MDA) prior to reaching the missed approach point (MAP). On many IAPs today, a vertical descent point (VDP) provides a defined point on the final approach course from which a "normal" (usually 3.0-degree glidepath) descent from the MDA to the runway touchdown point may be commenced, provided the pilot has established visual reference.

But, as importantly, the VDP is almost universally considered now to be the last point from which it is acceptable to be in your descent from the MDA to the runway. Beyond the VDP, you'll be too close and, hence, too steep. Aviation regulations generally specify that the pilot cannot descend below the MDA unless in a normal position to continue the approach to landing. This is not a trivial point, as a pilot very likely would run into trouble with a pilot examiner during a practical test if he flew past the VDP, and then decided to descend for landing. Either he would be steeper on approach than is deemed safe, or he would touch down beyond the touchdown zone.

The *ASW* article's source first argued that dive-and-drive IAPs inherently are prone to becoming unstabilized because of the fairly steep rate of descent — usually between 1,000 and 1,500 fpm (the "dive"), which operational experience and research consider unacceptable below 1,000 ft above ground level — required to level off at the MDA sufficiently prior to the VDP. Second, even if prior to reaching the VDP, the pilot has sufficient visual reference to continue the approach, he must fly level until reaching the VDP (the "drive"), and then re-establish a descent. The source then said that an added problem is that once you re-start the descent, you may also have to reconfigure the airplane. In his words, "You're configuring the airplane late, quite often reading checklists right down to the last moment." Aside from all other considerations, this was deemed contrary to today's stabilized-approach safety philosophy. I agree it would be contrary to stabilized-approach philosophy, but I don't agree that it is usually, or even commonly, called for.

A better method, according to the article, is the constant-descent approach (CDA). Here the pilot flying conducts an IAP designed or adapted for a continuous rate of descent from

Dive-and-Drive

the FAF/FAF altitude to arrive at the MDA and VDP at the same time. The pilot then just continues the descent, assuming sufficient visual reference has been established, to landing. *Visual reference* is a complex concept beyond the scope of this article, so I'll just say "runway in sight" for simplicity from now on.

I disagree with the CDA-only philosophy as presented for a few reasons. First, as pointed out in the article, not all airplanes have the capability to generate the guidance that many airlines require for a CDA. The source noted that some nonprecision, straight-in IAPs provide a table showing distances vs. altitudes which, if followed, approximate the proper descent rate. For IAPs that do not, the pilot would have to calculate these numbers as the airplane descends or refer to another tool if available.

Yet doing this mental calculation accurately, which is critical this close to the ground, is not assured, as pointed out in the article itself. The pilot must accurately calculate while flying the airplane, looking for the runway and maintaining situational awareness. Although letting an autopilot do the flying can help, if you get behind — or, worse, err in your calculations — you can put yourself in a bad situation. Even when provided with a table giving you distance vs. altitude numbers, having to constantly refer to it by looking down at the approach plate for the number, then to the flight instruments to see if "you're there," and also looking out the windscreen, is not easy or, perhaps, safe. Humans are not great multitaskers, and flying an approach in bad weather already involves lots of tasks, without adding math — and math that must be accurate.

Second, as mentioned, I disagree with the article's quote about level of risk while changing configuration and doing checklists after passing the FAF. There may be some airlines that specify this, but I rather doubt it is anywhere near common. I can't provide substantiation, but I know from the three or four operators with which I am familiar, that their standard operating procedures specify that the airplane be configured in the landing configuration by the FAF, with all checklists complete. This is required specifically so that the pilots do not have to concentrate on anything other than safely flying the last phase of the approach, and fully supports the stabilized-approach safety concept. This would apply in both CDA and dive-and-drive cases.

Third, the MDA of a nonprecision IAP is the lowest altitude to which a pilot can fly prior to having the runway in sight, as opposed to reaching the decision height (DH)/decision altitude (DA) on a precision IAP. The DH/DA allows continuing the descent for the brief period while the pilot decides whether there is sufficient visual reference to continue to land, or executes a missed approach. Not so with the MDA.

When you fly a CDA, the goal is to reach the MDA at the VDP. If you don't have the runway in sight at that time, you must go around. But the problem is that with a CDA, by definition, you're still in a descent as you reach MDA and make the go-around decision. If you see the runway, no problem; if you decide that you must miss the approach, you are below MDA in violation of regulations, and you may also be unsafe. If, for example, it takes 150 ft to transition from your descent to level flight at the MDA, then you must start to level off 150 ft prior to reaching the MDA. You are limiting yourself to having to either see the runway 150 ft above minimums, or leveling off at minimums where, if you see the runway, you'll be in the same position as if you'd done a dive-and-drive to begin with.

There's also the chance that the descent angle required from the FAF/FAF altitude to arrive at the MDA and VDP at the same moment will not be 3 degrees; this is not something the pilot has a choice in. I assume the goal in establishing the location and altitude of the FAF is to locate it on a nominal 3.0-degree glidepath to the touchdown point. But if anything (obstacles or perhaps other altitude restrictions) dictates that the FAF altitude be higher or lower than that provided by a 3-degree glidepath, then the descent path during the CDA will get you to the VDP via a steeper or shallower gradient than you want from the VDP to touchdown.

So if the idea of a CDA is to look out the windscreen as you approach the MDA-VDP, see the runway, and then continue the same rate of descent to landing, you may end up short or long. I understand that judging the final descent is what we get paid to do, but using a CDA may set you up to start off at the wrong descent rate.

Will the latest versions of dive-and-drive IAP solve any of these problems? No and yes.

No, because in a dive-and-drive you will, in fact, have to transition from level flight at the VDP to a stable descent. This will make you slightly steeper than the nominal 3 degrees. A mitigating factor is that, at least in the United States, pilots are allowed to begin a descent up to 0.2 nm (0.4 km) prior to a charted descent point. But as the ceiling is just as likely to be the reason you can't see the runway; if you level earlier at the MDA, you may see the runway earlier and then be able to start the descent by the VDP.

No, because the airplane will be level at a more nose-up attitude than if it reached the VDP in a descent. This will likely restrict the pilot's forward and down vision to some extent, depending on airplane design.

Yes, because the pilot is not giving up the last 150 ft or so of altitude approaching the MDA, where he might see the runway. If the ceiling is very near the MDA, then a CDA is likely to end in a missed approach for that reason.

Yes, because the pilot does not have to do math or continuously refer to the approach plate, checking altitude to go vs. distance while performing all other required tasks.

Yes, because if an autopilot can be used for vertical navigation, the pilot can let it level off and fly at the MDA while devoting more crosscheck capacity to looking for the runway prior to reaching the VDP. Even if this saves only a few seconds, it provides the pilot with a chance, when the weather is marginal, to see the runway before reaching the VDP.

If an autopilot is used to fly a CDA, which is a requirement at some airlines, then the autopilot will allow you to do the same search for visual reference,

but it's going to transition to level-off mode before you reach the VDP, as mentioned above. And if you have to do the math or check the altitude/distance table, there is not much time to be looking outside.

While considering a response to this article, I had the fortune to change seats at my airline. My new airplane, a large commercial transport jet, has flight management/autoflight systems that are fully capable of not only flying the airplane via either dive-and-drive or CDA IAPs, but they also can calculate the constant descent angle required and display this, very much like an instrument landing system glideslope. No math or table required.

And still, I've experienced exactly the dilemma mentioned: On each of the CDAs I fly (actually, our policy is that the automation must fly CDAs), when the pilot monitoring calls "approaching minimums" 200 ft above the MDA, I know that if I don't have the runway visually in the next 40 ft, the autopilot will start to level the aircraft at the MDA. Once that begins, I have no choice but to commence a missed approach, as the airplane is already past the point where I can cross the VDP at the MDA in a descent, which are the criteria my company (rightly) requires: That's the entire point of the CDA.

While I've always looked with suspicion on the concept of a pilot-derived CDA, it was mainly because of the added mental workload needed to constantly monitor the "distance to go vs. altitude" progress, and also because of how often I've made errors doing this calculation in line operations. I've often gotten behind, or paid too much attention to the math, and lost situational awareness in one way or another.

But by practicing CDAs in training with an airplane that does all the calculating and flying for me, I've become more concerned about the other issue: If I'd been able to descend to the MDA even a few seconds prior to the VDP, assuming the ceiling was right at minimums, I could've gained sufficient visual reference to descend below the MDA. True, I'd have had to start down very slightly before reaching the VDP to get on a 3-degree descent angle, or accept a slightly steeper descent by leaving the MDA at the VDP. I feel those are acceptable choices, and certainly no worse than the possibility of not seeing the runway until the airplane is already leveling off, and then having to miss the approach.

Even if I have the runway in sight as the autopilot levels the airplane at the VDP, I'm not supposed to disconnect the autopilot and dive back onto the glide path. So what do I do? Set up for another approach? What if that's the only IAP available? If I assume, because I just managed to see the runway as I passed the VDP after the autopilot leveled me off on the last approach, that I'll see the runway next time, do I disconnect the automation on the next try and hand fly the descent the last 150 ft to the MDA, so the airplane doesn't again start to level off? What if the weather has changed and I don't see the runway this next time? Then I bust the MDA. Is this so unsafe as to be a real issue? I can't answer that.

But I know that I could do that nasty old dive-and-drive IAP on my second approach, make sure I get to the MDA soon enough to ascertain I can still see the runway at minimums, and then start the descent just prior to, or upon, reaching the VDP. Yes, it might take a higher rate of descent from the FAF to get to the MDA early enough, but I don't feel it would be such a high rate as to be a greater threat than not seeing the runway and having to again miss the approach. And if I had done the dive-and-drive the first time around, I might already be on the ground, with more fuel. Perhaps, while planning for the approach, if I know it's going to take an unacceptably high rate of descent to reach the MDA prior to the VDP, then it's time to acknowledge that that approach, and today's weather, just aren't a safe combination.

All of this is not to say that I don't like the CDA concept. I just don't like CDAs when the ceiling is close to the MDA. And how can I be sure of where I'll break out in changing, or marginal, conditions?

There is one other possibility: Have the regulatory authorities recognize the problem of flying approaches to MDAs. Instead, convert all MDAs to DHs or DAs. That will likely mean the DH/DA will have to be somewhat higher than the old MDA for the same approach, to allow for the transition from a descent to a climb in the event of a missed approach. But at least then the pilot could reach DH/DA at the VDP and decide what to do. If there's no runway, miss the approach knowing that the airplane will (legally) descend (safely) below the DH/DA while transitioning to the missed approach climb or, if the runway is in sight, then the descent path can be continued. Of course, this doesn't address my concern about today's airline pilots calculating their own CDA flight paths. That is their individual decision.

In the past few months, I've learned that this appears to be exactly what another airplane model in my company's fleet does. Some of the IAPs have been modified to take into account the amount of altitude used in leveling off during the CDA. An altitude that is *not* an MDA is used as the missed approach decision point, prior to the autoflight system beginning the level-off. I look forward to the day when all nonprecision IAPs make use of this new idea, with an aircraft-generated CDA.

Alan Gurevich is a captain for an airline operating wide-body aircraft in both U.S. domestic and international operations. His background includes flying military fighters and transports, and engineering work in both the aerospace and systems safety fields.

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, director of publications, Flight Safety Foundation, 801 N. Fairfax St., Suite 400, Alexandria VA 22314-1774 USA or jackman@flightsafety.org.

Safety News

Underwater Search

Transmission time should be extended from 30 days to 90 days for the underwater locating devices (ULD) installed in large commercial airplanes to help searchers find flight recorders in the event of a crash into a large body of water, the European Aviation Safety Agency (EASA) says.

In proposals released in early May, EASA also said that large airplanes that fly over oceans should be equipped with a new type of ULD with a longer locating range than the ULDs now in use. As an alternative, EASA said that these airplanes could be equipped with "a means to determine the location of an accident within 6 nm [11 km] accuracy."

Another proposal said that the recording capacity of cockpit voice recorders should be increased to 20 hours, up from the current requirement of two hours.

EASA Executive Director Patrick Ky said that the proposals, coming as the search for the missing Malaysia Airlines Flight MH370 was about to enter its second month, were intended to enhance safety "by facilitating the recovery of information by safety investigation authorities."

The proposals must be adopted by the European Commission before they take effect; if adopted, they would apply to aircraft registered in EASA member states.

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Air Ambulance Rules

Medical transfer flights in Australia would be reclassified as air transport category operations under a proposal from the Civil Aviation Safety Authority (CASA).

The flights currently are regulated as aerial work, and CASA says that Australia is the only nation using that designation.

"This classification subjects Australia's medical transfer operations to a different standard of regulation than the International Civil Aviation Organization standards and those of most other nations," CASA said.

CASA's proposal calls for medical transfer flights to be subject not only to air transport regulations but also to "specific air ambulance operational requirements … to provide the flexibility needed for medical flights," the agency said.

Information Sharing

The European Aviation Safety Agency (EASA) and the International Air Transport Association (IATA) have agreed on a plan for sharing safety information and jointly analyzing safety trends.

The two organizations said that their analyses would be based primarily on information derived from EASA's Safety Assessment of Foreign Aircraft program — which conducts about 11,000 ramp inspections on randomly selected aircraft and their crews, focusing on flight preparation and aircraft technical condition — and the IATA Operational Safety Audit (IOSA), which evaluates airline operational safety management.

"Safety is aviation's highest priority, and IOSA is the global benchmark for airline operational safety management," said IATA Director General and CEO Tony Tyler. "Working together through this information and trend-sharing partnership will contribute to making aviation even safer, while offering the potential to optimize the audit processes."

EASA Executive Director Patrick Ky added that the partnership with IATA will "facilitate the demonstration of compliance to the new rules affecting non-European Union airlines."

Both organizations said that the information-sharing program will help identify safety issues and lay the groundwork for improvements in the safety auditing process, including the European Union's third-country operator assessments and authorization requirements.

Common Airspace

The European Commission (EC) has made a formal request to five countries to "make a decisive move" to improve their functional airspace block (FAB) — a regional air traffic control unit designed as a central part of the Single European Sky.

Belgium, France, Germany, Luxembourg, the Netherlands and Switzerland are the first European member states to receive letters of formal notice from the EC. Their FAB was formally established in June 2013, six months later than required by regulations, and subsequent progress in reorganizing airspace has been slow, the EC said.

Several other FABs also are not yet compliant with regulations, the EC said, adding that they may receive similar letters of formal notice in the future.

"We have to finally overcome national borders in the European airspace," said Siim Kallas, EC vice president responsible for transport. "FABs are a necessary, vital component of the Single European Sky. Right now, these common airspaces exist only on paper; they are formally established but not yet functional. I urge member states to step up their ambitions and push forward the implementation of the Single Sky."

The EC considers its system of FABs "a cornerstone towards a single airspace that reduced the fragmentation along national borders in air traffic management."

Benefits of the system include higher safety standards, the EC said, adding, "By enabling airplanes to fly without dealing with border crossings, FABs will remove the risk of border interference and national inconsistencies in safety procedures."

Other benefits include reductions in fuel usage, costs, travel delays, noise and emissions, the EC said.

Member states have two months from the receipt of a letter of formal notice to respond.

Ice-Detection Study Sought


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Civil aviation authorities should examine the possibility of installing infrared cameras or other sensors to detect the presence of ice or frost on aircraft wings, the French Bureau d'Enquêtes et d'Analyses (BEA) says.

The BEA included the recommendation in its final report on the March 4, 2013, crash of a Beechcraft Premier 1A shortly after takeoff from an airport in Cranves-Sales that killed the general aviation pilot and one passenger, seriously injured the other passenger and destroyed the airplane. Accident investigators determined that the airplane had stalled on takeoff and that its "observed behaviour … was consistent with a stall due to contamination of the wings with frost or ice," the report said.

The report said that the pilot's "insufficient appreciation of the risks associated with ground-ice led him to take off with contamination of the critical airframe surfaces" — and added that the same lack of understanding may have contributed to 32 other accidents since 1989. In those accidents, the aircraft were not deiced before takeoff.

"The investigation … showed that an onboard device for the detection of ice on the ground could have prevented the [2013] accident," the report said.

As a result of its investigation, the BEA issued three safety recommendations, including its call for the European Aviation Safety Agency (EASA), the U.S. Federal Aviation Administration and other non-European civil aviation authorities to "study the technical and regulatory means to put in place … systems for the detection of frozen contaminants on the critical surfaces of aircraft."

Another recommendation called for EASA and national civil aviation authorities to change pilot training requirements to include "periodic reminders on the effects of contaminants such as ice on stall and loss of control on takeoff."

The final recommendation said that the French Direction Générale de l'Aviation Civile should "define criteria to make it mandatory for aerodrome operators to have deicing/anti-icing facilities at aerodromes."

Rating Improvement

Safety standards in the Philippines have improved and the country now merits a Category 1 rating from the U.S. Federal Aviation Administration (FAA) — the rating that signifies compliance with safety oversight standards established by the International Civil Aviation Organization (ICAO).

The Philippines had held a Category 2 rating — signifying that a country lacks laws or regulations to oversee air carriers in accordance with minimum international standards — since January 2008, when it was downgraded as a result of an earlier FAA review.

The FAA conducts the reviews under its International Aviation Safety Assessment program, which is intended to determine whether civil aviation authorities meet ICAO standards.


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NORTHERN PLAINS
UAS TEST SITE

UAS Sites Operating

Two of the six U.S. test sites selected for unmanned aircraft systems (UAS) research have begun operating, one in North Dakota and the other in Alaska, the U.S. Federal Aviation Administration (FAA) says.

The North Dakota site, under the jurisdiction of the state Department of Commerce, was the first to receive a certificate of waiver or authorization (COA) from the FAA for flights using a Draganflyer X4-ES small UAS at a site in Carrington. The flights were scheduled to begin in early May.

A primary goal of the Department of Commerce is to use UAS in "precision agriculture," including checking soil quality and crop status, the FAA says.

The second COA was issued to the University of Alaska Fairbanks, authorizing the use of an Aeryon Scout small UAS for wild animal surveys at a test range in Fairbanks. Flights began in early May and were intended to demonstrate how a UAS can locate, identify and count caribou, bears and other large animals.

Both sites also will collect safety-related operational data needed for the integration of UAS into the National Airspace System, the FAA said, adding that the information "will help the FAA analyze current processes for establishing small UAS airworthiness and system maturity."

The FAA said that the Alaska flights also "will evaluate procedures for coordination with air traffic controllers, as well as the type and frequency of operational data provided to them."

In North Dakota, operators will collect maintenance data "to support a prototype database for UAS maintenance and repair," the FAA said.

Making a List

The European Commission's 23rd update of its list of airlines banned from operating in the European Union (EU) has returned flying privileges to all airlines from Swaziland and to others from the Philippines and Kazakhstan.

The updated list prohibits operations in the EU for 294 airlines from 20 countries, plus two individual airlines. Ten additional airlines may operate under specific restrictions.

Swaziland is the second country to be removed from the list because of aviation safety improvements; Mauritania, removed from the list in 2012, was the first.

Crash Site Designated as Landmark

The area where wreckage fell after a 1956 midair collision 21,000 ft over Grand Canyon National Park, Arizona, U.S., has been designated as a national historic landmark.

The collision, on June 30th of that year, of a Trans World Airlines Super Constellation L-1049 and a United Airlines DC-7 killed all 128 people in the two airplanes and is seen as the impetus for a new emphasis on aviation safety and the modernization of airways across the United States.

The Civil Aeronautics Board — a predecessor of the National Transportation Safety Board — found the probable cause of the crash was each pilot's failure to see the other's airplane.

The National Park Service said that the hundreds of pieces of aircraft wreckage in the remote section of the Grand Canyon, along with "evidence of land disturbance" associated with the crash, convey "a sense of the accident's improbability due to the area's uncongested airspace [and] the challenges associated with recovering accident victims."

Chloe93/WikiMedia Commons

In Other News …

The U.S. Federal Aviation Administration (FAA) has proposed a $547,500 **civil penalty** against Hawaiian Airlines for allegedly operating a Boeing 767-300 between July 2004 and July 2012 even though it was out of compliance with regulations that required inspections of some thrust reverser components. The FAA said that the airline had requested a conference to discuss the matter. … The European Commission has approved a plan to allow airlines outside the European Union (EU) to obtain a single **safety authorization** to operate within the entire EU.

Compiled and edited by Linda Werfelman.

Despite safety progress, the U.S. air tour industry must resolve duty time, flight surveillance and maintenance issues, a report says.

Touring

BY LINDA WERFELMAN

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The U.S. air tour community and federal regulators have addressed many of the issues that pushed accident rates in a recent 10-year period well above averages for the rest of the nation's aviation industry, but some problems persist, according to a new report on air tour safety concerns.[1]

Lingering problems include some operators' lack of adequate flight surveillance programs, evidence of a need for stricter flight and duty hour limitations for air tour pilots, insufficient implementation of maintenance quality assurance programs and the need to eliminate a rule allowing U.S. Federal Aviation Regulations (FARs) Part 91 operators to conduct commercial air tours within 25 mi (40 km) of their base without being subject to the more stringent safety requirements applied to Part 135 commuter and on-demand operators, said the report by Sarah-Blythe Ballard of the Johns Hopkins Center for Injury Research and Policy.

The U.S. National Transportation Safety Board (NTSB) and the Federal Aviation Administration (FAA) addressed similar concerns earlier this year. The NTSB included the need to deal with "the unique characteristics of helicopter operations" on its 2014 "Most Wanted" list of transportation safety improvements, released in January. The list noted that air tour operators — like the operators of helicopter emergency medical services and law enforcement flights — often must cope with rapidly changing weather conditions and other challenges, and that new safety improvements are needed to help reduce the current "unacceptably high number of helicopter accidents."

The FAA, in a package of rules changes announced in February to take effect at varying dates over the next few years, said helicopter air tour operators and other commercial helicopter operators would be subject to "enhanced procedures for flying in challenging weather, at night and when landing at remote locations." Many of the changes were developed in response to NTSB safety recommendations, the FAA said.

Earlier Study

Ballard's earlier study of air tour accidents, based on an examination of data from the FAA and the NTSB, found that there were 152 crashes of U.S. air tour aircraft from 2000 through 2010, including 30 fatal crashes (20 percent) with an average of 3.5 fatalities each.[2]

The average accident rate in the U.S. air tour industry during that period was 2.7 per 100,000 flight hours, with a higher rate (3.5 per 100,000 flight hours) in air tour operations conducted under Part 91 and a lower rate (2.3 per 100,000 hours) in those conducted under Part 135, said the new report, published in the February issue of *Aviation, Space, and Environmental Medicine*.

"Within the air tour industry," the report said, "the crash rate among Part 91 air tour operators is 50 percent more than [that of] Part 135 air tour operators.

In addition, the report noted that the accident rate for all air tour aircraft is "more than 10 times that of large commuter airlines (0.2 per 100,000 flight hours) and more than two times that of all Part 135 operators (1.3 per 100,000 flight hours)."

The rate of 3.5 accidents per 100,000 flight hours for Part 91 air tour accidents is similar to the elevated rates recorded in the past in "high hazard" categories of commercial aviation, the report said.

"Prior to 1994, the Hawaiian helicopter air tour crash rate of 3.4 per 100,000 flight hours was so alarming that it prompted the emergency implementation of Special Federal Aviation Regulation [SFAR] 71," the report said, referring to the 1995 document that prescribed special operating rules for air tours conducted in Hawaii, with a few exceptions. "Similarly, the helicopter emergency medical services crash rate of 3.5 per 100,000 hours flown between the years 1992 and 2001 prompted a special investigation by the NTSB in 2009. … Likewise, the extremely hazardous activity of overwater ferrying of personnel and heavy-load supplies to offshore drilling sites reported a national crash rate of all turbine-powered civilian helicopters of 5.1 per 100,000 hours flown.

"Exposing air tour patrons and pilots to the elevated crash rates normally associated with 'high hazard' flight during recreational and occupational activities that occur in visual meteorological conditions is unacceptable, and stakeholders in the air tour industry should continue to work together to reduce this unnecessary risk."

Industry Response

Government and industry have responded in recent years to many of the air tour community's safety concerns. For example, in 1998, the FAA issued FARs Part 136, *Commercial Air Tours and National Parks Air Tour Management*, which deals specifically with air tour operations, with a separate section for flights conducted over the Grand Canyon and other national parks.

In 1996, helicopter air tour operators formed the Tour Operators Program of Safety (TOPS), which has dealt with a number of safety issues including several maintenance-related safety issues. Some of these items have been the subject of NTSB safety recommendations. Ballard's new report cited a TOPS estimate that its members account for 85 percent of air tour flight hours in a typical year, adding that their safety record — in comparison to that of all air tour operators — is "considerably improved."

After the Study

An *ASW* search of NTSB accident data showed that, in the years following the study of the 2000–2010 period, seven air tour accidents have been recorded, including two fatal accidents that killed five people each (see "Fatal Crashes," p. 19). The NTSB had not, at press time, determined the probable cause of one of the fatal accidents, but the other fatal crash was traced to inadequate maintenance, the final accident report said.[3] The report cited a series of maintenance errors and identified as contributing factors the mechanic's and the quality control inspector's fatigue.

Maintenance issues also were cited in four of the five nonfatal (also noninjury) air tour accidents that occurred from 2011 through April 2014; in the fifth accident, which resulted in three injuries, the NTSB cited the pilot's failure to ensure that the helicopter had sufficient fuel for the flight.

Both fatal crashes, as well as three of the nonfatal crashes, involved helicopters.

Safety Initiatives

Ballard's new study points to NTSB safety recommendations, increased oversight by the FAA and the air tour industry's 20 years of heavy involvement in the safety process and in rulemaking efforts with helping to improve the accident record.

Nevertheless, the report said several safety issues still require attention from the air tour industry and the regulator.

Real-time flight following, also called flight surveillance, remains a problem because, "despite the enhanced capabilities of weather detection, communication and tour-route tracking associated with the proposed ADS-B [automatic dependent surveillance–broadcast] system implementation, Hawaiian air tour operators remain opposed to the system, asserting that the system would introduce more FAA interference with operations," the report said. "They have also cited supplemental concerns about the cost of the components, added weight to the aircraft and not enough space in the aircraft for modification."

Despite their reservations, however, some operators have taken steps needed for early implementation of ADS-B avionics to enable their flight surveillance, the report added.

The industry also has been generally receptive to the Part 136 requirement calling for the addition of personal flotation equipment and aircraft float systems to their aircraft — a provision that the report describes as the most costly element of the regulation, the report said.

Another regulatory requirement — originally an SFAR 71 directive (and now Appendix A to Part 136, "Special Operating Rules for Air Tour Operators in the State of Hawaii") that Hawaiian air tour flights must remain at or above 1,500 ft above ground level (AGL) — has drawn criticism from operators that say the limit "inadvertently degrades safe maneuverability in an operating environment characterized by unstable meteorological conditions," the report said.

The impact of the 1,500-ft requirement should be the subject of additional investigation, the report said, citing data that showed that, after implementation of the requirement, the accident rate decreased from 3.4 per 100,000 flight hours to 1.8 per 100,000 flight hours. However, the decrease was accompanied by an increase in crashes involving visual flight rules (VFR) flights into instrument meteorological conditions (IMC). The number of associated fatalities was similar, before and after the rules change, the report said.

"It is not clear whether the decreased crash rate is due to the 1,500-ft AGL minimum requirement," the report added. "It is plausible that the increased incidence of VFR-IMC crashes could be related to helicopter flying at higher altitudes, where exposure to cloud cover is likely."

The report added that TOPS has consistently addressed the maintenance issues that have been the focus of many NTSB recommendations involving the air tour industry, including the expansion of safety audits to include a review of TOPS members' maintenance quality assurance programs.

Unaddressed Issues

Other issues have not been adequately addressed, the report said, singling out pilot fatigue and noting that the FAA has not acted on the NTSB's recommendations calling for more stringent duty time limitations for air tour pilots.

Part 135 pilots are subject to limitations on flight time and requirements for adequate rest, but those provisions do not apply to their Part 91 counterparts, the report said.

"Commercial air tour pilots are exposed to multiple takeoffs, landings and maneuvers, resulting in a more demanding workload throughout the day relative to long-haul pilots," the document said, citing multiple studies that have identified pilot fatigue as a primary safety hazard, especially for those who conduct a number of short flights throughout their workdays.

"Further, most U.S. commercial air tours are carried out by single pilots, so there are no opportunities to share the workload or take in-flight rests, as there are for pilots who are part of multi-pilot crews. … Given the known risks of fatigue and the high crash rate of Part 91 air tour operators, addressing human fatigue in this population through flight time limitations could be beneficial."

Notes

1. Ballard, Sarah-Blythe. "The U.S. Commercial Air Tour Industry: A Review of Aviation Safety Concerns." *Aviation, Space, and Environmental Medicine* Volume 85 (February 2014): 160–166.
2. Ballard, S.B.; Beaty, L.P.; Baker, S.P. "Commercial Air Tour Crashes, 2000–2011: Burden, Risk Factors, and FIA Score Validation." *Accident Analysis and Prevention* Volume 57 (2013): 49–54.
3. NTSB. Accident Report AAR-13/01, *Loss of Control; Sundance Helicopters Inc.; Eurocopter AS350-B2, N37SH; Near Las Vegas, Nevada; December 7, 2011*. Jan. 29, 2013.

Fatal Crashes

U.S. National Transportation Safety Board (NTSB) accident data show two fatal crashes involving air tour aircraft during the period from 2011 through early May 2014. Each accident involved a helicopter, and each killed the pilot and four passengers.

The fatal crashes occurred one month apart late in 2011.

The NTSB has not released its final report on the first of the two crashes, which occurred Nov. 10, when a Blue Hawaiian Helicopters Eurocopter EC130-B4 struck a mountain near Pukoo on the Hawaiian island of Molokai.

In a preliminary report, the NTSB said that a company flight plan had been filed for the flight, which began at Kahului Airport on the island of Maui, and that visual meteorological conditions (VMC) prevailed, although witnesses reported rain in the area at the time of the accident.[1]

Witnesses also said that "their attention was drawn to the helicopter when they heard some form of 'woop wooping' sound" as the helicopter descended toward the ground.

The other crash involved a Sundance Helicopters Eurocopter AS350-B2 that crashed in VMC in the mountains east of Las Vegas at dusk on Dec. 7 (*ASW*, 4/13, p. 20). In its final report on the accident, the NTSB cited a series of maintenance errors as the probable causes of the crash.[2]

— LW

Notes

1. NTSB. Preliminary accident report no. WPR12MA034. Nov. 10, 2011..
2. NTSB. Accident Report AAR-13/01, *Loss of Control; Sundance Helicopters Inc.; Eurocopter AS350-B2, N37SH; Near Las Vegas, Nevada; December 7, 2011*. Jan. 29, 2013

Full Disclosure

BY WAYNE ROSENKRANS

Misconceptions among professional pilots about their prospects of continued qualification for an airman medical certificate can prove costly in safety, health and financial terms, says Quay Snyder, a physician[1] and president and CEO of Aviation Medicine Advisory Service and its parent company, Virtual Flight Surgeons. In the United States, inaccurate information has a tendency to seep into some pilots' understanding at different stages of the dynamic process of revising Federal Aviation Administration (FAA) medical certification standards, he said.

Looking back at 12 months of changes, through first quarter 2014, shows a mostly positive impact on this pilot community, Snyder told the Business Aviation Safety Summit (BASS 2014) in San Diego, a conference hosted by Flight Safety Foundation and the National Business Aviation Association (NBAA).

The FAA's authority to issue waivers to pilots on some certificate requirements stems from agency policy governing the work of aviation medical examiners (AMEs), and this policy essentially expects AMEs to help pilots identify, to the extent possible, any medical conditions that might prevent them from flying safely, Snyder said. However, pilots should realize that the FAA is being tasked to do more with less while constantly being asked "Is that safe?" with respect to changes of medical certification standards and special issuances under them, he said.

Thorough U.S. aviation medical examiners ultimately save time, money and airman medical certificates of pilots.

"You'll be safe if you stay healthy," Snyder said. "Don't avoid seeking any medical evaluations. Get what you need because, generally, the FAA will waive you. … The sense I hope I'm conveying is that the FAA has flexibility despite not publishing the policies they're using — flexibility to liberalize the standards."

Fred Tilton, a physician and former U.S. Air Force F-15 pilot who retired from the FAA post of federal air surgeon in January, published policy-directive language to AMEs through the quarterly *Federal Air Surgeon's Medical Bulletin* that can be summarized as "issue a certificate whenever possible," Snyder said. "He did not want to see them deferred. [Tilton would tell AMEs,] 'If you're looking at a deferral, call the regional flight surgeon or call the Aeromedical Certification Division in Oklahoma City to see if you can get permission to issue that certificate.'"

James Fraser, a former U.S. Navy physician appointed in March as federal air surgeon, has continued the deferral-averse stance, Snyder noted. Fraser has invited experts' consensus about the latest scientific evidence for the remaining prohibitions against AMEs issuing an airman medical certificate. The physicians often use an unofficial term — *conditions AMEs can issue* (CACI) — for the physical and mental conditions that previously required FAA-level approval for special issuance of a medical certificate (Table 1, p. 22). Those had resulted in pilots not being able to fly after visiting an AME for a medical certificate, having it deferred and waiting maybe three or four months to get the certificate, Snyder said.

Personal Responsibility

Compliance with FAA requirements, one tenet of aviator professionalism, is the foundation of the national airman medical certification system. "The one regulation that we, as pilots, have to look at every time we fly — [Federal Aviation Regulations (FARs)] Part 61.53, ["Prohibition on operations during medical deficiency"] — is not a medical regulation [but] a certification regulation," Snyder said. "You can't act as a pilot-in-command — nor can you act as a required crewmember — if you have any medical condition or are taking any medication that may … make you [unsafe]. And you have to do this before every flight. It's a self-certification process separate from the medical certificate that you hold."

Although, as noted, the FAA does not publish its aviation medical policy, the agency periodically updates and posts its free *Guide for Aviation Medical Examiners*[3] — available online in the searchable Adobe Acrobat PDF format. The *Guide* discloses, for example, the long-requested "do not issue, do not fly" list of medications (Table 2, p. 23). The idea of publishing that list had been controversial for years. "The most important thing is 'What's the underlying condition you're taking the medicine for?'" Snyder told BASS attendees. "You could be taking an allowed medicine for a disallowed condition — or something that wouldn't be safe."

Fitness for Duty

Deficits in pilot cognition related to aging and impairments associated with medications or other known factors recently have become a focus area for the NBAA Safety Committee and the FAA General Aviation Joint Steering Group, BASS presenters said. Snyder's firm, for example, has been assessing flight operations personnel during the past four years for a major company that provides fractional aircraft services.

"We have [the company's] data on between 30 and 40 people right now," he said. "What was initially surprising is we find a lot of different conditions, physical and mental — all [items on the FAA's] IM SAFE checklist[2] — but also many nuances." Sleep apnea (*ASW*, 2/14, p. 34) and depression (*ASW*, 5/12, p. 29) were the most common conditions noted among these pilots, and others were of a psychologic, neurologic or drug-induced nature.

Difficulties in safely performing flight duties, sometimes manifested by such conditions, had been observed by coworkers in some cases. "The interesting part is that these are people who no one will fly with, have violated FARS, can't pass training events [and] can no longer requalify on recurrent training on their aircraft," Snyder said. "In about 70 percent of [such] people, [AMEs] identify a treatable condition. [They] do cognitive testing before and after, and we see that treating the medical or psychologic condition returns [pilots] to a healthy cognitive and psychologic state so they are qualified to fly, and the FAA routinely certifies them."

Backlog Empowers AMEs

One of every pilot's health-related objectives should be to develop and maintain a strong relationship with what he called a "good" AME, one who is not only qualified as a physician, educated in the applicable FARs and closely monitoring pilots' health changes, but also motivated, willing and ready anytime to communicate with the FAA on the pilot's behalf. "That's the person to go to," he said. "A good AME is worth his or her weight in gold."

In his experience, however, some pilots claim it's a great idea to search for an AME who has a reputation for signing medical certificates after a cursory medical assessment or even without an examination. "That really is not good because you could be [in] a situation where you have a disqualifying condition that's never been looked at — and that's an AME who's not willing to make a phone call if something [e.g., an undesired test result] comes in," he said.

"If you don't have an AME who — if there's a question — is willing to call the FAA, you need to find a new AME because that person who won't call will cost you a lot of money in sick leave, downtime, wasted effort and extra tests. If you don't have a good AME who will pick up the phone, get rid of that AME."

During the past 12 months, this advice has increased in relevance. The FAA's process of reviewing cases of U.S. pilots with problematic medical conditions, making decisions and issuing waivers slowed significantly because of a temporary government services interruption. By April 2014, however, the average duration of this process dropped from several months to 46 working days, Snyder said.

"The good part is that [the FAA] pushed all the [backlogged] work out to the AMEs," he said. "The AMEs are given more authority — more autonomy — and are encouraged to call the FAA to … reduce the paper flow that's coming in, the 'bandwidth' [workload] taken up in all the waivers going back and forth. … If the AME is willing to make a phone call to the FAA, you can speed that process up."

Evolving U.S. Airman Medical Certificate Standards for Health Conditions

Health Condition/Issue	Change in Policy/Standard	Effect on Pilots
LASIK/PRK eye surgery	Return to duty requires no appeal to FAA or grounding period.	If normal outcome — 20/20 distant vision — the treating physician's clearance and documentation are sufficient for AME issuance.
Cataract eye surgery	After correction of a single-vision cataract with one intraocular lens, return to flying duties is simple and quick, but an adjustment period is required for more complex cataracts.	If normal outcome, the treating physician's clearance and documentation are sufficient for AME issuance. Treatment of any multifocal cataract requires a three-month wait — or six months for a functionally monovision pilot — before resuming flight duties.
Hypertension	No longer requires authorization for special issuance certificate or waiver, or stress test or laboratory reports.	AMEs typically can issue a certificate based on pilot-presented documentation of diagnosis and successful treatment.
Electrocardiogram	Specific, formerly disqualifying results will now be accepted as normal.	The AME can issue for 10 result variants that have been reclassified as "normal." Abnormal results, including erroneous results, require less costly follow-up evaluation.
Prediabetes	AMEs can issue certificates without the special issuance procedure.	Pilots using a prediabetes medication other than insulin typically receive first-class and second-class certificates after a 60-day trial, but combining some allowed medications can be disqualifying.
Heart surgery	Pilots return to flight duty more quickly after some procedures.	Reapplying for a certificate is now allowed three months after an angioplasty with stent or a valve repair. Bypass or valve-replacement procedures still require a six-month grounding period. Only one initial radionucleide stress test is now required for subsequent issuance.
Pacemaker-battery replacement	Pilots return to flight duty more quickly.	AMEs can issue the certificate when the surgical wound has healed rather than requiring a two-month wait.

AME = aviation medical examiner; BASS = Business Aviation Safety Summit; FAA = U.S. Federal Aviation Administration; LASIK = laser-assisted in situ keratomileusis; PRK = photorefractive keratectomy

Note: A presentation to BASS 2014 in April drew attention to highlights of recent FAA policies and standards governing the issuance of airman medical certificates to pilots who have these conditions/issues. They are among changes that pilots can study in the April 2014 edition of the agency's *Guide for Aviation Medical Examiners.*

Source: Quay Snyder, M.D.

Table 1

Disqualifying Diagnoses

FARs Part 67, Medical Standards and Certification

— technically the FAA's only medical regulation — lists only 15 diagnoses that disqualify an applicant for an airman medical certificate; that list can be a point of confusion, Snyder noted. The small number appears here because this regulation also states that the federal air surgeon — "based on the case history and appropriate, qualified medical judgment relating to the condition involved"— has the authority to identify any condition, medication or treatment that would make the person unable to safely perform the duties or exercise the privileges of the airman medical certificate applied for or held.

The *Guide to Aviation Medical Examiners*, 336 pages long in 2014, contains more than 300 disqualifying diagnoses that for many years were difficult for non-AMEs to discover. "There's a downside in that [FAA medical policy] is a mystery to everyone, but the upside is that, as technology improves [and] medicine improves, they can adopt changes without going through a rulemaking process," Snyder said.

In practice, if the airman brings the appropriate documentation (see "Certificate-Keeping Tactics," p. 24) to the office visit, the AME now can perform the examination and complete a standardized worksheet for special issuances. Assuming all requirements are fulfilled, "the airman walks out with a medical certificate — bypassing the process that used to take two or three months," Snyder said.

A group of advocates for further updates, including Snyder, recently was informed that the FAA has adopted 14 of the 18 most recently proposed changes, expanding "protocols for conditions that we think should be well within the authority of an AME to issue," he said. "Some of the ones we

Evolving U.S. Airman Medical Certificate Standards for Medications

Medication/Concern	Change in Policy/Standard	Effect on Pilots
Anti-depressants	The period for AME observation of a pilot being treated for major depression (and other specified conditions) with the approved SSRIs Celexa, Lexapro, Prozac or Zoloft recently has been reduced.	FAA in 2010 grounded airline pilots during their first 12 months of a treatment limited to one dose of one medication, followed by 3 to 6 months of further evaluation before issuance, and then an annual cognitive assessment costing up to $4,000. The treatment evaluation is now six months, and a 1-hour, computer-based, aviation-specific cognitive test costing about $300 has been accepted by FAA and simplifies airman medical certificate issuance.
"Do not fly" dosing intervals	For specified medications on this list, pilots must wait five dosing intervals before resuming flight duties.	One example was that a listed OTC antihistamine taken every 8 hours now requires a 40-hour wait.
Chantix (smoking cessation)	This medication was added to the FAA "do not issue" list because of new labeling warning users of the possibility of depression or seizures.	AMEs cannot issue an airman medical certificate to pilots using this product.
Malaria prophylaxis	Mefloquine has been disallowed by FAA, and pilots should verify that only allowable medications are prescribed.	Prescription anti-malarial medications including Malarone usually are suitable for airline pilots and strongly recommended during travel to some places.
Scheduled medicines (including OTC)	All of these — some abused, for example, because of semi-synthetic opioid properties — are disallowed for airline pilots by the FAA "do not fly" list.	For example, Robitussin DM has such restrictions, and if taken by a pilot, requires a 60-hour grounding.
Nonsedating antihistamines	Only 2 products — Allegra and Claritin — are approved by FAA.	Some commercial products advertised as nonsedating nevertheless are on the FAA's "do not fly" list.
Valium (various drugs of abuse)	Valium is prescribed routinely before surgical or dental procedures.	For example, a single 5-mg dose of Valium grounds the pilot for 24 hours; a 10-mg dose requires a 48-hour grounding; and more than one dose, a 21-day grounding.
Erectile-dysfunction medications	All of these are on the FAA "do not fly" list, requiring a wait before flight duty (e.g., 6 hours after taking Viagra or 36 hours after taking Levitra or Cialis).	One adverse effect is interference with blue-yellow color vision, required to correctly interpret the multifunction display of the aircraft.
Prescription sleep medicines	Among those newly allowed by FAA are Ambien, Ambien CR, Edluar, Intermezzo, Restoril, Rozerem and Sonata, but pilots must follow the respective "do not fly" dosing intervals.	For example, Sonata, with its 6-hour waiting period before flight, may be recommended by a physician for quickly obtaining sleep while Ambien may be recommended for sleeping longer during a 36-hour layover.

BASS = Business Aviation Safety Summit; FAA = U.S. Federal Aviation Administration; OTC = over-the-counter (nonprescription); SSRI = selective serotonin reuptake inhibitor

Note: A presentation to BASS 2014 in April drew attention to highlights of recent FAA policies and standards governing the issuance of airman medical certificates to pilots who use these medications. They are among changes that pilots can study in the April 2014 edition of the agency's *Guide for Aviation Medical Examiners*..

Source: Quay Snyder, M.D.

Table 2

weren't successful in getting approved immediately — but I think will — are in the cancer category, particularly lymphoma and leukemia."

Intoxicated Driving

If a professional pilot in the United States is charged by police with violating a state law that prohibits driving a motor vehicle under the influence of alcohol (or other intoxicating substances or medications), potentially irreversible consequences to an aviation career can result. *Driving under the influence* (DUI) and *driving while intoxicated* (DWI) are two common terms for this offense.

"The FAA doesn't look kindly upon drinking," Snyder told BASS attendees, referring to such arrests, convictions and administrative actions. If an applicant ever has registered a blood alcohol level greater than 0.1499 in the context of an alcohol-related driving incident — in other words, 0.15 or higher — the AME cannot issue a medical certificate, he said. Likewise, if the applicant refused to provide a breath-alcohol sample to a law enforcement officer, the AME cannot issue a medical certificate. In practical terms, the pilot is likely to lose flying privileges for three to six months while dealing with the paperwork required before the FAA rules on whether to restore the airman medical certificate.

The AME also must defer certification, for example, if any alcohol-related or drug-related driving incident occurred within the preceding two years and there has been another arrest, conviction and/or administrative action at any other time. "[If] you had a minor-in-possession charge 30 years before [the latest incident,] that is disqualifying; the AME cannot issue," Snyder said. He cited that scenario because it was an actual case involving a pilot who was arrested for DUI while driving away from celebrating a daughter's wedding to assist someone involved in a car accident. The arrested pilot had to provide the AME a record from the 30-year-old incident.

Moreover, the AME cannot issue if the applicant has had a total of two arrests, convictions or administrative actions within the preceding 10 years, or has had a total of three arrests, convictions or administrative actions within a lifetime, Snyder said.

Generally, the AME does not take further action until the pilot provides all police reports, driving records from all states that ever issued the pilot a driver's license, arrest records, court records and military records. This process also

Certificate-Keeping Tactics

Apart from strategically selecting an aviation medical examiner (AME) and building a long-term relationship, airline pilots can avoid or overcome problems in the issuance of a U.S. airman medical certificate by applying simple tactics to the office visits, according to Quay Snyder, a physician and president and CEO of Aviation Medicine Advisory Service and its parent company, Virtual Flight Surgeons. His recommended tactics include:

- Schedule the office visit early in the month of certificate expiration. That way, if Federal Aviation Administration (FAA) requirements impose a two-week wait before issuance, you still can fly on the current certificate.
- Prescreen your medical status and history, and be ready to talk about treatments received or available, and medications being taken.
- Don't show up sick on the day of the examination. The AME will not be able to issue the certificate in that circumstance. From the AME's perspective, rescheduling the appointment does not result in a penalty and has no detrimental effect on obtaining a new certificate — even if the postponement causes the current certificate to lapse.
- Be ready for the physical examination by bringing all relevant medical records, corrective lenses and hearing aids. If you already have an FAA letter of authorization for special issuance, present the letter so the AME knows what documents must be checked. There are more "conditions AMEs can issue" than ever — i.e., AMEs often have authority to immediately make decisions about issuance — but only if the pilot can present all required documents.
- Don't unwittingly induce strange electrocardiogram (ECG), heart rate or blood pressure measurements, which will prevent the immediate issuance of the certificate. Prior to an office visit involving these tests, minimize consumption of caffeine, a factor that can induce unusual heart rhythms. Anything causing significantly high blood pressure during the visit can be a problem. By the same token, a resting heart rate of 50 beats per minute or less — while normal among fairly well conditioned athletes — will be problematic for the AME, so performing an activity such as jogging in place before the ECG is advisable so that the rate exceeds this low end of the normal range of typical patients.

—WR

includes a requirement that the pilot write and sign two personal statements, one explaining the circumstances that caused a law enforcement officer to stop the pilot and investigate, and the other describing the pilot's entire drinking history from taking the first drink until the present time — including how much alcohol is consumed, what types of alcohol are consumed and in what situations the pilot drinks alcohol.

"Then you have to get a substance-abuse evaluation [compliant with detailed] FAA standards," Snyder said. "You may as well pay for [this] evaluation up front with the person who's qualified to do it. … So my bottom line is 'You can't afford a DUI — not in this career.'" Some BASS attendees indicated that they already were familiar with the national Human Intervention and Motivation Study–based abstinence program, which began in the early 1970s and essentially allows U.S. airline pilots who have a diagnosis of substance abuse to continue flying if they are identified to the FAA and if they are participating successfully in the program (*ASW*, 9/06, p. 32).

"It's a wonderful, collegial program [among] the airline management, the unions and physicians, both FAA and commercial," he said. "We've returned 4,800 airline pilots with drug and alcohol dependence to flying. … They have to attend a 12-step [treatment] program. They have to do weekly after-care, a group meeting with a professional [substance-abuse counselor present]. They have to get annual psychiatric assessments. … The minimum period of time for alcohol [abuse] is three years in that monitoring program, after which they have to maintain abstinence for the duration they hold the medical certificate. For drugs or recurrent alcohol [problems], it's a minimum of five years to do that, although some [cases] can be extended." Sponsors of the pilots dictate how much random drug and alcohol testing, generally off-duty testing, that each participant must undergo.

Sleep Apnea Update

Tilton, the former federal air surgeon, generated controversy within the professional pilot community by proposing a new requirement that AMEs proactively screen all airline pilots for obstructive sleep apnea (OSA) based on factors such as body mass index (BMI). The proposal was withdrawn but led to high awareness of this condition and the serious risks to commercial aviation. "OSA has been a disqualifying condition since 1996 with the FAA," Snyder said. "People have been getting waivers for it. In the past, there was no effort to screen for OSA."

In December 2013, 15 advocates for pilot medical interests — including Snyder — met with FAA officials and worked out an agreement on how to address the issue of OSA in pilot ranks. "[FAA] will screen based on BMI," he said, summarizing the status of new agreements as of mid-April. "If you have a BMI of 40 or greater … that's what's considered morbidly obese, and 98 percent of people who have a BMI like that will meet medical criteria for sleep apnea."

In practice, the pilots newly identified by these criteria now get 90 days to see a primary care physician for assessment of possible OSA, and several types of physician-prescribed home studies are allowed. "The screening is different [now, no longer requiring evaluation only by a sleep medicine specialist], and … unless you have [OSA] that's not treated, it's not grounding," Snyder said.

"If the doctor writes a note that says 'I don't think Joe Pilot has sleep apnea,' you give that to the AME — that's the end of the evaluation. No more questions. … If you come in and [tell the AME, furnishing documents and compliance data,] 'I have sleep apnea and I'm on a CPAP [a continuous positive airway pressure machine] and I'm using my CPAP, the AME is directed to clear you right then. Or you can continue to fly while you're going through the evaluation as long you're making progress toward getting the treatment initiated."

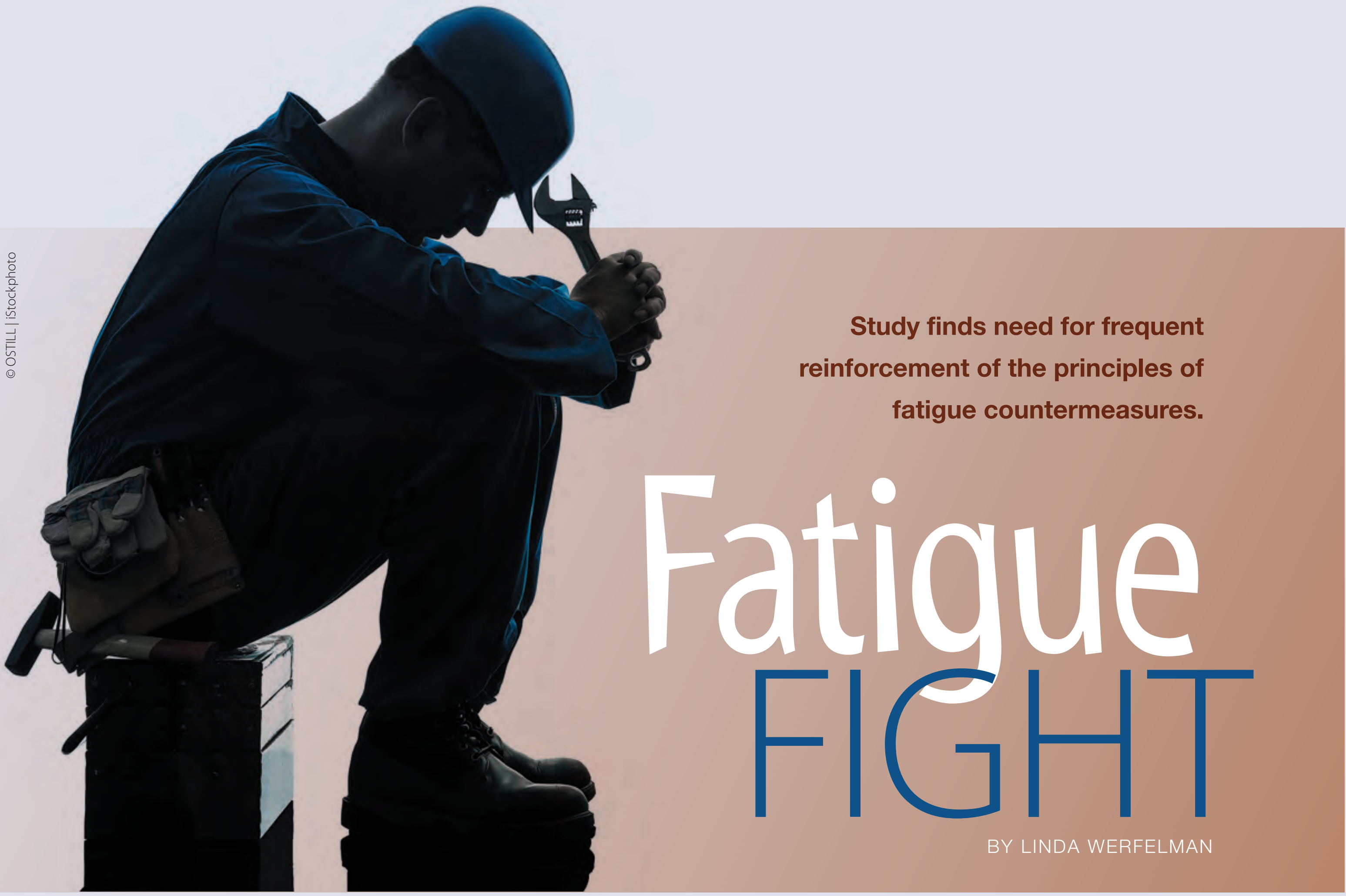
The only thing required for certificate renewal is delivering current compliance data to the AME, such as validating the pilot's correct use of the CPAP. The recent *ASW* article offers details of three other OSA-treatment options allowed by the FAA.

Notes

1. Snyder holds doctor of medicine and master of public health degrees.

2. He said that the FAA *Aeronautical Information Manual* [*AIM*], Section 8-1-1, "Medical Facts for Pilots" — which recommends use of the IM SAFE personal checklist — constitutes the only guidance on physical/mental fitness for duty published widely for all U.S. pilots. In the *AIM* edition last updated Aug. 22, 2013, the checklist says every pilot should be able to say before flight, "I'm physically and mentally safe to fly; not being impaired by: illness, medication, stress, alcohol, fatigue [or] emotion." This *AIM* section elaborates on the scope of issues within each listed item, as well as broader aviation medical facts to consider. Snyder said that a future edition will combine the "emotions" item content under the "stress" item and introduce "eating and hydration" as the last checklist item.

3. FAA. *Guide for Aviation Medical Examiners*. April 22, 2014. <www.faa.gov/about/office_org/headquarters_offices/avs/offices/aam/ame/guide/>.



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Fatigue FIGHT

Study finds need for frequent reinforcement of the principles of fatigue countermeasures.

BY LINDA WERFELMAN

A classroom course in fatigue countermeasures gave a short-lived boost to aviation maintenance employees' commitment to fatigue management, so stronger on-the-job support from the maintenance organization is needed to achieve long-term benefits, according to a study by the U.S. Federal Aviation Administration (FAA).[1]

The course effectively increased participants' general knowledge of fatigue and had an immediate positive effect on their awareness of the importance of managing fatigue and their commitment to that goal, the researchers said in their report on the study.

Six weeks later, a follow-up questionnaire showed that participants had grown more consistent in using "a few good sleep routine habits and avoidance of the majority of sleep routine and health and fitness bad habits, but there was no real impact on good work-life habits," the report said (see "Do This, Not That").

"Additionally, the occurrence of good work-life habits declined," the report said, and "commitment, motivation and self-efficacy toward fatigue management significantly declined."

The small study was conducted by researchers from the FAA Civil Aerospace Medical Institute (CAMI) and Kenexa, an employee-recruitment and performance management firm, as a test of the effectiveness of the fatigue countermeasures course, developed by CAMI for use as part of a fatigue risk management system (FRMS) and subsequently made available online at <MXfatigue.com>. The website also offers a fatigue risk assessment tool and a fatigue awareness video.

In their report, the researchers said that "developing fatigue countermeasures training tailored to aviation maintenance is an obvious starting place" for development of the FRMS.

"Maintenance organizations have been slow to implement fatigue risk management policies," the report said.

The document noted that some organizations, instead of taking action to mitigate fatigue, have adopted policies that prohibit napping and allow workers to be scheduled "to work or exceed three consecutive 16-hour shifts.

"Such policies are counter to personal, organizational and public safety and foster a culture where it is acceptable (and expected) to work when fatigued."

The report cited previous studies that concluded that aviation maintenance technicians slept an average of five hours a night, and that people who routinely sleep less than seven hours a night may experience "significant daytime cognitive dysfunction that accumulated to levels comparable to that found after severe acute total sleep deprivation."

Over the past two decades, some industries that operate around the clock — including railroading, trucking and water transport — have adopted training in fatigue countermeasures to help mitigate fatigue risks.

"The training can be beneficial to both the individual and the organization," the report said. "Individuals who replace bad sleep and health habits with good ones benefit from improved sleep quality and quantity, while the organization benefits from improvements in performance and fewer safety-reducing turnovers, absenteeism and morale issues."

A training program was developed that covered three areas — sleep basics, including the sleep process, circadian rhythm, sleep disorders and sleep debt; fatigue basics, including fatigue-related hazards, causes and symptoms and how to assess fatigue; and fatigue countermeasures, including work breaks, napping, sleep routine and the sleeping environment.

The program's objectives were to "remember symptoms of fatigue and fatigue countermeasures, recognize the importance of managing fatigue risk and incorporate practical recommendations for fatigue prevention and management into one's daily routine," the report said.

Do This, Not That

Research into fatigue countermeasures has yielded many recommendations for improving the quality of sleep and taking other action to limit fatigue.[1]

Recommended good habits include:

- Using a pre-sleep routine at a consistent bedtime, sleeping only in the bedroom and modifying the sleep environment (by blocking out noise, keeping the room cool, silencing the telephone and asking not to be disturbed);
- Drinking plenty of water, eating nutritious meals that are not too large, taking vitamins, exercising regularly (walking, stretching, strength training and using cardio exercises) but not within the three hours before bedtime; and,
- Wearing sunglasses while going home from work in the morning, increasing exposure to bright light, using relaxation techniques, socializing with others and making family and friends aware of the work schedule.

Bad habits to be avoided include:

- Exercising right before going to bed, although exercise earlier in the day is beneficial;
- Eating unhealthy food;
- Using caffeine or other stimulants, although caffeine consumed at strategic times during a work shift can boost alertness;
- Using tobacco;
- Using alcohol to relax before bedtime; and,
- Watching television in bed, watching the clock in bed and sleeping less than usual on days off.

— LW

Note

1. Banks, Joy O.; Wenzel, Brenda M.; Avers, Katrina E.; Hauck, E.L. *An Evaluation of Aviation Maintenance Fatigue Countermeasures Training*, DOT/FAA/AM-13/9. A report prepared by the U.S. Federal Aviation Administration (FAA) Civil Aerospace Medical Institute and Kenexa Inc. for the FAA Office of Aerospace Medicine. May 2013.

Measures that determined whether the program met its objectives included "gains in knowledge, increased awareness of fatigue risk and the importance of managing fatigue, and an increase in self-report of fatigue-relative positive behaviors and reduction of negative behaviors at home and work," the document added.

Airline Participation

A major airline — not identified in the report — agreed to have its maintenance personnel participate in the classroom training session and in follow-up activities. Thirty-three workers volunteered to attend the three-hour class, led by a CAMI researcher with considerable classroom-instruction experience. After each of three sections of the class, the instructor led a group discussion, reviewed the section's content and conducted a check on the participants' understanding of what they had just been taught.

The evaluation focused on four areas: "learning (positive change in knowledge of and attitude toward countering fatigue), behavior modification (change in fatigue management behaviors at home and work), transfer (application of what was taught at home and work) and reaction to the training experience," the report said.

Of the 33 workers attending the class, 24 participated in both of the first two data-collection sessions, conducted one week before the classroom session and immediately afterward; only 14 were available six weeks later to complete a final, follow-up questionnaire, the report said.

The 24 classroom participants had an average age of 50.4 years and had spent an average of 29 years on the job. They worked an average of 43 hours a week with an average of 2.8 hours of overtime. More than 90 percent worked a day or extended day shift, and 25 percent said they had received prior fatigue awareness training.

'Immediate Impact'

The report said that evaluation results of the impact of classroom training showed an "immediate impact of training on attendee fatigue-related knowledge." Average scores on questionnaires designed to assess the 24 participants' knowledge of fatigue increased from 50 percent correct before the class to 75.2 percent correct afterward.

Before-and-after questionnaires — with identical questions — also measured increases in participant awareness of the importance of not being fatigued while at work, as well as their commitment to manage their fatigue, the report said. For example, when asked to rank, on a scale of 1 to 5,[2] how important they thought it was to not be fatigued while on duty, respondents scored an average of 4.2 in the pre-training questionnaire and 4.5 post-training, the report said. (A number of score changes in this area were characterized as not statistically significant, even though they were higher after training than they had been before.)

When the questionnaires about fatigue knowledge were repeated six weeks after the class for 14 participants, the average score was 68.9 percent, down from the "after" questionnaires but still 40 percent higher than the average had been before training, the report said. At the same time, the questionnaires measured a downward trend in awareness, self-efficacy and intention toward fatigue management, although, again, many of the differences were not considered statistically significant. For example, when asked how motivated they were to avoid feeling fatigued, the average score was 4.0 in the immediate post-training questionnaire and 3.4 six weeks later. Asked to what extent they thought they could successfully manage fatigue, the post-training score was 3.7, compared with 3.2 six weeks later.

When answers to the six-week follow-up questionnaire were compared with the pre-training responses, the results were statistically insignificant. The average scores were slightly lower when the respondents were asked how committed they were to managing fatigue and how motivated they were to avoid feeling fatigued and slightly higher when they were asked how often they thought about ways of managing fatigue and how often they changed their behavior or schedule to avoid feeling fatigued.

Course Evaluation

Although the course content was still being developed when the maintenance personnel took the class, the material generally increased their awareness of FRMS strategies as well as the "consequences of fatigue, which influenced some to change their daily activities in an effort to manage fatigue," the report said.

The document characterized the workers' response to the class as encouraging, especially in light of earlier studies that found resistance to the concept of fatigue management.

"Modifying and sustaining new behaviors and attitudes toward fatigue can be challenging, since lifestyle changes are required," the report said. "When resistance exists, a positive approach would be to treat it as valuable feedback. For instance, during class, some attendees voiced resistance to changing their sleep habits. The interaction provided the instructor an opportunity to generate a better understanding of how and why they needed to modify their sleep environments."

The document noted that duty hour limitations and other rest requirements do not exist for maintenance personnel, who therefore are "susceptible to high levels of physical and cognitive fatigue. Implementing an effective fatigue countermeasures training program is just one step that aviation maintenance organizations should take in reducing fatigue risk to improve public safety."

Notes

1. Banks, Joy O.; Wenzel, Brenda M.; Avers, Katrina E.; Hauck, E.L. *An Evaluation of Aviation Maintenance Fatigue Countermeasures Training*, DOT/FAA/AM-13/9. A report prepared by CAMI and Kenexa Inc. for the FAA Office of Aerospace Medicine. May 2013.
2. On the 5-point scale, 1 represented "never," 2 represented "rarely," 3 represented "sometimes," 4 represented "often," and 5 represented "always."

Airlines take a fresh look at all first officer training through the lens of their performance-based MPL programs.

Timely Refinements

BY WAYNE ROSENKRANS

A few of the world's airlines already are taking steps to refine traditional *ab initio* pilot training programs after comparing the performance of these cadets to that of counterparts qualifying as first officers through multi-crew pilot licensing (MPL) programs. Airline representatives described these steps as seizing opportunities to provide the best aspects of both program types in light of the high MPL success rate reported by a proof-of-concept data analysis (*ASW,* 5/14, p. 38) for the International Civil Aviation Organization (ICAO).

Airline case studies, other regulator analysis, perspectives of approved training organizations (ATOs) and positions taken by the International Federation of Air Line Pilots' Associations (IFALPA) comprised much of the December agenda of the ICAO Multi-Crew Pilot License Symposium. The accounts of airlines' experiences in overcoming MPL deficiencies and impediments encountered during implementation (Table 1, p. 30) influenced an informal working list of improvement priorities — some tied to industry safety objectives, such as upset prevention and recovery training — that could accelerate launches of new MPL programs.

A number of presenters and attendees stressed that any performance level by MPL cadets and graduates that merely matches that of traditionally

Case Studies of Challenges Facing Airline MPL Programs

Partnership/Start/Scale	Problems/Adjustments	Solutions/Recommendations
Lufthansa Flight Training (Germany Switzerland, United States and Japan); February 2008; more than 800 cadets completed at least the basic phase, with 400 graduates now flying as first officers for Lufthansa, Germanwings and Lufthansa Cityline	MPL was implemented in parallel with an advanced *ab initio* and integrated ATPL program already using complex high-performance aircraft, MCC, CRM and airline jet FSTDs for first officers. Key issues were the recruitment of sufficient instructor pilots for the basic phase to prevent waiting periods, and airline volatility causing reduced pilot demand coupled with a European restriction on MPL holders' ability to obtain employment with a different operator.	IFR skills improved quickly after replacing a turboprop aircraft procedures training platform with the Cessna Citation CJ1 FSTD and aircraft with a custom third-pilot radio console. UPRT was enhanced by the use of the Grob Aircraft G120A aerobatic trainer. One future enhancement will be targeted theoretical instruction and scenario-based exams replacing multiple-choice exams, partly to boost relevance for recognition of threats, errors and undesired aircraft states.
Air China Southwest, China Eastern Airlines, Civil Aviation Flight University of China, Civil Aviation University of China, and China Academy of Civil Aviation Science and Technology (China, July 2008, 35 cadets in first three courses and 80 more now enrolled; two of six early MPL graduates have upgraded from first officer to captain at China Airlines and Xiamen Airlines)	Students with no prior flight training had difficulty assimilating 900 hours of theoretical training at one time, so this was divided into two parts. The Civil Aviation Administration of China has set 20 takeoffs and landings in the type-rating aircraft as the minimum. As in other states, instructor pilot qualifications currently specify ratings and flight hours rather than competence-based selection criteria, but China Eastern is an exception by applying Airbus competency criteria.	The CJ1 is used in a manner similar to the Lufthansa Flight Training MPL program. Airbus A320 or Boeing 737 FSTDs are used for the type rating in the final advanced phase of the program. Computer-based training and learning-management systems have accelerated English proficiency. Aptitude testing of candidates based on latest international standards, new competency standards for instructors and uniform training for examiners and inspectors became critical priorities.
Dragonair/Cathay Pacific Group, Hong Kong Civil Aviation Department and CAE (China, 2013, 76 cadets)	Hong Kong Civil Aviation Department required safety management systems for airlines implementing MPL to help assure adequate consideration of risk, including MPL laws. Adverse wind/weather, heavy traffic, aircraft scheduling and inefficient ATC at a Chinese airport used for base training increase typical experience all cadets need to master takeoffs and landings. Visual flying, raw data flying and manual flying elements in the intermediate phase have increased, along with extra pre-base practice in higher-fidelity FSTDs.	Dragonair compares performance of its first graduates of MPL and of 150 datasets of pilots in parallel past/present CPL-IR programs. Competency-based training of cadets on both tracks begins at the base training stage. CPL-IR cadets typically perform 20 takeoffs and landings to achieve three-in-a-row rated satisfactory. MPL cadets averaged 22 to attain proficiency. Results from data collected led to enhancement of descent-profile management, terminal-area situational awareness, runway-exit finesse and ATC communication.
Ethiopian Airlines, FlightPath International and Ethiopian Aviation Academy (Ethiopia, October 2011, first 26 cadets graduated in May 2013; 95 more cadets in courses as of symposium)	Increased demand for pilots and a base-training airport with significant congestion have proved to be special challenges. Chronic shortages and high prices of avgas also have affected cadets' schedules, leading to use of the Diamond Aircraft DA42-VI, which uses Jet A.	Significant challenges have been ATC communication proficiency "gaps" and adapting to cultural/behavioral norms of power distance, particularly cadets performing duties differently in the presence vs. absence of people in authority. Modifying the cadet-selection process was cited as a mitigation.
Swiss Airlines and Swiss Federal Office of Civil Aviation — comprising MPL Quality Board — and FlightSafety International (Switzerland and United States, 2006, 133 MPL students)	Unsatisfactory performance in MPL first officer communication with ATC was noted. In 2010, a completely modified MPL course added MPL topics to the continuing ATPL program for 140 students, including TEM and progress tests in every training phase. MPL students typically needed more practice in a Diamond DA42 (34 vs. 25 landings) for mastery of takeoffs and landings before Airbus A320 type-rating training. An electronic qualification system tracks cadet performance and helps to calibrate instructor ratings of cadet competency. For example, data showed those in the ATPL program at a "slight disadvantage in the area of listening watch and clearly weaker results in standard phraseology, in ATC-related [communication] and in [speech] structure articulation" while the MPL group showed difficulties in standard phraseology of procedures more than in clarity of expression.	Partners are pursuing new tools for ATC simulation to reflect real-world voice communications that often vary from official ICAO English phraseology. MPL program cadets showed slightly more problems relative to their ATPL counterparts in approach phase monitoring, taking expected action at pilot-monitoring intervention thresholds, flight path awareness, navigation, automation management and mode awareness/selection. In several cases, the MPL student "showed excellent planning ability at the end of the base training but struggled then with changing conditions on the line." Providing additional simulator practice was one response for both programs.

ATC = air traffic control; ATPL = airline transport pilot license; CPL-IR = commercial pilot license-instrument rating; CRM = crew resource management; Date = implementation of first course(s); FSTD = flight simulation training device; ICAO = International Civil Aviation Organization; IFR = instrument flight rules; MCC = multi-crew cockpit; MPL = multi-crew pilot license program; Scale = cadets and graduates, as shown, as of December 2013; TEM = threat and error management; UPRT = upset prevention and recovery training

Source: Presentations by airline partnerships at the ICAO Multi-Crew Pilot License Symposium

Table 1

trained first officers eventually will be deemed insufficient, despite ICAO's good-news proof-of-concept. This redoubles the need for careful selection of additional performance metrics, they said.

Competency Confusion

Dieter Harms, a captain who consults as a senior adviser to the International Air Transport Association (IATA) Training and Qualification Initiative and the Civil Aviation Administration of China on MPL implementation, said that his improvement priorities merely reflect a growing consensus. He also is member of the European Aviation Safety Agency's MPL Advisory Board, and he chaired IATA's MPL Implementation Working Group,

"First, solve the 'competency confusion' … when people speak about [ICAO's similar-sounding *Procedures for Air Navigation Services–Training (PANS-TRG)*] competencies and pilot core competencies," he said. "We have to improve course-approval guidance [on the process by which state authorities approve an MPL course]. There is also a lot of confusion [about this] around the world. We have to link EBT [evidence-based training] and the MPL. … We have to follow what we call the 'total systems approach.' We have to adjust theoretical training to the competency principle. We have to adjust the base training to competency-based principles. We have to remove the 'European license restriction' [for MPL holders]. We have to clarify and finalize the [solution to] uncertainty about where and when we need motion [simulators during MPL Phase 3]. We have to clarify the air traffic control [ATC] simulation. … [We have to] improve the qualification requirements for MPL instructors, especially for Phase 2. Last, not least, [we have to] improve and continue the data collection and analysis process."

Symposium sessions generated examples of misunderstandings that actually should be fairly simple for ICAO to clarify, said Mitchell Fox, chief, Flight Operations Section, ICAO Air Navigation Bureau. "There was a lot of concern expressed on the part of several of the speakers that we might be out there to get rid of solo time; that was never included in the MPL provisions," he said. "There is no intent to eliminate the solo time, not from an international perspective. The other point that was raised was the use of aerobatic airplanes for the purpose of upset prevention and recovery training. … The provisions do not dissuade the states and the ATOs from using aerobatic airplanes, but do not establish it as a requirement." Scarce availability of aerobatic aircraft in some states and regions was cited, as was the possibility of negative transfer of training on recovery techniques from inappropriate instruction in small, utility-category airplanes to large transport category airplanes, he said.

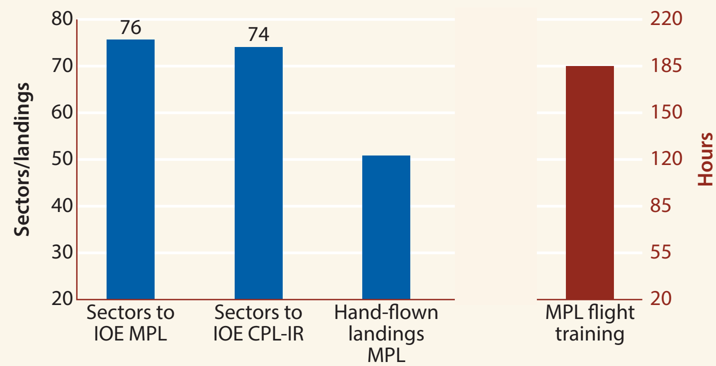
A number of MPL-implementation lessons provided by the first 30 airlines now can be applied globally. "I think that we all agree that this proof-of-concept has been completed … that the MPL at this particular juncture has met the expectations of the global community," Fox said.

Leading explanations for MPL successes, as cited in the case studies, are: stringent cadet-selection process; competency-based training; competent instructors; integrated threat and error management; learning-management systems and record keeping; continual feedback about programs from cadet pilot performance data, cadets and sponsoring airlines; and robust global MPL data sharing and analysis. "The MPL needs to be sustainable, it needs to be repeatable, and it needs continuous improvement," Fox said.

As in the evolution of other performance-based training in aviation — MPL presumes far more from regulators than checking airlines' compliance with regulations — government oversight can be a serious challenge for some states. "The MPL is a very good example of the performance-based requirement," Fox said. "[Oversight is] going to require some additional skills, and I think we need to promote the skills for the regulators. … [There is] need for better inspector and examiner qualifications, for sure, and that might be [in] improved guidance material" such as amendments that increase the overall level of detail on this subject in *PANS-TRG*.

'The MPL needs to be sustainable, it needs to be repeatable, and it needs continuous improvement.'

Typical Analysis: MPL Advanced Phase (IOE) Data at Dragonair, 2013



CPL-IR = commercial pilot license-instrument rating; FSTD = flight simulation training device; IOE = initial operating experience; MPL = multi-crew pilot license

Note: In parallel programs to train first officers, Dragonair MPL and CPL-IR cadets are scheduled to perform 30 basic IOE sectors, then an FSTD continuation session, then 36 advanced-phase sectors leading to a full-sector, final line check of their qualification for release to line flying. These data for the sectors actually flown show similarity between a relatively large dataset of average sectors for CPL-IR cadets and the average sectors for the small, first class of MPL graduates.

Source: Dragonair

Figure 1

Ironically, several presenters said, the qualifications for instructors under the MPL provisions are prescriptive — i.e., requiring hours of experience in specific areas rather than evidence of the specific competencies — so they clash with the basic idea of performance-based training.

A number of presenters and attendees shared the opinion that MPL programs would be enhanced simply by tighter integration of knowledge, practice and testing. An example would be interspersing activities focused on theoretical training with activities that require almost immediate practice in practical scenarios. Another is conducting mastery tests along the way that progressively measure each cadet's progress rather than conducting an all-encompassing test at the end of a training course.

Another enhancement yet to be considered — especially in Europe, where an MPL holder only can fly for his or her sponsor airline — is a defined, internationally agreed path to employment for MPL graduates who do not obtain a first officer position from that operator.

Differences in how airlines and ATOs attempt to provide MPL cadets a balanced ratio of actual flight time (including solo time) and simulator training also need further study. A similar variation arises when balancing time spent on instrument flying using raw data against time spent on instrument flying with automation.

Another area where variations among MPL programs stood out was the number of full-stop takeoffs and landings that different national regulators require MPL cadets to perform in the actual aircraft in which they will be type-rated. ICAO provisions call for a minimum of 12, a number that the regulator can reduce but that in many cases has been increased significantly. Fox said this is another program aspect that needs closer harmonization to be predictable from one state to another state, and to support eventual recognition of MPLs among states.

IFALPA takes the position that MPL-specific data collection and analysis should be expanded greatly and be uniform for comparisons over time, said Tanja Harter, an Airbus A320 captain and presenter representing the federation. "We need to collect data from after the license [issuance] and not stop at the license [issuance but rather include] data beyond — up to captaincy — and maybe even beyond that, including feedback not only through [line-]check data but also from the day-to-day ops [i.e., routine flight data monitoring of operations to look for root causes]," Harter said. "Where did the strengths come from, and what's causing the weaknesses? And, if possible, correct those."

A Vulnerable Flower

Many other data-collection possibilities were advanced. "The ATPL [airline transport pilot license] in the current training system has led to fairly good safety data, so already we know that's a good starting point," added Stéphane Clément of CAE. "It would be good if we eventually could compare the MPL graduates to today's reality."

Clément added that some recognized deficiencies, along with the complexity of MPL implementation, are "right now a barrier to adoption of MPL worldwide, and the more clarity and the more simplicity … the smoother the adoption will be and the faster the benefits will come."

Doug Farrow of the U.S. Federal Aviation Administration said that one of the most sensitive performance metrics is line operational evaluations in actual line conditions. ICAO's Fox noted that to his knowledge, airlines with MPL programs have yet to use that tool to track MPL cadet/graduate performance.

"We need better data, so we have to reengineer the questionnaires, and we have to include the [MPL first officer] upgrade issue because I think, in the next years, we will see more and more MPL graduates upgrading to captains," Harms said. "This thing [MPL] is still a little vulnerable flower; it is not yet a robust system. If we take care of it, and if we do not allow misuse, then I predict that in a five-year period, MPL [will become] the leading system for our future airline pilot training."

Dirk Kröger, a captain and vice president, Pilot Schools Division, Lufthansa Flight Training, cautioned attendees that in cases where an airline already has inserted competency-based training into a traditional *ab initio* program, the apparent similarity of MPL pilot performance can be misleading regarding true MPL benefits.

"[For all] students who finally pass the line training — [at] airlines in which this is hopefully already competency-based — we have the same result," Kröger said. "[Lufthansa, however,] heard a lot about high dropout rates happening with the students coming from different programs. … I saw a 0.5-percent failure rate in the IOE [initial operating experience], and that is our goal, and no failures in the intermediate or advanced phase [of MPL]. We have selection [of only about 9 percent of total applicants up] front, and then a low dropout rate in the beginning of the training, so we are not wasting time and money for the students or for us. So that is the difference.

"At some other point, there is a possibility to transfer the idea of MPL competency training to the CPL-IR [commercial pilot license–instrument rating] conventional training. That should be the next step."

Nick Taylor of Transport Canada Civil Aviation said that although some airlines have had comparable outcomes from the MPL and the traditional *ab initio* training of first officers, this is the exception rather than the rule at a global level. "My … very small observation of MPL [indicates] that it is fundamentally better than the traditional route that we normally see," he said.

Bai Hongqiu, a captain and deputy director of flight training, Standards Department of the Civil Aviation Flight University of China, said that after comparing the traditional, pre-airline training backgrounds of first officers in states and regions such as the United States, Canada and Europe, officials came to the conclusion that "The world is different. … Chinese airlines are very welcoming to the MPL training. … In China, the [MPL] results are good; they're excellent … totally different for students graduated from the CPL [course] compared to the MPL students."

A representative from an Austrian ATO cited an operator that considers MPL a "brilliant" solution based on results for cadets in four courses. The operator has been pressing for regulator approval to reduce the minimum 12 landings in ICAO MPL provisions because that number has proven to be a "waste of resources." "This is reason no. 1 for why to have MPL. … [MPL] makes us a different ATO now, giving us the opportunity to [also] train our unscreened, regular, self-sponsored ATPL students a different way by looking at competencies, giving them a better chance to develop their competencies, making them better pilots. … This is, in my opinion, one major and very important side effect from MPL."

Several speakers described some MPL cadets' relative difficulty attaining the required level of proficiency in pilot–air traffic control communication. ICAO's Fox said there is reason to believe the issue is broader than MPL programs and does not necessarily imply a problem communicating in English. "We tend to focus in on a very rote practice of phraseology, but when [MPL cadets] get out into the real world, it doesn't always work that way, and some of the graduates are having problems in adapting to that," he said, acknowledging a need for more guidance material on solutions, such as jump seat observations of line operations, as some attendees suggested.

Another tool requested by IFALPA is official guidance on the expected role of MPL programs in the development of future commanders/captains.

IFALPA's Harter also indirectly touched on this last aspect of balancing the time that MPL cadets spend in flying airplanes, particularly solo flights, which has not been captured in the data showing the success of MPL programs. "We know there's discussion about 'fear factor,' but I think that still, real-flight training is required for actual risk exposure," she said. "Why? Because there is some emotion involved when you fly alone, and know you're responsible for your own [life]. And I think that makes the difference. Learning through emotions can be very powerful, and sometimes we need it. [There's] no need to … to adjust the simulator to include the fear factor, that's not the idea. The emotion is the thing."

The drag created by the nil or negative thrust produced by propellers set in the beta/ground idle range is very useful in controlling taxi speed on the ground without wearing out the wheel brakes, but it can transform an aircraft's aerodynamic efficiency to that of a grand piano when selected in flight.

Thus, a variety of mechanical latches, locks, levers and detents have been devised to prevent the power levers, which contribute to propeller control, from being moved into beta/ground idle mode at the wrong time, such as on short final approach.

Like other aircraft manufacturers, Xian went one step further in its MA60 twin-turboprop transport by incorporating an electromechanical lock as a backup to the mechanical stops that help prevent the power levers from being moved aft of flight idle in the air.

A copilot trainee inadvertently selected ground idle thrust on final approach.

Six-G Arrival

BY MARK LACAGNINA

The electromechanical lock is designed to release automatically when the weight-on-wheels system is triggered on touchdown, allowing the pilot flying to subsequently release the mechanical stops and move the power levers from flight idle into ground idle and then into reverse (Figure 1, p. 38).

However, when Indonesia's Merpati Nusantara Airlines added MA60s to its fleet, it found that some pilots were having difficulty moving the power levers from flight idle to ground idle — delaying the selection of reverse thrust — on landing because the electromechanical lock tended to balk in release.

Xian MA60

Joshua Lim | Wikimedia

The MA60 is a 60-seat twin-turboprop transport introduced by Xian Aircraft Industry Co. of China in 2000. It is a stretched version of the Y7-200, a short-takeoff-and-landing aircraft manufactured by Xian primarily for the Chinese air force. The design of the Y7, and consequently the MA60, was based on the Antonov 24, which Xian began to build under license to Antonov in 1977.

The MA60 is powered by Pratt & Whitney PW127J engines rated at 2,052 kW (2,750 shp) each. Maximum weights are 21,800 kg (48,060 lb) for takeoff and 21,600 kg (47,620 lb) for landing. Cruise speed is 430 kph (232 kt), maximum range is 1,600 km (864 nm) and service ceiling is 25,000 ft.

As of April 2014, 53 MA60s were in service in 23 countries. In 2011, Xian introduced the MA600, which has upgraded avionics equipment, cabin improvements and more powerful engines. A 70-seat version, the MA700, was in development.

Sources: *Aviation International News* and Wikipedia

Believing that the problem would persist as more of the aircraft were acquired, the airline solved the problem expediently by revising the "Approach" checklist to require pilots to disable the electromechanical lock before landing. (The lock can be disengaged manually by pulling up a knob located at the top of the central quadrant and between the power levers. The mechanical stops then can be disengaged by pulling up tabs located in slots just below the power lever handles.)

The checklist revision requiring the electromechanical locks to be disengaged manually on approach was effected without the approval of civil aviation authorities and set the stage for a costly mistake, according to Indonesia's National Transportation Safety Committee (NTSC).

The mistake occurred the morning of June 10, 2013, when a first officer-in-training disabled the electromechanical lock per the checklist but then inadvertently released the mechanical stops and moved the power levers into ground idle while the aircraft was still hundreds of feet above the ground on approach to El Tari Airport in Kupang, Indonesia.

The MA60 entered a rapid descent and struck the runway with a vertical velocity of 5.99 g (i.e., 5.99 times standard gravitational acceleration). The force of the impact was enough to crush the landing gear and cause the aft wing attachments to fail. Five people aboard the aircraft were seriously injured; the other 45 occupants sustained minor or no injuries, said the NTSC's final report on the accident.

Training Deficiency

The MA60 was inbound to Kupang, in the Timor area of Indonesia, on a scheduled flight with 46 passengers and four crewmembers from Bajawa, on Flores Island. The aircraft, PK-MZO, was manufactured in 2007 and had accumulated 4,486 flight hours and 4,133 cycles.

The pilot-in-command (PIC), 42, had 12,530 flight hours, including 2,050 hours in type. He was employed by Merpati Nusantara Airlines in 1994 and earned an airline transport pilot certificate and a type rating in the MA60 in

The MA60 was descending at 1,280 fpm when it touched down on the runway. The landing gear was crushed, and the fuselage was torn on impact.

© Stringer. | Reuters

The controller advised the pilots that Runway 07 was in use and that the weather conditions at the airport included surface winds from 110 degrees at 11 kt, 10 km (6 mi) visibility and a few clouds at 2,000 ft. Surface temperature was 30 degrees C (86 degrees F).

At 0938, the PIC told the controller that the aircraft was descending through 10,500 ft in visual meteorological conditions. About 10 minutes later, he reported that the aircraft was on left base for a visual approach to Runway 07. The controller said that he had the aircraft in sight, cleared the crew to land and advised that the surface winds were from 120 degrees at 14 kt.

2004. He later qualified as a route instructor for the airline and had logged 218 flight hours in that capacity.

The second-in-command (SIC), 25, joined the airline in 2012. He had 311 flight hours, including 117 hours in type. He held a commercial pilot certificate with an instrument rating and an MA60 type rating. The SIC had accumulated 142 flight hours, including 24 hours as an observer, in a line training program leading to qualification as a first officer.

The airline had planned to have the PIC conduct the SIC's first officer check ride during the flight from Bajawa to Kupang, but the SIC had requested a delay "to be more confident prior to the flight check," the report said.

Of special note is that the SIC had displayed a tendency to delay moving the power levers to ground idle and reverse after touchdown, even after the electromechanical lock had been disengaged on approach. The report said that this deficiency likely played an influential role in the accident.

Visual Approach

The aircraft departed from Bajawa at 0902 local time with the SIC as the pilot flying. Twenty minutes into the flight, the PIC told the El Tari Airport traffic controller that the aircraft was at 11,500 ft and 110 nm (204 km) northwest of the Kupang VOR (VHF omnidirectional radio).

Flight data recorded on final approach showed that the left power lever was moved into ground idle when the aircraft was about 112 ft above the ground, followed by the right power lever at 90 ft.

Airspeed was 113 kt — about 11 kt above the target speed — and the MA60 was descending at 1,280 fpm when it touched down about 58 m (190 ft) from the approach threshold of the 2,500-m (8,203-ft) runway.

"The vertical deceleration recorded on the flight data recorder (FDR) was 5.99 g and followed by –2.78 g," the report said. "The longitudinal deceleration after impact was calculated as approximately 0.7 g."

The aircraft came to a stop on the runway after sliding for 261 m (856 ft). The flight attendants conducted an evacuation through the main entrance door at the rear of the aircraft. Two passengers and the PIC sustained back injuries, one passenger suffered a neck injury, and another passenger suffered a broken wrist.

The report classified the damage to the aircraft as "substantial." Photographs of the wreckage show that the main landing gear and the nose landing gear had collapsed on impact, the fuselage had buckled and torn near the forward section of the cabin, and the entire wing had tilted leading-edge-down, causing both propellers to separate when the forward sections of the power plants struck the runway.

Unrecoverable Descent

Examination of the accident aircraft revealed that the electromechanical lock was in the open position, indicating that the crew had disengaged the lock on approach as prescribed by the checklist revision.

Post-accident interviews with the pilots indicated that the SIC had been focused on proving that he deserved to be designated as a qualified first officer during the flight to Kupang and likely had been overly conscious of his "repeated error [of] delay on moving the power levers to ground idle during landing," the report said, noting that these factors likely contributed to his inadvertent selection of ground idle thrust during the approach.

After the accident, the NTSC supervised tests conducted in an MA60 flight simulator flown by instructor pilots for Merpati Nusantara. The tests simulated a gradual reduction of power beginning at 1,500 ft on approach and selection of ground idle at about 200 ft. The result in each case was a rapid descent from which recovery was not possible, the report said.

At the time of the accident, the state-owned airline operated a diverse fleet that comprised Boeing 737s, CASA 212s and de Havilland Twin Otters, as well as 14 MA60s. Management personnel told investigators that after the first two MA60s entered the fleet, the airline encountered several problems with the power lever lock system, "whereas the automatic power lever lock system sometimes failed to open after landing," the report said.

No Risk Analysis

Based on recommendations by its board of instructors, the airline revised its MA60 "Approach" checklist in April 2012 to include the item "PL LOCK … OPEN." The checklist specified that the power lever lock must be opened (disengaged) on approach by the pilot monitoring.

Although Xian had revised the master minimum equipment list in 2008 to include provisions for operating the MA60 with the electromechanical lock inoperative, the flight crew operating manual did not include any procedure for disengaging a functioning lock on approach. The report noted that manual disengagement of the electromechanical lock does not cause a caution light to illuminate or an aural warning to sound.

The NTSC concluded that the lock is a "safety device" according to airworthiness regulations and that any change in procedure related to the device would require specific approval by Indonesia's Directorate General of Civil Aviation (DGAC).

Moreover, the report said that the airline's board of instructors had not explored factors that might have contributed to the operational problem experienced in the first MA60s introduced to the fleet. "The problem might exist due to aircraft system problem, runway condition or pilot operation error," the report said. "The investigation could not find any evidence of safety assessment, risk analysis and approval related to the checklist revision."

Checklist Re-Revised

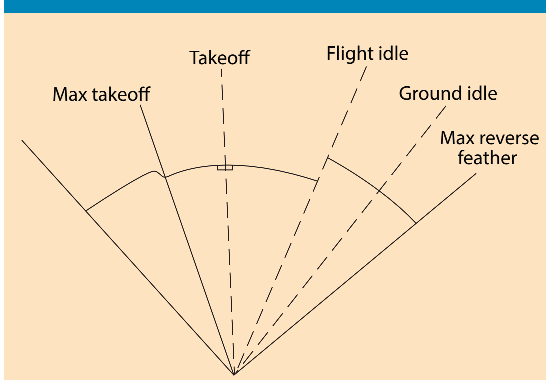
Among the actions taken by Merpati Nusantara Airlines after the accident was the removal from the "Approach" checklist of the item requiring disengagement of the electromechanical power lever lock.

The airline also revised its training procedures to caution pilots against touching, in flight, the tabs beneath the power lever handles that disengage the mechanical ground idle stops.

Based on the findings of the accident investigation, NTSC recommended that the DGAC review its oversight of changes made by operators to safety-related procedures and to specifically review the MA60 master minimum equipment list to ensure that it complies with airworthiness requirements.

This article is based on NTSC Aircraft Accident Investigation Report KNKT.13.06.19.04, "Merpati Nusantara Airlines, Xi'An Aircraft Industry MA60, PK-MZO; El Tari Airport, Kupang, Republic of Indonesia, 10 June 2013." The report is available at <dephub.go.id/knkt/ntsc_aviation/aaic.htm>.

Positions of Engine Power Lever



NTSC = Indonesian National Transportation Safety Committee

Source: NTSC Aircraft Accident Investigation Report KNKT.13.06.19.04

Figure 1

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Specialized aviation weather services aim to make information for pilots more accurate and more accessible.

SEARCHING FOR Safety

BY ED BROTAK

Weather is still a critical risk factor for aviation. Anything that improves the accuracy of weather forecasts will greatly benefit the aviation industry's level of safety and operational efficiency. General improvements in numerical forecast models and new forecasting techniques have certainly helped, but to meet the particular requirements for aviation weather in the United States, the federal government turned to a more specialized effort, establishing the Aviation Weather Research Program (AWRP) of the Federal Aviation Administration (FAA).

In the early 1990s, the FAA introduced the Aviation Weather Products Generator (AWPG) Program, the goal of which was to provide aviation-specific current and short-term forecast data to the aviation community. The applied research of AWPG emphasized the standard aviation weather hazards such as turbulence, icing, etc. The operational component of AWPG later was phased out, to be replaced by other systems, but the research aspect was continued. This program became the AWRP under the direction of the FAA's Weather Research Branch.

"The goal of the AWRP is to increase the scientific understanding of atmospheric conditions that cause dangerous weather, which, in turn, impacts aviation," the agency said. "The research is aimed toward producing weather observations, warnings and forecasts that are more accurate and more accessible. AWRP funds research into aviation meteorology as it relates to problems in aviation safety or National Airspace System capacity and traffic management, which may be solved or mitigated by the results of dedicated scientific studies."[1] The AWRP also is an integral part of the Next Generation Air Transportation System Implementation Plan.

The AWRP is broken down into research groups. Each group deals with a specific aviation hazard, with the goal of developing products that the aviation community can use to lessen the risk of incidents/accidents. Some of the basic research and development is done in-house at FAA Headquarters in Washington by the Aviation Weather Research Team. Other projects are contracted out. The National Center for Atmospheric Research (NCAR) in Boulder, Colorado, has an aviation applications program. The MITRE Corporation works closely with the FAA through its Center for Advanced Aviation Systems Development. A number of universities also are involved in aviation weather research.

As numerical weather models and forecasting techniques improved over the years, much of the standard public forecast became automated. Many of today's weather forecasts come almost directly from a computer with little human intervention. However, this was not the case with aviation weather forecasts. These still were done mainly by hand by meteorologists, a time-consuming practice.

One of the goals of the AWRP was to go beyond the standard aviation weather products, which rely heavily on human input, and to provide computer-generated results that could be produced and updated quickly. The goal was not to replace the standard terminal area forecasts (TAFs), significant meteorological advisories (SIGMETs), airmen's meteorological information (AIRMETs) and other weather advisories but rather to augment them.

Producing these new aviation weather products was challenging. The numerical models and their host computers improved over time, but often these models did not directly forecast elements the aviation community needed, such as visibility, ceiling heights, etc. The trick was to relate what the models *did* forecast to elements that are crucial to pilots. Imaginative techniques involving statistics and "fuzzy logic" were implemented.

Another problem was that aviation hazards on a meteorological scale are small in size and can change quickly in a short period of time. The standard computer models used in day-to-day, nonaviation weather forecasting may not detect these elements and certainly do not forecast rapid changes in them. Aviation meteorologists turned to high-powered, small-scale models that cover smaller areas and produce forecasts on a faster schedule, not the typical six or 12 hours. These models also featured numerous vertical layers that could be used to forecast elements at various flight levels. For example, the Rapid Refresh Weather Forecast Model was developed and came online in 2012. With a fine grid of 13-km (8-mi) resolution and a one-hour update rate, this model was superior in forecasting aviation hazards such as icing, turbulence, convection and low ceilings and visibility.

The job of making these new products readily available to the aviation community was given to the National Oceanic and Atmospheric Administration's National Weather Service, an organization already highly experienced in disseminating weather information to the general public.

The Aviation Digital Data Service (ADDS) was developed and became operational in 1996. This web portal utilizes a number of formats to display data, including text, digital, and graphical. ADDS is hosted by the National

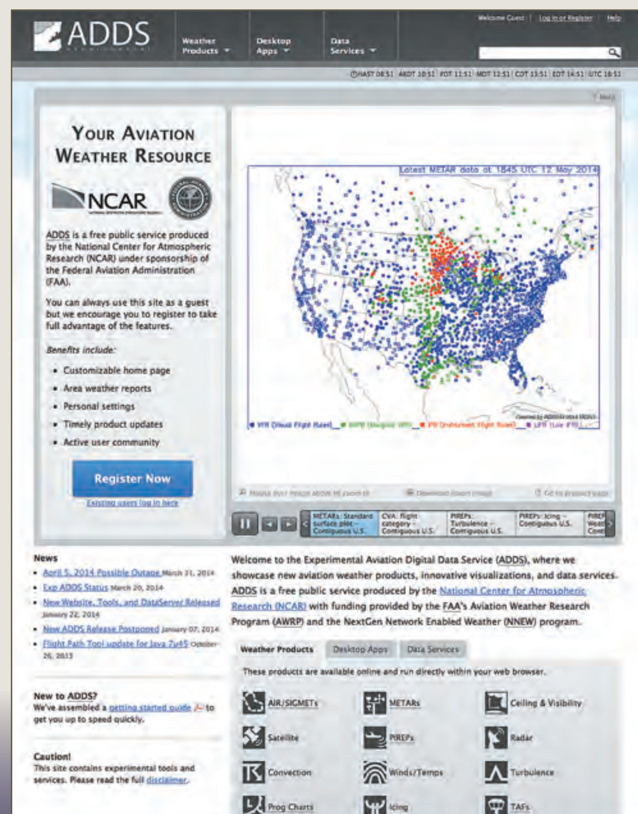
Weather Service at its National Centers for Environmental Prediction's Aviation Weather Center (AWC) site in Kansas City, Missouri. ADDS products are available for operational use either under the individual forecast element website links (convection, turbulence, icing, etc.) or from the ADDS website homepage <www.aviationweather.gov/adds/>. Newer aviation weather products can be viewed and tried, with limitations noted, at NCAR's experimental ADDS website <weather.aero/>, where they are being tested before becoming operational and moving to the ADDS website.

The AWC gives the aviation community easy access to observations such as pilot reports (PIREPs) and aviation routine weather reports, as well as satellite and radar data, and also forecasts such as TAFs, area forecasts, AIRMETs and SIGMETs. These comprise the "primary" products that pilots and dispatchers should consult before a flight. It should be noted that the AWRP also has helped in the development of new and more user-friendly methods of displaying these products. In terms of new products, the AWC also displays supplementary ADDS weather products for enhanced situational awareness. These should be used in addition to one or more primary products.

For turbulence, there is the Graphical Turbulence Guidance, which provides forecasts of possible turbulence from 10,000 ft above mean sea level (MSL) to Flight Level (FL) 450 (approximately 45,000 ft) in 2,000-ft increments. It uses a five-step scale (from no turbulence to severe turbulence) and represents the data on a three-dimensional grid for the continental United States. The AWC display shows a map of the lower 48 states with forecast turbulence intensities for the current time and to 12 hours in the future. The forecasts are generated automatically using input from a high-resolution numerical model augmented with the latest data from pilot-generated and automated PIREPs, and lightning data. It is meant to augment PIREPs and SIGMETs. Future improvements will include increasing the vertical range from the surface to FL 650 and including mountain wave and convective turbulence (*ASW*, 3/14, p. 14 and p. 20).

Ceilings and visibility are depicted in the Ceiling and Visibility Analysis (CVA). An interactive map of the continental United States enables users to click on their area of interest for the latest ceiling and visibility information for official reporting stations and estimated values for points between these stations. The CVA is updated automatically every five minutes. The

The Aviation Digital Data Service website homepages for the Aviation Weather Center and the National Center for Atmospheric Research.



U.S. National Oceanic and Atmospheric Administration and © University Corporation for Atmospheric Research information is useful in determining where instrument meteorological conditions are occurring. The CVA also provides 24 hours' worth of previous observations.

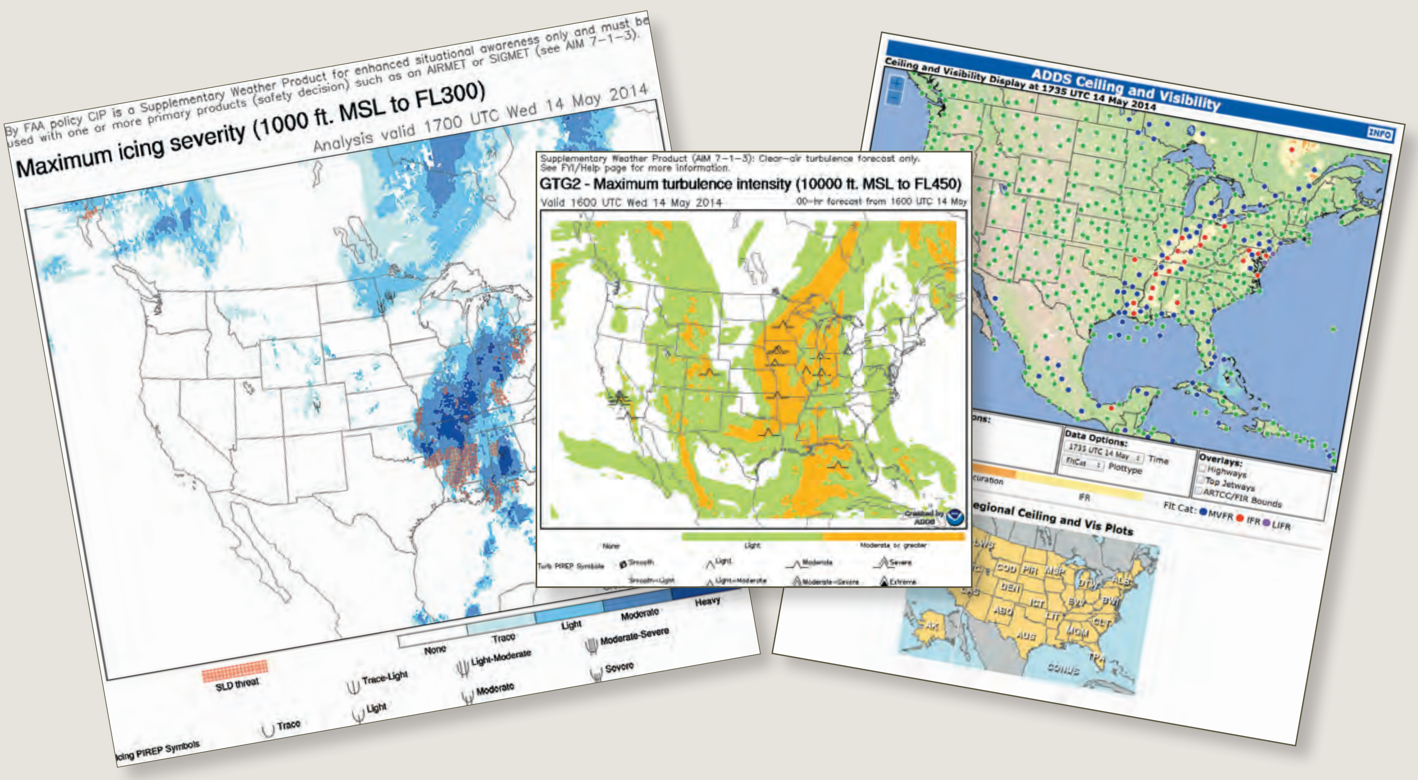
For icing, the Current Icing Product/Forecast Icing Product displays an interactive map of the continental United States with an icing forecast for the current time out to 12 hours for flight levels from 1,000 ft MSL to FL 300, in 2,000-ft increments. Two forecasts are provided for each level: icing severity in a five-step scale (from no icing to severe icing) and the probability of icing. Maximum icing severity expected is included for the entire vertical layer. Another product is the lowest freezing level as displayed in map form. The freezing level height is shown in 2,000-ft increments indicated by various colors. It starts with the current analysis and gives 12-hour forecasts in three-hour increments.

Convection is, of course, a major concern for aircraft in flight. There are a wide variety of ADDS convective products. The National Convective Weather Forecast (NCWF), sponsored by the AWRP and developed by NCAR, begins with current convection. This is determined by WSR-88D (Doppler weather surveillance radar, 1988), echo tops and detected cloud-to-ground lightning strikes. The NCWF also provides a one-hour extrapolation forecast for what is called the *convection hazard detection field* for each storm. This information field may show severe turbulence, severe icing, hail, frequent lightning, tornadoes and/or low-level wind shear. A six-level, color-coded scale is used with Level 6 indicating a severe hazard.

Basically, the NCWF gives an accurate one-hour forecast for location, speed and direction of movement for individual storms. The convective-hazard field and forecasts are automatically generated and updated every five minutes. The NCWF works best with existing long-lived mesoscale convective systems such as squall lines. It cannot accurately forecast the initiation, growth or decay of such systems, and shorter-lived individual storms are also not well forecast. Products also contain the reminder that the NCWF should not be used to replace convective SIGMETs.

The Collaborative Convective Forecast Product starts at hour four and goes out in two-hour increments to eight hours. Included in the forecast are projected cloud-top heights,

Icing, turbulence, and ceiling and visibility products from the Aviation Weather Research Program.

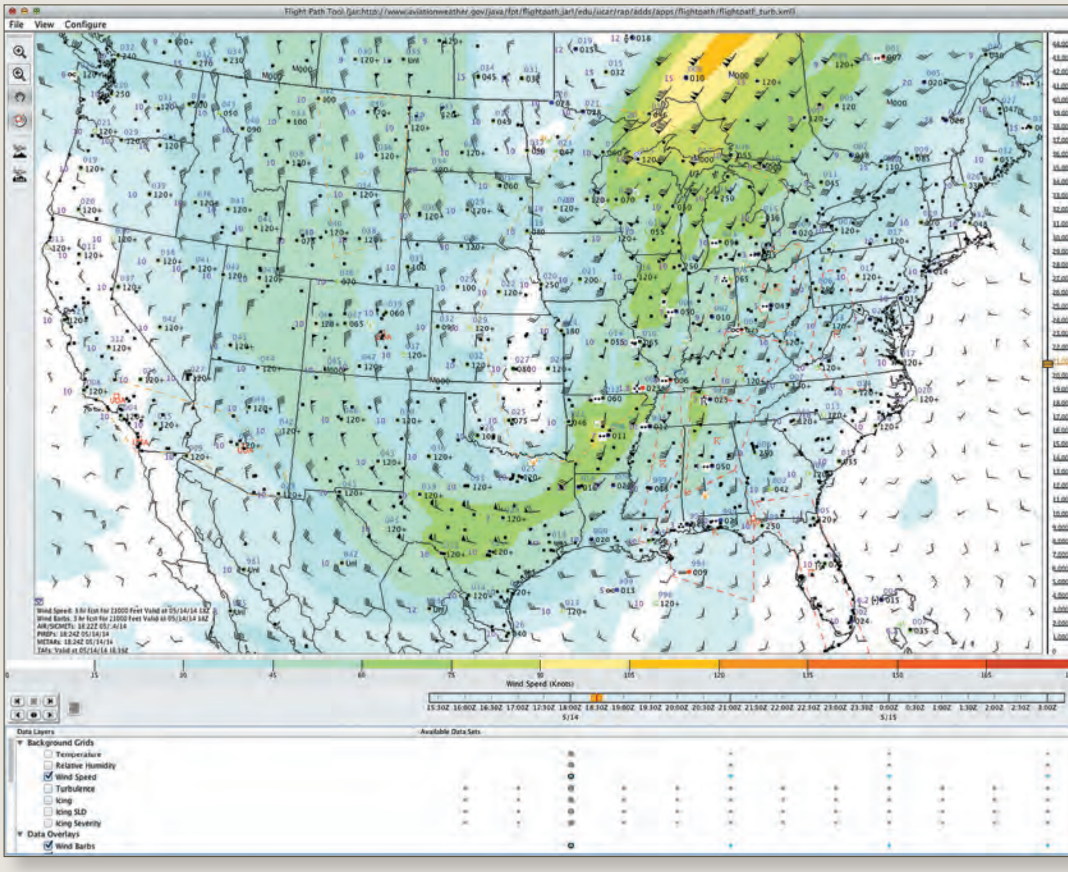


Images: © University Corporation for Atmospheric Research expected changes in growth, area coverage of convection, the direction and speed of movement of the convection, and the confidence level of the forecast (high or low).

The Extended Convective Forecast Product (ECFP) goes well beyond the six- or eight-hour forecast period of the NCWF, all the way out to 72 hours. Again, utilizing an interactive map of the continental United States, the ECFP gives a probabilistic forecast of thunderstorm activity. The ECFP is also just a planning tool designed for dispatchers and others who are involved with the development of flight plans, typically not the pilots. This product is available continuously and is updated every six hours.

One new product being developed and tested is the Consolidated Storm Prediction for Aviation (CoSPA), which is an advanced mathematical technique for making accurate thunderstorm forecasts well beyond the standard time range. Typically, convective storms are forecast out to two hours based on extrapolation of current motion. CoSPA starts with this and adds high-resolution model data to produce a convective forecast out to eight hours. The goal — minimizing flight delays due to thunderstorms — could produce millions of dollars in savings to aircraft operators.

A product that combines much of the available current and forecast data in a highly usable format is the Flight Path Tool. This is an interactive map display that features all of the aviation weather products available on ADDS and runs as a desktop/laptop computer application. All data are in 3D (three dimensional) graphics and are accessible for various flight levels or vertically at points along flight paths. Current and forecast surface weather conditions for various terminals can be displayed as meteorograms, graphical displays of the time variations of several weather elements at a specific location. The data can be animated, and route information can be stored and recalled to get quick updates in the future. Basically, a user can enter a flight path and get all pertinent weather information and warnings on one display.



Example of the Aviation Digital Data Service Flight Path Tool available at the Aviation Weather Center.

Edward Brotak, Ph.D., retired in 2007 after 25 years as a professor and program director in the Department of Atmospheric Sciences at the University of North Carolina, Asheville.

Note

1. AWC. "Experimental Product Description Document." <nws.noaa.gov/infoservicechanges/ADDS.pdf>.

BY FRANK JACKMAN

Analysis of Newly Harmonized Data Confirms Global Priorities

Approximately 61 percent of all commercial aviation accidents in 2013 occurred during the approach and landing phases of flight, according to an analysis of harmonized International Civil Aviation Organization (ICAO) and International Air Transport Association (IATA) safety data. The analysis was included in the recently released *ICAO Safety Report 2014 Edition.* Forty-three percent of 103 accidents considered using the harmonized accident criteria occurred during the landing phase, followed by 18 percent during approach and 12 percent during takeoff (Figure 1). The other 27 percent occurred during the en route, standing[1] and taxi phases.

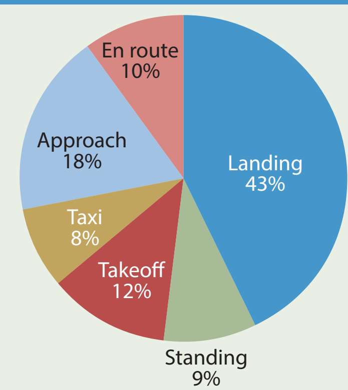
In September 2010, IATA, ICAO, the U.S. Department of Transportation and the European Commission signed a memorandum of understanding on a global safety information exchange (GSIE), the objective of which is to identify information that can be exchanged between the parties to enhance risk reduction activities in aviation safety, according to the *ICAO Safety Report*. The GSIE developed a harmonized accident rate beginning in 2011 through cooperation between ICAO and IATA to align accident definitions, criteria and analysis methods used to calculate the harmonized rate. The analysis includes accidents meeting the ICAO Annex 13, *Incident Reporting, Data Systems and Information Exchange,* criteria for all typical commercial airline operations for scheduled and nonscheduled flights. For 2013, ICAO and IATA further harmonized the accident analysis process and developed a common list of flight phases and accident categories to facilitate the sharing and integration of safety data between the two organizations, ICAO said.

The 103 accidents in 2013 considered using the harmonized criteria were scheduled and nonscheduled commercial operations, including ferry flights, for aircraft with a maximum certificated takeoff weight of more than 5,700 kg (12,566 lb).

Of the 103 accidents, 36 fell into the "runway safety" category, which includes excursions and incursions, overshoot/undershoot, tail strike and hard landing events (Figure 2). Twenty accidents were categorized as "operational damage," described as damage sustained by the aircraft while operating under its own power. This includes in-flight damage, foreign object debris and all system or component failures including gear-up landings and gear collapses.

The next most common category was "ground safety," with 15 accidents. Ground safety includes ramp safety, ground collisions, all ground servicing, pre-flight, engine start/departure and arrival events, taxi and

Accidents by Phase of Flight, 2013



Note: Using harmonized data.

Source: International Civil Aviation Organization *Safety Report 2014 Edition*

Figure 1

Accidents by Category, 2013

Note: Using harmonized data.

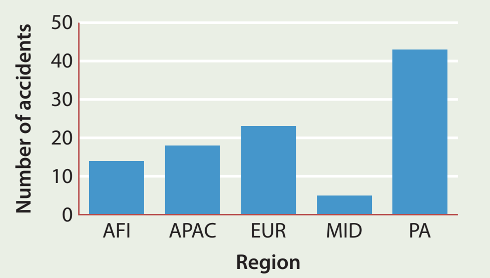
Source: International Civil Aviation Organization *Safety Report 2014 Edition*

Figure 2

towing events. Controlled flight into terrain (CFIT) and loss of control–in flight (LOC-I) accounted for seven and six accidents, respectively.

The ICAO *Safety Report* also included a harmonized regional analysis using the organization's regional aviation safety group (RASG) regions: Pan America (PA), Africa (excluding North Africa; AFI), Middle East (MID), Europe (EUR) and Asia Pacific (APAC). According to the analysis, RASG-PA had the most accidents, followed at a distance by RASG-EUR and RASG-APAC (Figure 3). RASG-AFI, however, had by the far the highest accident rate at more than 14 accidents per million departures (Figure 4), followed by RASG-MID, with fewer than four accidents per million departures.

Accidents by ICAO RASG Region, 2013



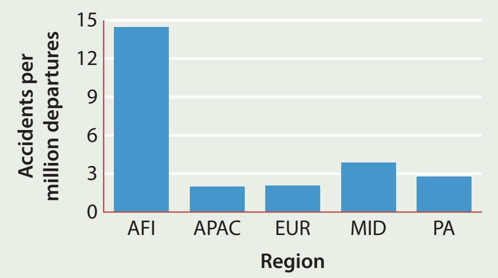
AFI = Africa; APAC = Asia Pacific; EUR = Europe; ICAO = International Civil Aviation Organization; MID = Middle East; PA = Pan America; RASG = regional aviation safety group

Note: Using harmonized data.

Source: International Civil Aviation Organization *Safety Report 2014 Edition*

Figure 3

Accident Rate by ICAO RASG Region, 2013



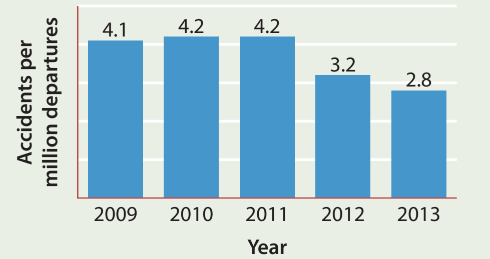
AFI = Africa; APAC = Asia Pacific; EUR = Europe; ICAO = International Civil Aviation Organization; MID = Middle East; PA = Pan America; RASG = regional aviation safety group

Note: Using harmonized data.

Source: International Civil Aviation Organization *Safety Report 2014 Edition*

Figure 4

ICAO Global Accident Rate, 2009–2013



ICAO = International Civil Aviation Organization

Source: International Civil Aviation Organization *Safety Report 2014 Edition*

Figure 5

Scheduled Commercial Flight Accidents and Fatalities, 2009–2013

Source: International Civil Aviation Organization *Safety Report 2014 Edition*

Figure 6

The vast majority (79 percent) of the 103 accidents analyzed involved passenger flights. Approximately 16 percent involved cargo flights and 5 percent involved ferry flights. Most of the accidents occurred to jet aircraft (54 percent), but ICAO pointed out that turboprop aircraft, which suffered 46 percent of the accidents, represent a much smaller percentage of the global commercial fleet than do jet aircraft.

The 2014 *Safety Report* was the first to include a section dedicated to aircraft below the traditional 5,700 kg mass limit, albeit on a limited basis. Because of data acquisition issues, only two regions were considered in the analysis: APAC and North America, Central America and Caribbean (NACC), ICAO said. Exposure data for small aircraft operations are difficult to obtain, but the number of accidents is well-documented, ICAO said. There were a total of 12 accidents involving fixed wing aircraft with a maximum takeoff weight (MTOW) of less than 5,700 kg conducting scheduled commercial operations. Of these, eight occurred in the NACC region and four in the APAC region. Six of the accidents were fatal accidents, and 22 people were killed as a result.

The *Safety Report* also included the more traditional ICAO accident statistics for scheduled commercial operations involving aircraft with an MTOW greater than 5,700 kg, using the accident definition and categorizations contained in Annex 13. On that basis, the global accident rate last year was 2.8 accidents per million departures, which ICAO said is the lowest since the ICAO Accident/Incident Reporting database began tracking the global accident rate with 2005 occurrence data (Figure 5, p. 45).

Both the number of accidents (90) and the number of fatalities were down in 2013 (Figure 6, p. 45). For the third straight year, the number of accidents declined. The 173 fatalities in 2013 represent a decline of 53 percent from 2012; the fatalities are 65 percent less than the average number for the previous five-year period and the fewest number of fatalities suffered in commercial scheduled air transport since 2000, ICAO said.

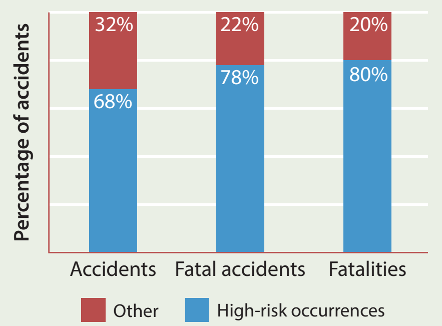
When looked at by RASG region, as noted, PA had the most accidents (39, or 43 percent of the total) in the context of significantly more departures (13.8 million, or 43 percent) than any other region in 2013 (Table 1). RASG-MID had the lowest accident rate per million departures at 1.8, followed by RASG-APAC at 2.2. RASG-AFI's accident rate was 12.9 per million departures, which is lower than its accident rate in the harmonized statistics analysis. Based on its analysis of historic accident data, ICAO has identified three high-risk accident occurrence categories: runway safety-related events, LOC-I and CFIT. These categories together represented 68 percent of all accidents in 2013, comprising 78 percent of fatal accidents and 80 percent of all fatalities (Figure 7).

Runway safety–related accidents accounted for 62 percent of all the accidents within these high-risk categories, but only 22 percent of all fatal accidents and only 6 percent of all fatalities (Figure 8). Conversely, LOC-I accounted for 3 percent of the high-risk category accidents, but 33 percent of all fatal accidents and 60 percent of all fatalities. CFIT accounted for 2 percent of the high-risk category occurrences, but 22 percent of all fatal accidents and 13 percent of all fatalities.

Note

1. The Common Taxonomy Team, formed by ICAO and the U.S. Commercial Aviation Safety Team, defines *standing* as the period "prior to pushback or taxi, or after arrival, at the gate, ramp or parking area, while the aircraft is stationary."

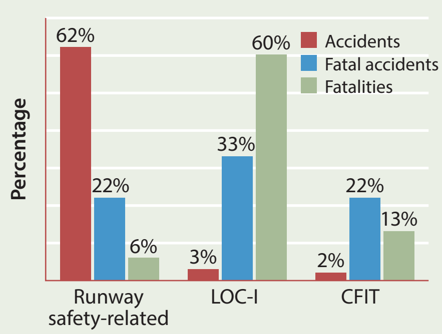
High-Risk Accidents as a Percentage of All Accidents, 2013



Source: International Civil Aviation Organization *Safety Report 2014 Edition*

Figure 7

High-Risk Category Accident Distribution, 2013



CFIT = controlled flight into terrain;
LOC-I = loss of control–in flight

Source: International Civil Aviation Organization *Safety Report 2014 Edition*

Figure 8

Analysis of ICAO Accident Data by RASG Region, 2013

RASG	Estimated Departures (in millions)	Accidents	Accident Rate*	Fatal Accidents	Fatalities	Share of Accidents	Percent of Fatal Accidents	Percent of Fatalities	Share of Traffic
AFI	0.7	9	12.9	1	33	10%	11%	19%	2%
APAC	8.6	19	2.2	1	49	21%	11%	28%	27%
EUR	7.9	21	2.7	2	71	23%	22%	41%	25%
MID	1.1	2	1.8	0	0	3%	0%	0%	3%
PA	13.8	39	2.8	5	20	43%	56%	12%	43%
World	**32.1**	**90**	**2.8**	**9**	**173**				

ICAO = International Civil Aviation Organization; RASG = regional aviation safety group

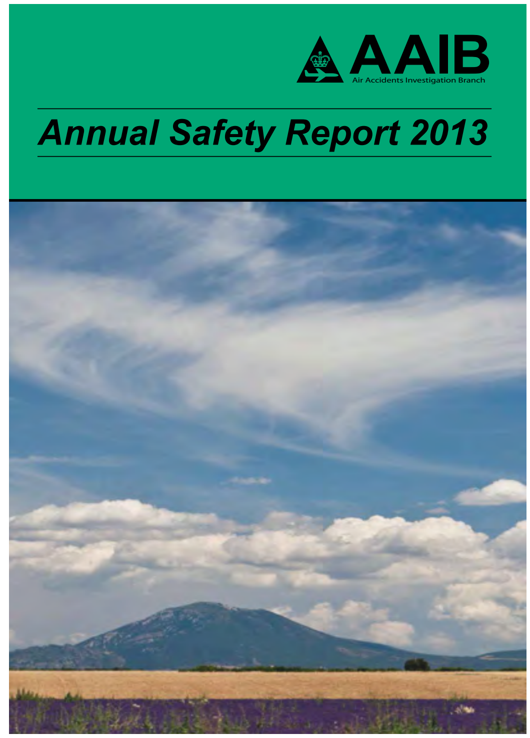
*per million departures

Source: International Civil Aviation Organization *Safety Report 2014 Edition*

Table 1

Data Review

BY LINDA WERFELMAN



REPORTS

Annual Safety Report 2013

U.K. Air Accidents Investigation Branch (AAIB). 77 pp. Figures, indexes, tables. October 2013. Available from the AAIB at <www.aaib.gov.uk>.

This report is the AAIB's ninth annual review of aviation accident data from the previous year, along with a description of progress made involving agency safety recommendations published the previous year.

The document includes a brief presentation of accident data from 2012, 2011 and 2010, followed by the AAIB's progress report on the results of recommendations; this progress report is divided into eight sections — one each for three weight categories of airplanes and three weight categories of rotorcraft, one for microlights and one for "others" — and two indexes — one arranged by section and the other, by recommendation number.

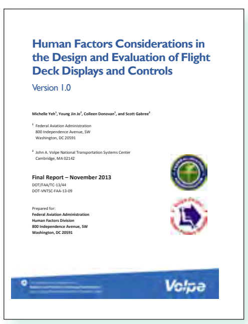
The report's data show a total of 744 aviation accidents and serious incidents in 2012, including 13 fatal accidents involving 16 fatalities; all fatal accidents involved privately operated aircraft. In comparison, the 2011 data showed 788 accidents, including 14 fatal accidents and 16 deaths.

The AAIB made 35 safety recommendations in 2012. Of that number, 22 were accepted and considered closed, one was rejected "for acceptable reasons" with no further AAIB action planned, two were rejected and considered open with further action required, and four were partially accepted and still considered open. The AAIB was awaiting a response to six others, which were classified as open.

More AAIB safety recommendations were directed to the European Aviation Safety Agency than to any other entity, with a total of 32;

followed by the U.S. Federal Aviation Administration, the recipient of 19 recommendations; and the U.K. Civil Aviation Authority, which received 11, the report said. (A number of recommendations were made to more than one addressee.)

In an introductory section of the report, AAIB Chief Inspector Keith Conradi wrote that, because of the recent introduction of the European Union (EU) Safety Recommendation Information System, which provides a central repository for recommendations from all EU member states, the AAIB will review the format of its annual safety report before publication of the 2014 document.


Human Factors Considerations in the Design and Evaluation of Flight Deck Displays and Controls
Version 1.0
Final Report – November 2013

Human Factors Considerations in the Design and Evaluation of Flight Deck Displays and Controls

DOT/FAA/TC-13/44. Yeh, Michelle; Jo, Young Jin; Donovan, Colleen; Gabree, Scott. U.S. Department of Transportation John A. Volpe National Transportation Systems Center. 361 pp. Appendixes, figures, index, tables. Available from the Volpe Center at <www.volpe.dot.gov/our-work/safety-management-and-human-factors/human-factors-publications-and-papers>.

This report, designed as a "single-source reference document for human factors regulatory and guidance material for flight deck displays and controls," is intended to help in the early identification of a number of human factors issues on the flight deck.

"The flight deck is an information-intensive environment," the report said. "The number of flight deck displays and controls has proliferated as new technology offers new capabilities and formats for presenting information and new methods for control and interaction. Understanding how a display system or control will be used by pilots and flight crews and how it will interact with other flight deck displays and controls is essential. Consideration of human factors issues early on and throughout the design process will help to ensure that the displays and controls will support all flight crew functions, tasks and decisions."

Human factors requirements for using flight deck displays and controls are discussed in a number of regulatory and guidance documents, the report said, and in many cases, generic human factors material is scattered throughout a document that is several hundred pages long.

Therefore, this report was designed to consolidate human factors material that applies to "all types of flight deck displays and controls used for all types of aircraft," the report said. "The guidance addresses the human factors/pilot interface aspects of the display system hardware, software (e.g., the depiction and organization of information display elements and features), and the design of control devices. A discussion of the importance of establishing a design philosophy and considerations for assessing workload, managing errors, implementing automation, and protecting against and managing system failures [is] also provided."

In its introduction, the report said that it should not replace the FAA's aircraft-specific regulatory and guidance information but instead help "raise the level of awareness regarding human factors to facilitate the identification and resolution of human factors issues as well as to support consistency and compatibility in designs within and across flight decks."

The report's 10 chapters discuss issues including display hardware and how hardware resolution, size and other characteristics affect the readability of cockpit displays; the design, layout and operation of controls and related usability issues; flight deck design philosophy; error management and mitigation, as well as the potential for human error; workload and workload evaluation techniques; and automation.

A series of appendixes provide additional information on the best use of the report; a list of related research reports and other helpful documents; sample checklists, evaluation procedures and "scenarios for identifying human factors considerations as part of flight deck display and control evaluations"; and a list of regulations related to human factors.

Further Actions Are Needed to Improve FAA's Oversight of the Voluntary Disclosure Reporting Program

AV-2014-036. U.S. Department of Transportation Office of Inspector General (OIG). April 10, 2014. 20 pp. Exhibits, figures. Available from OIG at <www.oig.dot.gov/oversight-areas/aviation>.

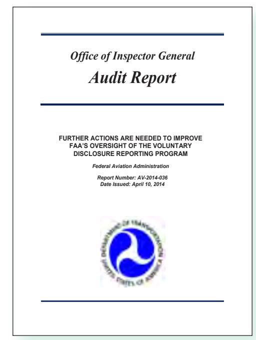
This OIG report on the agency's review of the U.S. Federal Aviation Administration's (FAA's) handling of its voluntary safety reporting programs describes the programs as crucial in improving air carrier safety and suggests that the FAA ensure that it takes advantage of all opportunities to use the associated safety data.

The report focused on the FAA Voluntary Disclosure Reporting Program (VDRP), which allows air carriers to voluntarily report areas of noncompliance with FAA regulations and to make corrections without being subject to civil penalties. The voluntary reporting process also provides the FAA with valuable safety oversight information.

"While VDRP provides an important opportunity to identify and mitigate safety issues, it requires close monitoring by FAA to ensure the program is not misused," the report said. "For example, in 2008, we reported a serious abuse of the program in which FAA allowed a major airline to repeatedly self-disclose violations of mandatory safety directives without ensuring the carrier had developed and implemented solutions to prevent recurrence of the problems."

A 2012 law required an OIG review of the FAA's oversight of VDRP, and this report describes the findings of that review, which found that the FAA has strengthened controls designed to prevent misuse of the program and has improved its analysis of safety data.

The report said that OIG auditors visited 10 air carriers operating under U.S. Federal Aviation Regulations Part 121, as well as the FAA offices responsible for oversight of the air carriers' VDRPs. The review found that instances of noncompliance reported through VDRP usually are identified "through the air carrier's internal quality control processes, analysis of safety data and employee reporting through the aviation safety action program [another voluntary program that enables individual pilots, dispatchers, flight attendants, maintenance technicians and members of other specified employee groups to disclose possible safety violations without fear of penalty]," the report said.

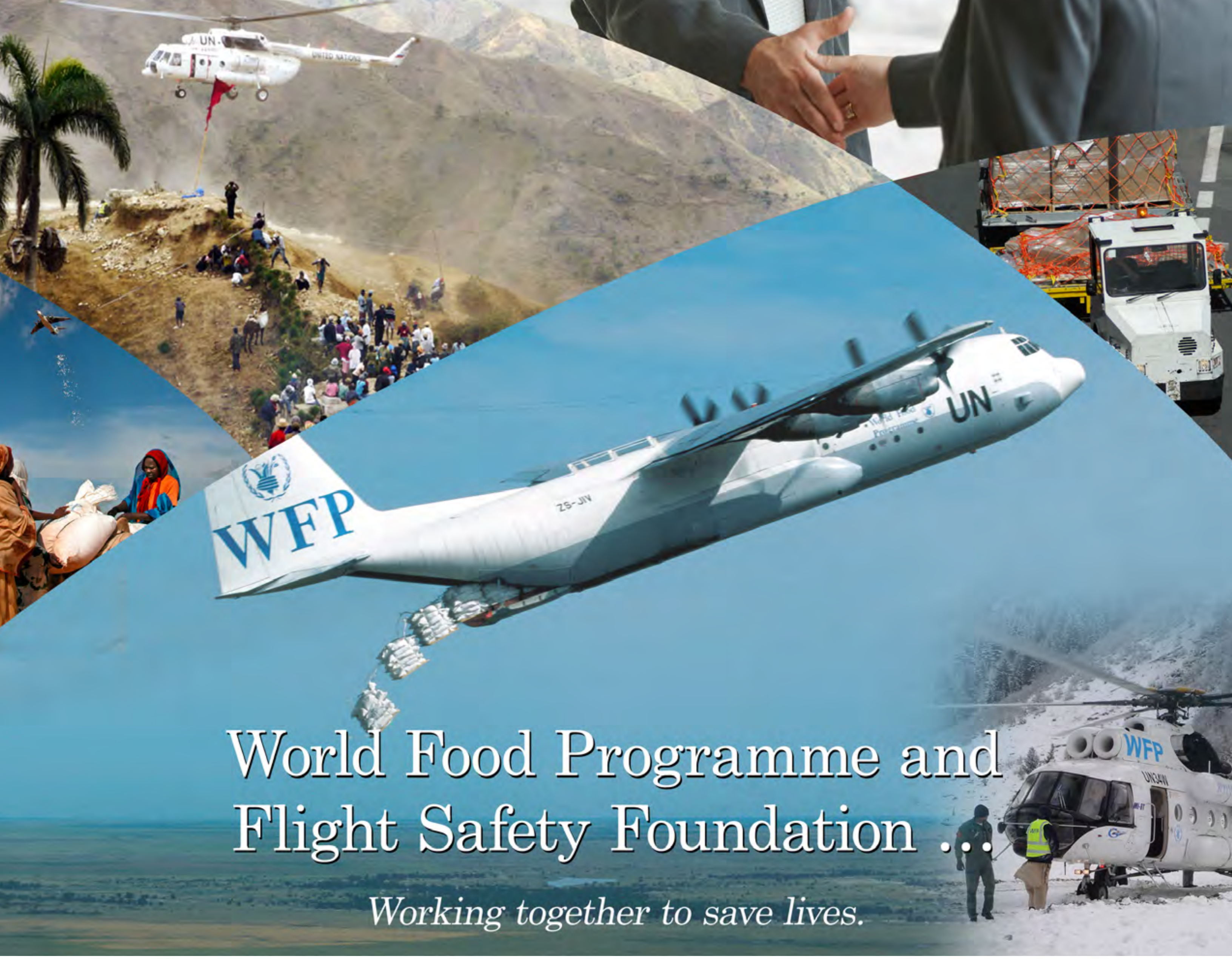

Office of Inspector General
Audit Report
FURTHER ACTIONS ARE NEEDED TO IMPROVE FAA'S OVERSIGHT OF THE VOLUNTARY DISCLOSURE REPORTING PROGRAM
Federal Aviation Administration
Report Number: AV-2014-036
Date Issued: April 10, 2014

The review found that the FAA has made progress since the 2008 incident in "ensuring that air carrier disclosure reports meet VDRP requirements."

Nevertheless, the report detailed several persistent problems, including an insufficient emphasis on underlying causes of VDRP-covered violations and the ineffective collection and analysis of VDRP data to "identify trends and target safety risks."

To address those concerns, the report recommended that the FAA "add dedicated data fields in the VDRP electronic system for air carriers to describe the root cause(s) associated with the noncompliance and identify whether the violation occurred due to the actions of an individual or a systemic problem" and "require inspectors to evaluate the root cause(s) determination to ensure repeat self-disclosures do not go undetected and potential systemic issues are identified."

Other recommendations included calls to "ensure that inspectors' ability to obtain safety data is not further restricted through efforts to streamline voluntary safety programs" and to "analyze VDRP data from a national perspective to aid in the identification of system-wide trends and patterns that represent risks."



The World Food Programme (WFP) is the food aid branch of the United Nations, and the world's largest humanitarian organization. WFP provides food to about 90 million people each year, including 58 million children. From its headquarters in Rome and offices in more than 80 countries, WFP helps people who are unable to produce or obtain enough food for themselves and their families.

The Aviation Safety Unit (ASU) of WFP is responsible for the aviation safety of the humanitarian air services provided by WFP — flights to many of the highest-risk parts of the world every day for clients' needs and, often, survival.

The WFP aviation safety activities are designed to reduce the risk of accidents and to enhance safety awareness among all users and service providers. They strive to offer professional and safe air transport service through quality control.

We need you!

Your volunteer efforts, industry experience, safety expertise, and/or financial support are needed.

Flight Safety Foundation will assist the World Food Programme's efforts to further enhance the training and education needs of its Aviation Safety Unit by providing FSF products and services, instructional seminars, expertise, knowledge and lessons learned to this vital aspect of the World Food Programme.

WFP United Nations World Food Programme

For more information on how you can help, contact Susan Lausch in the FSF Development Department at development@flightsafety.org or phone +1.703.739.6700, ext. 112.

FLIGHT SAFETY FOUNDATION

Engine Fire on Night Takeoff

Fuel leak resulted from partial separation of a fuel flow transmitter.

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

Single-Engine Landing

Boeing 757-200. Substantial damage. Three minor injuries.

The captain told investigators that she observed a slight yaw as the landing gear was being retracted during departure in visual meteorological conditions (VMC) from Hartsfield–Jackson Atlanta (Georgia, U.S.) International Airport shortly after midnight on June 21, 2011. The 757 was climbing through 3,000 ft a few seconds later when the flight crew received indications of a fire in the no. 1 (left) engine.

The crew shut down the left engine, declared an emergency and turned back to the airport. They subsequently conducted an uneventful, but overweight, single-engine landing on Runway 26L, said the report by the U.S. National Transportation Safety Board (NTSB).

After the 757 was stopped on the runway, aircraft rescue and firefighting personnel extinguished the engine fire. The captain ordered an emergency evacuation through the exits on the right side of the airplane. Three passengers sustained minor injuries while exiting the airplane on slides. The other 169 passengers and the six crewmembers were not hurt.

Damage was limited to the left engine and its mounting pylon and cowlings. "Examination of the engine found extensive fire damage and thermal distress in the fan and core compartments, with the vast majority of the thermal distress and the most extensive fire damage located in the fan compartment between and including the intermediate case and the turbine exhaust case," the report said.

Further examination of the Pratt & Whitney PW2037 turbofan engine revealed that the fire had started when the fuel flow transmitter's end housing partially separated from the main housing, creating a 0.3-in (0.8-cm) gap, through which fuel under high pressure escaped from the housing and ignited on contact with the hot engine cases.

The end housing on the fuel flow transmitter (FFT) is attached to the main housing with four through-bolts. The bolts engage threaded inserts in the main housing, which has tapped threads that accommodate the inserts. Investigators found that three of the threaded inserts had been partially pulled out of the main housing, and one had sheared.

"All of the inserts and the bolts were in good condition," the report said. "However, the main housing tapped threads that accommodate the inserts exhibited sheared and flattened threads at each of the four locations," the report said.

Investigators found several inconsistencies in the FFT component maintenance manual, including specification of two different torque values for the end housing bolts and inadequate instructions for the application of graphite lubricant to the bolts. Tests showed that the amount of lubricant applied, as well as whether lubricant is intentionally or inadvertently applied to the washers, are significant factors in proper installation of the bolts. Moreover, the manual did not specifically state that used washers must not be used during reassembly of the component.

The report said that, based on the findings of the accident investigation, changes to the FFT maintenance manual were proposed to "ensure a more consistent FFT assembly practice."

Power Loss Prompts RTO

Airbus A330-243. Substantial damage. No injuries.

The A330 was departing from Manchester (England) Airport with 328 passengers and 11 crewmembers for a scheduled flight to the Dominican Republic the morning of June 24, 2013. The aircraft was accelerating through 105 kt on Runway 23R when it abruptly yawed right. The captain called out "stop" and took control from the copilot. The pilots completed the rejected takeoff (RTO), bringing the aircraft to a stop on the runway.

"Initially, it was unclear what had taken place, but an ECAM [electronic centralized aircraft monitor] warning confirmed that a right engine failure had occurred," said the report by the U.K. Air Accidents Investigation Branch (AAIB).

Videos showed that the right engine had emitted a flash of flame and a large cloud of smoke. "This was accompanied by a bang, followed by significant shuddering of the engine pylon and nacelle," the report said.

Examination of the Rolls-Royce Trent 772B-60 engine, which had undergone 5,200 cycles since its last overhaul, revealed that a blade on the high-pressure turbine had fractured just above its root. The blade was carried downstream, causing further release of debris that caused the intermediate- and low-pressure spools to seize.

"The blade failure was caused by high-cycle fatigue crack propagation with crack initiation resulting from 'Type 2 sulphidation' corrosion," the report said, explaining that this type of corrosion occurs when a metal component comes in contact at high temperature with sulfur from fuel or from airborne contaminants, which causes decay of the protective oxide layer and weakening of the component.

Unstable and Unprofessional

Beech 400A. Substantial damage. Two serious injuries, two minor injuries.

Before taking off from Gadsden, Alabama, U.S., for a business flight to Atlanta, Georgia, the morning of June 18, 2012, the pilot calculated a reference landing speed of 120 kt and a landing distance of 3,440 ft (1,049 m) at Dekalb Peachtree Airport. The pilots did not review these calculations after departure, according to the NTSB report.

The copilot, who had 3,500 flight hours, including 150 hours in type, flew most of the flight from the left seat while receiving almost continuous instruction and coaching by the pilot, who had logged 1,500 of his 10,800 flight hours in type.

VMC with light winds prevailed at Dekalb Peachtree, and the flight crew was cleared for a visual approach to Runway 20L, which was 5,001 ft (1,524 m) long. The Beechjet was on a right base leg when the pilot took control from the copilot and began a turn to final approach.

"During the approach, the enhanced ground-proximity warning system (EGPWS) sounded the aural caution 'sink rate, sink rate' and also the aural warning 'pull up, pull up' several times," the report said. "The CVR [cockpit voice recorder] did not record comments from either flight crewmember about the cautions or warnings. They performed no maneuvers in response to the cautions or warnings and elected to continue the approach to the runway rather than perform a go-around, which is what they should have done."

The CVR captured a comment, "way too fast," by the pilot during final approach. Witnesses told investigators that the Beechjet's flaps did not appear to be extended. The airplane was 0.5 nm (0.9 km) from the runway and 153 ft above runway threshold elevation when a groundspeed of 194 kt and a descent rate greater than 2,150 fpm were recorded.

The Beechjet touched down with about 2,970 ft (905 m) of runway remaining. The pilots deployed the thrust reversers and speed brakes, and applied maximum wheel braking, but the airplane overran the runway, traveled down an embankment and across a service road, and came to a stop about 800 ft (244 m) from the departure threshold.

The landing gear separated, and the fuselage partially fractured in two places. Both pilots were seriously injured, and their two passengers sustained minor injuries.

NTSB said that the probable cause of the accident was the "flight crew's failure to obtain the proper airspeed for landing" and that contributing factors were "the failure of either pilot to call for a go-around and the flight crew's poor crew resource management and lack of professionalism."

TURBOPROPS

In-Flight Break-Up

Beech King Air E90. Destroyed. One fatality.

A company in DeKalb, Illinois, U.S., had hired the pilot to transport aircraft parts to Mexico and then deliver the King Air to another operator. The flight to Mexico, planned for July 6, 2012, was delayed for inspection of a recent propeller installation and a return of the airplane to service by the company's chief mechanic. However, shortly after midnight, the chief mechanic told the pilot that he was too tired to perform the inspection and would complete the work the next morning.

Nevertheless, the pilot departed without authorization from DeKalb at 0230 to position the airplane to Brownsville, Texas, the NTSB report said. It was his first flight in the airplane. The pilot had not obtained a preflight weather briefing or filed a flight plan, but he did request and receive flight-following service from air traffic control (ATC).

The King Air was in cruise flight at 14,500 ft at about 0400 when a Dallas–Fort Worth Center controller told the pilot, "I'm showing some moderate, heavy and extreme precipitation now [at] 12 o'clock and about two miles. It just popped up."

"Yeah, I'm seeing some weather, sir," the pilot said. "Do you have a recommendation [for] deviation left or right?"

"No, I really don't," the controller replied. "It looks like you are heading right for it. It looks like the heavier stuff, most of it, is to your left, to the east, so maybe going west would be better."

Accordingly, the pilot advised that he was changing course 25 degrees to the right. "That's fine," the controller said. "Whichever way you need to go is fine." A few minutes later, the controller inquired about the pilot's ride conditions, but there was no response. Radar contact was lost shortly thereafter.

The wreckage of the King Air later was found in Karnack, Texas. "A review of the radar data, available weather information and airplane wreckage indicated that the airplane flew through a heavy to extreme weather radar echo containing a thunderstorm and subsequently broke up in flight."

NTSB concluded that the probable cause of the accident was "the pilot's inadvertent flight into thunderstorm activity" but said that a contributing factor was "the failure of [ATC] personnel to use available radar information to provide the pilot with a timely warning that he was about to encounter extreme precipitation and weather along his route of flight or to provide alternative routing to the pilot."

Weakened Gear Collapses

ATR 42-320. Substantial damage. Four minor injuries.

VMC with winds from 210 degrees at 16 kt prevailed at Jersey Airport in Britain's Channel Islands the morning of June 16, 2012, and the flight crew conducted a visual approach to Runway 27. "The commander reported that both the approach and touchdown seemed normal, with the crosswind from the left resulting in the left main gear touching first," the AAIB report said.

Both pilots heard a noise that they thought was from a tire bursting, and the aircraft rolled left until the wing tip and propeller struck the runway. The aircraft quickly came to a stop to the left of the runway centerline. The commander shut down the engines, and the flight attendant assisted the passengers in evacuating the aircraft. Four of the 40 passengers sustained minor injuries during the evacuation.

Examination of the left main landing gear revealed that the upper arm on the left side brace had fractured. "Evidence provided by the flight data recorders indicates that the landing was not extraordinary and that it was not considered to have been a contributing factor in the collapse of the landing gear leg," the report said. Investigators found signs that the side brace had been cracked when subjected to overload during a previous flight.

Radio Contact Lost

Mitsubishi MU-2B. No damage. No injuries.

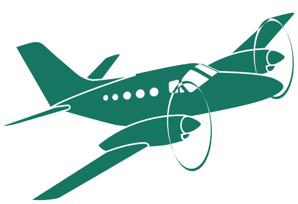
The flight crew was ferrying the MU-2 from the Solomon Islands to Melbourne, Victoria, Australia, with an intermediate stop at Townsville, Queensland, on April 5, 2013. Shortly after departing from Townsville at 1354 local time, the pilots heard static in their headsets and found that they were able to hear radio transmissions from ATC but that their VHF (very high frequency) radios were transmitting only carrier wave (no voice).

The pilots tried unsuccessfully to resolve the problem by turning the two VHF radios on and off, changing frequencies, recycling the circuit breakers, changing headsets and using the handheld microphone, said the report by the Australian Transport Safety Bureau (ATSB).

The pilot later told investigators that they could not return to Townsville because the aircraft exceeded its maximum landing weight. "He also considered changing the transponder to the radio failure code of 7600, however elected to continue with the code previously assigned as the aircraft had already been identified on radar by Townsville ATC," the report said.

The aircraft remained in ATC radar contact throughout most of the flight but was not in radio contact for 3 hours and 35 minutes. The aircraft was about 230 nm (426 km) north of Melbourne and at 21,000 ft when the crew was able to establish normal radio communications with ATC on a frequency relayed by the crew of another aircraft. The MU-2 subsequently was landed without further incident.

Investigators found that the radio malfunction resulted from water that had leaked onto, and caused corrosion of, two main radio isolator breakers. "The aircraft had been left outside for some time and subjected to tropical storms," the report noted.



PISTON AIRPLANES

Prop Feathering Delayed

Piper P-Navajo. Substantial damage. One fatality.

The pilot took off from Dalton, Georgia, U.S., the afternoon of June 30, 2012, to have an annual inspection performed in Douglas, Georgia. The NTSB report noted that the inspection was 12 days overdue.

Witnesses about 2 mi (3 km) from the departure runway saw the Pressurized Navajo flying low and descending. One witness said that the left engine appeared to be at full power, and the right engine and propeller were not operating. The airplane pitched up above a power line, rolled right and descended into wooded terrain.

Examination of the wreckage revealed that the propeller had not been feathered promptly after the right engine failed for reasons that could not be determined because of impact and fire damage. The report said that the right engine had accumulated 1,435 hours since it was overhauled 24 years earlier; the recommended time between overhauls of the Lycoming TIGO-541 engine is 1,200 hours or 12 years.

NTSB said that a contributing factor in the accident was the absence of guidance in the pilot's operating handbook that the propeller should be feathered before rpm decreases below 1,000 rpm after a power loss.

Sick Pilot Loses Control

Beech B95 Travel Air. Substantial damage. Four fatalities.

The pilot landed the Travel Air in Holbrook, Arizona, U.S., for fuel during a flight from California to Texas on June 24, 2009. Witnesses said that the pilot appeared to be ill and that he rested on a sofa while his passengers had lunch.

Shortly after takeoff from Holbrook, the airplane made a 45-degree right turn at about 300 ft and then entered a left turn. The roll steepened past the vertical, and the airplane descended to the ground, killing the four occupants.

"It was very likely that the acute gastrointestinal distress the pilot was suffering at the time impaired his ability to successfully fly the airplane," the NTSB report said. "Due to his condition, the pilot likely decided to return to the departure airport but failed to maintain control of the airplane."

Leak Causes Gear to Jam

Piper Chieftain. Substantial damage. No injuries.

After landing at Providenciales, Turks and Caicos Islands, the evening of June 28, 2013, the pilot noticed that the left main landing gear oleo strut was leaking oil. "After consultation with his employer, it was decided to ferry the aircraft back to its base [on Grand Turk] for rectification," said the AAIB report.

The flight crew was unable to extend the main landing gear on approach to Grand Turk. They conducted a go-around and tried without success to extend the main gear. "The pilot declared an emergency and committed himself to a wheels-up landing," the report said. "He raised the nose landing gear and feathered both engines on final approach, closing the firewall fuel valves and selecting fuel off. The landing was successful, and there was no fire."

Examination of the left main gear revealed that the leak originated from a twisted and broken O-ring seal. The leak prevented the oleo strut from extending fully and caused the torque link to foul inside the wheel well.

HELICOPTERS

Fuel Unporting Causes Flameout

Bell 206-L3. Substantial damage. No injuries.

Before departing on a chartered survey flight of the Buccaneer Archipelago in Western Australia the morning of June 8, 2013, the pilot determined from gauge indications that the LongRanger had sufficient fuel for the flight.

"The operator's fuel management system was almost totally reliant on the fuel quantity indicating system and, as a consequence, lacked a high level of assurance," the ATSB report said.

The helicopter was at 1,000 ft and heading to Cone Bay for refueling when the engine flamed out. The pilot deployed the floats, but the LongRanger rolled inverted shortly after touching down on the water. The pilot and his four passengers were rescued by a boat crew.

"The ATSB found that, without the pilot realising, the fuel on board was probably sufficiently low to allow momentary unporting of the fuel boost pumps, which interrupted the flow of fuel to the engine," the report said. "Contributing to the pilot's lack of awareness of the fuel state was a likely malfunction of the helicopter's fuel quantity indicating system and a faulty low fuel caution system."

Tail Rotor Driveshaft Disconnects

Bell 206L-4. Substantial damage. No injuries.

The helicopter departed from Abbeville, Louisiana, U.S., the morning of June 6, 2013, for an apparent fire-fighting mission. It was the LongRanger's first flight following extensive maintenance that had included removal and installation of the tail rotor gearbox.

After about 40 minutes of flight, the helicopter was approaching a canal at 20 ft to pick up an external load of water when the pilot heard a loud pop. The helicopter began to spin, and the pilot was unable to recover. He reduced power, and the helicopter descended into the canal and settled in about 3 ft (1 m) of water. Damage was substantial, but the pilot and his passenger were not hurt.

Examination of the helicopter revealed that the tail rotor driveshaft had become partially disconnected. "Of the driveshaft's two bolts, one remained with its associated nut," the NTSB report said. "However, the other bolt had backed out of the driveshaft but remained in the coupling; its corresponding nut was missing."

The safety board concluded that the probable cause of the accident was the "failure of maintenance personnel to ensure adequate torque of a tail rotor driveshaft coupling bolt, which resulted in the partial disconnection of the driveshaft."

Preliminary Reports, March 2014

Date	Location	Aircraft Type	Aircraft Damage	Injuries
March 2	Hadhramaut, Yemen	Antonov 26	substantial	6 NA
The flight crew conducted a gear-up emergency landing in the desert after encountering technical problems during a cargo flight from Sana'a to an oil field in Masila. The occupants of the aircraft reportedly were kidnapped by anti-government tribesmen.				
March 3	Kish Island, Iran	Dassault Falcon 20E	destroyed	4 fatal
The Falcon was being operated by the Iranian Civil Aviation Organization to calibrate navigation equipment at the island airport when it struck the Persian Gulf about 4 km (2 nm) offshore.				
March 3	Guasdualito, Venezuela	Beech King Air 90	destroyed	2 NA
The King Air reportedly had narcotics aboard when it entered Venezuelan airspace illegally and was forced by armed forces to land in an open field. The aircraft subsequently was destroyed by fire.				
March 8	Indian Ocean	Boeing 777-200	NA	239 NA
Search efforts were continuing at press time for the 777, which was believed to have diverted from course during a scheduled flight from Kuala Lumpur, Malaysia, to Beijing, China, and descended into the Indian Ocean about 2,600 km (1,404 nm) west of Perth, Australia.				
March 9	Tenerife, Spain	McDonnell Douglas MD-11F	substantial	3 none
The flight crew returned to the airport after an uncontained failure of the no. 2 engine occurred during initial climb on a cargo flight.				
March 12	Villavicencio, Colombia	Beech King Air C90	destroyed	5 fatal
The King Air was on a medevac flight from Bogotá to Araracuara when the flight crew diverted to Villavicencio due to technical problems. The aircraft subsequently stalled and crashed on approach.				
March 13	Gillingham Hall, Norfolk, England	Agusta Westland AW139	destroyed	4 fatal
Night instrument meteorological conditions prevailed when the helicopter struck terrain shortly after takeoff.				
March 13	Philadelphia, Pennsylvania, U.S.	Airbus A320-214	substantial	154 none
The nose landing gear collapsed after the flight crew rejected a takeoff from Runway 27L at Philadelphia International Airport.				
March 14	Stuart, Florida, U.S.	Cessna 402	destroyed	1 minor
The 402 crashed in a garden on final approach.				
March 18	Seattle, Washington, U.S.	Eurocopter AS350-B2	destroyed	2 fatal, 1 serious
Witnesses said that the helicopter began to rotate after lifting off from a rooftop helipad and then descended onto a city intersection, striking a vehicle and seriously injuring the occupant. The pilot and passenger were killed.				
March 19	Gisborne, New Zealand	MD Helicopters 500N	substantial	1 fatal, 1 serious
The helicopter was engaged in a night firefighting mission when it crashed in Hawkes Bay.				
March 19	Aurora, Colorado, U.S.	Piper 601P Aerostar	destroyed	1 fatal
The pilot was performing low-level aerobatics over a residential area when the Aerostar struck trees and crashed in a field.				
March 20	Charleston, South Carolina, U.S.	Cessna 421B	substantial	3 none
The 421 veered off the runway and struck two runway lights after the right main landing gear collapsed on landing.				
March 22	Ridgway, Colorado, U.S.	Socata TBM-700	substantial	5 fatal
The pilot was conducting an area navigation approach to Montrose Airport in day VMC when he told an air traffic controller that the airplane was in a spin and that he was trying to recover. The TBM then descended into a reservoir.				
March 26	Traverse City, Michigan, U.S.	Cessna Citation 560XL	none	4 none
The flight crew landed the Citation without further incident after the rudder jammed on approach.				
March 27	Chandigarh, India	Beech King Air B200	substantial	9 minor
The King Air was taking off for a flight to Delhi when it stalled on initial climb and crashed on the runway.				
March 28	Karauli, India	Lockheed C-130J	destroyed	5 fatal
The aircraft, operated by the Indian air force, was on a training mission when it struck terrain.				

NA = not available

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

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