# AeroSafety WORLD

**EMOTIONAL AWARENESS**
Essential element for CRM

**CYPRUS ATC CONFLICT**
Diplomats seek solutions

**TARGETED TRAINING**
Loss of control, dual HGS

**BIRD STRIKES**
Mitigating the hazard

## LIGHT UP THE NIGHT

NIGHT VISION LIMITATIONS

# CHANGING Vision

About once a year I find a need to use a famous quote. This time the urge came to me as I read a detailed analysis of the human factors surrounding Turkish Airlines Flight 1951 that, last year in March, crashed short of the runway at Amsterdam Schiphol.

In 1962, U.S. President John F. Kennedy welcomed a large group of Nobel laureates to a dinner at the White House by saying, "This is the most extraordinary collection of talent, of human knowledge, that has ever been gathered together at the White House, with the possible exception of when Thomas Jefferson dined alone."

In the 18th century it was possible for a remarkable individual like Thomas Jefferson to have some mastery over most areas of human knowledge. One hundred and sixty years later, even a room full of geniuses could not make a similar claim. I have to wonder if the same thing has happened to our own industry while we were busy cutting costs.

I would never claim to have the intellect of Thomas Jefferson, but when I was a young man studying for my Boeing 727 flight engineer exam, I felt like I had a pretty comprehensive knowledge of how those aircraft systems operated. I am not sure that pilots flying the latest generation of sophisticated aircraft feel the same way.

Today, there is so much interconnected technology, so many possible modes of operation; it just doesn't seem realistic to suggest that one person can know all that is going on. Yet, a misunderstanding of how systems interact can be fatal. In the case of TK 1951, the pilots made a reasonable assumption about how the autothrottle system would respond with one radar altimeter out. They guessed wrong. The right answer was never in their training, and wasn't even in a manual they could have read on their day off.

It is not possible for pilots to know everything about their advanced equipment, so instead they watch the systems do their thing, day in and day out, and come up with mental models about how they think the systems work. That solution works pretty well until the stick shaker activates early and dumps the aircraft in your lap, or the throttles retard themselves while you are trying to recover from a stall, or an engine goes into climb thrust while you are trying to stop on a wet runway with one reverser locked out.

During the last several decades, complexity has increased, and the pressure on the training system has increased. Cost pressures force training to be done in the absolute minimum amount of time. New training requirements are layered on top of one another and compete for what little training time is available. That doesn't leave much time to develop understanding of complicated systems.

We need to consider revising the approach. Traditional training focuses on observable tasks and observable outcomes. It is an approach that has its roots in the time-and-motion studies of the late 1800s. This may not be the way to prepare somebody to deal with a one-in-a-million event in an automated system. Maybe it is time to talk about things like education, understanding and insight, and change our perspective. The problems are different today. It is time to adapt.

*William R. Voss*
*President and CEO*
*Flight Safety Foundation*

AeroSafetyWORLD

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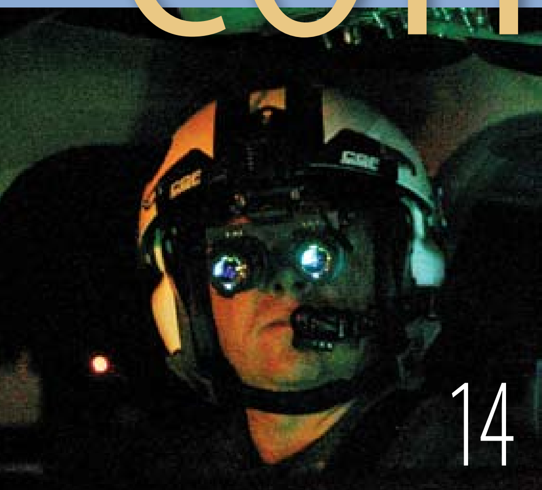




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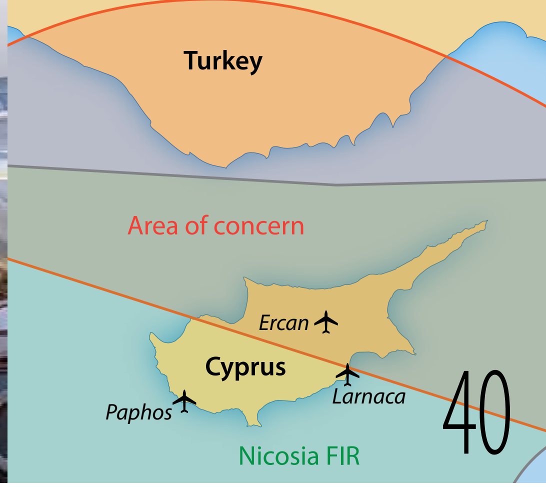





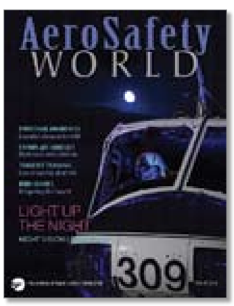


**About the Cover**
The Santa Barbara County Fire Department demonstrates night vision goggles.
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# TRAINING Footprint

Not long ago I would write stories fairly regularly about aviation training, probably a couple each year. One of the most dependable recurring themes I would hear from training providers was the difficulty they had in dealing with the additional required training modules regulators continually loaded onto the operators. Some of this was back in the old days of tombstone regulation when the industry knee-jerked to do something, anything, after each accident, but some of it also was the result of well-considered responses to developing knowledge and technology.

The problem, the providers would always say, was trying to fit the new material into the existing training "footprint," the investment in time and money operators set aside for the process. They weren't worried about the validity of the additional material as much as they were concerned about which part of the existing training curriculum would get compressed or even tossed out in order to make room for the new stuff.

The fixed training footprint is not the same for all operators or all types of operations, of course, but in most cases there are defined amounts of time and money. Managers who don't make and adhere to a budget are not managers at all, and training is one of many business elements to account for in the budget cycle.

Make no mistake, training for modern flight operations is a pricey process, involving travel, rooms and food, expensive training technology and technicians, and instructors. Plus, crews in training are not working, so productivity is lost.

Meanwhile, our aircraft are becoming increasingly complex, often in the quest to make flying safer. Perhaps counter-intuitively, experience and studies are showing that the greater the amount of automation, the more hidden become dangerous failure modes.

The crew of the Turkish Airlines 737 that crashed short of the runway in Amsterdam apparently didn't realize what it meant to the automation system as a whole to have one of its two radar altimeters displaying an altitude below sea level (*ASW*, 6/10, p. 32). This is but one of many examples. In addition, there seems to be an increasing number of catastrophic loss-of-control accidents in which mismanaged automation plays a role.

The key thought here is that it seems increasingly obvious that pilots need additional training in their aircraft's systems and their operation.

The point that ties the start of this column to the automation part is that operators, we are told, are distancing themselves from the idea that economic decisions play any role in developing training programs. If that were to be true, operators would voluntarily boost systems training in nearly every phase of the process, from computer-based training to fixed-base training devices to the full-motion simulators. But we won't see much of this because it is expensive, and the economic squeeze is still on for most operators.

Airlines and corporate flight departments don't want their complete training process mapped out for them, but if the training footprint is not enlarged voluntarily to deal with the complexities of modern cockpit systems we may see regulators move more and more in that direction, especially should there be one or two more high-profile accidents. With operators in a public state of denial about the role economic considerations take in formulating a training plan, I see a rough road ahead for cooperative efforts to boost systems training without a regulatory mandate.

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

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**AUG. 24–25 ➤ The Just Culture Public Course.** Outcome Engineering. Dallas. +1 214.778.2038.

**AUG. 26–27 ➤ Introduction to Aviation SMS Workshop.** ATC Vantage. Tampa, Florida, U.S. <info@atcvantage.com>, <www.atcvantage.com/>, +1 727.410.4759.

**AUG. 30–SEPT. 3 ➤ Aviation SMS Course and Workshop Taught in Spanish.** PRISM. Bogotá, Colombia. John Darbo, <John.Darbo@argus.aero>, <www.aviationresearch.com/ProductsServices/PRISMSolutions.aspx>, +1 513.852.1057.

**SEPT. 1–3 ➤ Dangerous Goods Inspector Initial Training.** U.K. Civil Aviation Authority International. London Gatwick. Sandra Rigby, <training@caainternational.com>, <www.caainternational.com/site/cms/coursefinder.asp?chapter=134>, +44 (0)1293 573389.

**SEPT. 6–9 ➤ ISASI 41st Annual Seminar.** International Society of Air Safety Investigators. Sapporo, Japan. Mamoru Sugimura, <www.isasi.org/annualsem.html>, +81 3 5253 8814.

**SEPT. 8–9 ➤ International Air Safety and Climate Change Conference.** European Aviation Safety Agency. Cologne, Germany. Matthew Hilscher, <matthew.hilscher@easa.europa.eu>, <www.easa.europa.eu/iascc>, +49 2218 999 02071.

**SEPT. 13 ➤ Airworthiness Surveyor Theory Course.** U.K. Civil Aviation Authority International. London Gatwick. Sandra Rigby, <training@caainternational.com>, <www.caainternational.com/site/cms/coursefinder.asp?chapter=134>, +44 (0)1293 573389.

**SEPT. 14–15 ➤ Regulatory Affairs Training Course.** JDA Aviation Technology Solutions. Bethesda, Maryland, U.S. Josh Plave, <jplave@jdasolutions.aero>, <www.jdasolutions.aero/services/regulatory-training.php>, +1 301.941.1460, ext. 170.

**SEPT. 14–16 ➤ Cabin Safety Workshop.** U.S. Federal Aviation Administration Civil Aerospace Medical Institute. Oklahoma City, Oklahoma, U.S. Lawrence Paskoff, <lawrence.paskoff@faa.gov>, <www.faa.gov/data_research/research/med_humanfacs/aeromedical/cabinsafety/workshops>, +1 405.954.5523.

**SEPT. 14–17 ➤ Wildlife Hazards and Aviation Training.** AviAssist Foundation. Kilimanjaro Airport, Tanzania. Tom Kok, <tom.kok@aviassist.org>, <www.aviassist.org/pages/website_pages.php?pgid=6&CategoryID=33>.

**SEPT. 15–16 ➤ Atlantic Conference on Eyjafjallajökull and Aviation.** Keilir Aviation Academy. Keflavik, Iceland. <conferences@keilir.net>, <en.keilir.net/keilir/conferences/eyjafjallajokull>, +354 664 0160.

**SEPT. 20-22 ➤ Wildlife Hazards and Aviation Master Class.** AviAssist Foundation. Kilimanjaro Airport, Tanzania. Tom Kok, <tom.kok@aviassist.org>, <www.aviassist.org/pages/website_pages.php?pgid=6&CategoryID=33>.

**SEPT. 20–23 ➤ Flight Data Monitoring and Flight Operational Quality Assurance in Commercial Aviation.** Cranfield Safety and Accident Investigation. Cranford, Bedfordshire, England. Matthew Greaves, <m.j.greaves@cranfield.ac.uk>, +44 (0)1234 754243.

**SEPT. 20–24 ➤ Accident/Incident/Hazard Investigation Training.** Prism Training Solutions. Denver. John Darbo, <John.Darbo@argus.aero>, <www.aviationresearch.com>, +1 513.852.1057.

**SEPT. 23–24 ➤ Safety Aspects of Air-Ground Communications (Challenges and Solutions).** Flight Safety Foundation South East Europe–Middle East–Cyprus, Eurocontrol and International Federation of Air Traffic Controllers' Associations. Larnaka, Cyprus. <info@flightsafety-cy.com>, <www.flightsafety-cy.com>.

**SEPT. 24–25 ➤ A Practical Approach to Safety Management Systems.** Beyond Risk Management and Curt Lewis & Associates. Calgary, Alberta, Canada. Brendan Kapuscinski, <brendan@beyondriskmgmt.com>, <www.regonline.ca/builder/site/Default.aspx?eventid=867389>, +1 403.804.9745.

**SEPT. 26–27 ➤ ICAO/McGill University Worldwide Conference and Exhibition: Air Transport: What Route to Sustainability?** International Civil Aviation Organization and McGill University. Montreal. Maria Damico, <maria.damico@mcgill.ca>, <www.icao.int/ICAO-McGill2010>.

**SEPT. 27–OCT. 1 ➤ Crew Resource Management Instructor Training Course.** Integrated Team Solutions. London. <sales@aviationteamwork.com>, <www.aviationteamwork.com/instructor/details_atticus.asp?courseID=7>, +44 (0)7000 240 240.

**SEPT. 27–28 ➤ Quality Assurance and Auditing — A Practical Approach.** Beyond Risk Management and Curt Lewis & Associates. Calgary, Alberta, Canada. Brendan Kapuscinski, <brendan@beyondriskmgmt.com>, <www.regonline.ca/builder/site/Default.aspx?eventid=867409>, +1 403.804.9745.

**SEPT. 28–29 ➤ Fourth European Flight Test Safety Workshop.** Royal Aeronautical Society and Society of Flight Test Engineers. London. <raes@aerosociety.com>, <www.raes.org.uk/conference/indexconf.html>, +44 (0)20 7670 4300.

**SEPT. 28–29 ➤ Second European Safety Management Symposium.** Baines Simmons. London. Mary Lejeune, <mary.lejeune@bainessimmons.com>, <www.bainessimmons.com/symposium>, + 44(0) 1276 855 412.

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

# Safety News

## Mexican Downgrade

The U.S. Federal Aviation Administration (FAA) has downgraded Mexico's aviation safety rating to Category 2, after determining that its civil aviation authority does not meet safety standards established by the International Civil Aviation Organization (ICAO).

The downgrade from FAA Category 1 to Category 2 means that Mexican air carriers may not establish new service to the United States; they may continue their existing service, however.


Wikimedia

"While Mexico has been responsive to the FAA's findings and has made significant improvements in recent months, it was unable to fully comply with all of the international safety standards," the FAA said. "However … Mexico continues to make progress. The FAA is committed to working closely with the Mexican government and providing technical assistance to help Mexico regain its Category 1 rating."

A Category 1 rating means that a country's civil aviation authority meets all ICAO standards. Category 2 means that a country "either lacks laws or regulations necessary to oversee air carriers in accordance with international standards or that its civil aviation authority … is deficient in one or more areas, such as technical expertise, trained personnel, recordkeeping or inspection procedures," the FAA said.

After the FAA announcement, Aeromexico, a Mexican airline that flies to and from U.S. airports, issued a statement noting that the FAA's action "does not refer to the level of safety of the airlines, nor does it reflect the safety of Aeromexico, which complies with the highest international standards of operational safety."

## Rudder Pedal Limitations

Citing two accidents involving "potentially hazardous rudder pedal inputs," the U.S. National Transportation Safety Board (NTSB) has asked the European Aviation Safety Agency (EASA) to modify its certification specifications to limit rudder pedal sensitivity.

The NTSB recommended that EASA Certification Specifications for Large Aeroplanes be modified to "ensure safe handling qualities in the yaw axis throughout the flight envelope."

After the new standard has been established, EASA should "review the designs of existing airplanes to determine if they meet the standard," the NTSB said. "For existing airplane designs that do not meet the standard, … EASA should determine if the airplanes would be adequately protected from the adverse effects of a potential aircraft-pilot coupling (APC) after rudder inputs at all airspeeds. If adequate protection does not exist, EASA should require modifications, as necessary, to provide the airplanes with increased protection from the adverse effects of a potential APC after rudder inputs at high airspeeds."

Both accidents cited by the NTSB involved wake turbulence encounters during which pilots' rudder inputs caused the vertical stabilizer limit loads to be exceeded by a large margin.


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The first accident was the Nov. 12, 2001, crash of an American Airlines Airbus A300 after takeoff from John F. Kennedy International Airport in New York. All 260 people in the airplane were killed, along with five people on the ground. The investigation revealed that, during the encounter with the wake of a Boeing 747, the first officer "made a series of full alternating rudder pedal inputs before the airplane's vertical stabilizer and rudder separated in flight."

The second accident involved an Air Canada A319, which experienced an in-flight upset on Jan. 10, 2008, after encountering wake turbulence from a 747 while climbing from Flight Level (FL) 360 (approximately 36,000 ft) to FL 370. The crew declared an emergency and diverted to Calgary, Alberta. Three of the 88 people in the airplane were seriously injured and 10 received minor injuries.

A subsequent accident analysis and simulation by Airbus found that the rear vertical stabilizer attachment had experienced loads 29 percent greater than the design limit, primarily as a result of "the flight crew's series of alternating rudder pedal inputs and … not the result of the wake turbulence," the NTSB said.

## Proposed Penalties

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The U.S. Federal Aviation Administration (FAA) has proposed a $230,000 civil penalty against Continental Airlines for allegedly operating a Boeing 767 on 22 revenue flights during a time when the airplane was not in compliance with U.S. Federal Aviation Regulations.

The FAA says the airline replaced the 767's nosewheel and tire assembly without installing a required axle washer.

The agency has proposed smaller civil penalties against 11 companies for allegedly violating U.S. Department of Transportation Hazardous Materials Regulations.

The largest of the proposed penalties — $91,000 each — were against Boston Scientific Corp. of Natick, Massachusetts, U.S., and Cardinal Health of Madison, Mississippi, for allegedly offering fiberboard boxes containing flammable liquids to DHL. In each case, DHL employees discovered the leaking package, the FAA said.

Lesser penalties were proposed against nine other companies accused by the FAA of similar violations.

## Seat Belt Airbag

A U.S. manufacturer of aircraft seat restraints has received a supplemental type certificate from the European Aviation Safety Agency (EASA) to allow the retrofitting of general aviation aircraft with its seat belt airbags.

The AmSafe seat belt airbag already is being installed on 80 percent of new single-engine general aviation aircraft as standard equipment, the Phoenix-based company said. It also has been installed in commercial aircraft at more than 50 airlines around the world.

The company describes the seat belt airbag as a "self-contained, modular restraint system designed to improve occupant protection from serious head-impact injury and to enhance one's ability to exit the aircraft following an otherwise survivable accident."

The seatbelt airbag is deployed when the system's sensors detect a crash. AmSafe says the device has saved more than 17 lives since it was first installed in 2001.

## SMS Recommendations

An aviation rule-making committee (ARC) has recommended that the U.S. Federal Aviation Administration (FAA) issue regulations and guidance on the implementation of safety management systems (SMS).

The ARC, which developed its recommendations after reviewing public comments that were submitted on an FAA advance notice of proposed rulemaking (ANPRM), said that regulations would be desirable, even though the FAA already has issued advisory information on SMS development and implementation.

In developing the regulations, the FAA should, among other things, address methods of protecting SMS safety information and proprietary data against disclosure and inappropriate use, the ARC said.

"Protecting safety information from use in litigation (discovery), Freedom of Information Act (FoIA) requests and FAA enforcement action is necessary to ensure the availability of this information, which is essential to SMS," the ARC said in its recommendations to the FAA. "The ARC believes that this issue can only be adequately addressed through legislation in the case of discovery, subpoena and FoIA requests. This protective legislation must be in place prior to promulgation of an SMS rule."

The ARC characterized SMS as "the next step in the evolution of safety in aviation, based on processes and tools to systematically identify hazards and mitigate the risk associated with those hazards."

It also noted that its recommendation is the first step in what will be a lengthy rule-making process, "and it is clear the FAA has a lot of work to do before a proposal can be initiated."

The process will include development of a cost-benefit analysis and an evaluation of alternative methods for small businesses that are subject to any new regulations.

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## Human Factors Coordination

The two U.S. agencies responsible for human factors research relating to implementation of the Next Generation Air Transportation System (NextGen) — the modernization of U.S. airspace — have failed to establish a "cross-agency human factors plan," the Government Accountability Office (GAO) says.

The GAO praised the Federal Aviation Administration (FAA) and National Aeronautics and Space Administration for "coordinating their NextGen human factors research efforts" but said that the absence of a coordination plan has prevented the agencies from designating the areas that should be the subject of upcoming research.

In a report to Congress, the GAO recommended that the FAA develop a coordination plan and give the people in key positions the authority to set priorities for human factors research.

## Fatigue Risk Management

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The U.S. Federal Aviation Administration (FAA) has set an Oct. 31 deadline for U.S. air carriers to submit a fatigue risk management plan (FRMP) "outlining policies and procedures for reducing the risks of flight crewmember fatigue and improving flight crewmember alertness."

FAA Information for Operators (InFO) bulletin 10013, issued in early August, said the FRMP would be required of air carriers operating under U.S. Federal Aviation Regulations Part 121.

The FAA said that it would issue another InFO and FAA Order 8900.1, *Flight Standards Information Management System (FSIMS)*, to provide guidance on the development and implementation of an FRMP.

In addition, the FAA has issued Advisory Circular (AC) 120-103, *Fatigue Risk Management Systems for Aviation Safety*, and amended versions of several related ACs to discuss the development of an overall fatigue risk management system (FRMS).

AC 120-103, which is not mandatory, describes the basic concepts of an FRMS and its role in aviation operations, along with implementation guidelines.

## Finances Linked to Safety Risks

Air operators in Australia have identified a shaky economy as the greatest risk to aviation safety, according to a survey by the Civil Aviation Safety Authority of Australia (CASA).

CASA surveyed 789 operators — a number that excludes the 12 largest regular public transport operators. Similar surveys are conducted annually to gather operational and safety data.

About 30 percent of the operators questioned said that economic conditions and profitability represented the greatest "potential risk to safety." Second on the list was "unsafe operators being allowed to continue operating" — a factor cited by nearly 20 percent of those questioned. Other areas identified as presenting safety risks included issues relating to operational personnel, "aircraft characteristics," airport issues, airspace issues and "lack of understanding of safety management systems."

RuthAS/Wikimedia

Despite their concerns, 56 percent of the operators said that they believe aviation is "extremely safe" or "very safe," CASA said. Two percent said that they believe Australian aviation is "not very safe."

Most of the air operators responding to the survey flew their aircraft fewer than 1,000 hours per year. Twenty-two percent operated one aircraft, and 20 percent operated two aircraft. Fifty-eight percent said that their operations involved carrying passengers. The survey also found that half of these operators' fixed-wing aircraft were built before 1980; most of their helicopters, however, were manufactured after 1990.

## In Other News …

The Civil Aviation Safety Authority of Australia (CASA) is updating its **maintenance rules** and expects the new package of regulations to take effect in June 2011. The revisions are intended to "provide Australian aviation with clearer, more concise and internationally harmonized maintenance rules," CASA said. … Data from the European Aviation Safety Agency (EASA) show that in 2009, there was one **fatal accident** involving a commercial air carrier operated by a company from an EASA member state. The June 1 crash of an Air France Airbus A330 over the South Atlantic killed 228 people. … The International Association of Flight Training Professionals is being formed, with plans to begin developing a database of global **pilot training** best practices. More information is available from Robert Barnes at <RBarnesAZ@aol.com>.

*Compiled and edited by Linda Werfelman.*

# Contaminated and Closed

BY DAVID THOMAS

**Will U.K. airports be ready for another winter onslaught?**

Last winter's unusually heavy snowfall caused major disruptions at most U.K. airports. Many scheduled airlines were obliged to cancel services, while charter airlines continued to fly, albeit with substantial delays. The financial implications for the airlines and airport operators are still difficult to gauge. However, with the benefit of hindsight, could the current U.K. practices regarding operations with contaminated runways be improved?

The U.K. Civil Aviation Authority (CAA) currently complies with International Civil Aviation Organization (ICAO) recommendations that operations on contaminated runways should be the exception and not the norm. U.K. airports have a "back to black" policy, which means that contaminated runways must be cleared and then treated with deicing/anti-icing fluid to prevent further contamination. However, this may not always be practical; tactical decisions on runway closure are not taken lightly and are difficult to predict. Traditionally, our benign winters and maritime airflow have rarely put this policy to the test.

## Uncertainty

So, what information can pilots rely on when making decisions about operating on runways that are not dry? Currently, U.K. Civil Aviation Publication (CAP) 493, *Manual of Air Traffic Services*, states that braking action reports must be issued in plain language for compacted snow and ice — for example, as "good," "medium" or "poor." This is derived from a matrix based on friction measuring devices first developed in 1959 by the Nordic countries and later adopted by ICAO (Table 1, p. 12).[1] CAP 493 also says that friction measuring


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devices can produce inaccurate readings in conditions of slush and thin deposits of wet snow — a phenomenon highlighted by an operators' bulletin issued by the U.K. CAA in 2006.[2]

It has been known for some years that readings by friction measuring devices do not necessarily reflect the braking performance of a modern airliner and that the devices can produce differing results. The Norwegian Accident Investigation Board has found that measurements can vary by 0.10 with dry contaminants and by 0.20 with wet contaminants. These issues are currently being addressed by research committees formed by ICAO, the European Aviation Safety Agency, the U.S. Federal Aviation Administration (FAA) and others.

So, where do we stand with regard to braking action reports if the runway is contaminated with something other than compacted snow or ice? The answer lies in CAP 493: "In conditions of slush or thin deposits of wet snow, friction measuring devices can produce inaccurate readings. [Therefore,] no plain language estimates of braking action derived from those readings shall be passed to pilots." Does this matter if the airport always clears the runway surface? The answer is yes. There can be a period of uncertainty from the time the runway begins to become contaminated to the time the airport decides to close it. Likewise, when the runway is reopened, it probably will be wet with deicing/anti-icing fluid, which should equate to a braking action of "good." However, under certain narrow temperature-dew point splits at or below freezing, ice can form when the deicing/anti-icing fluid starts to break down, which may reduce the braking action to "poor." In these scenarios, the crew will have to make an assessment of the likely runway braking action without any meaningful data. Snow notice to airmen (SNOWTAM) code "9" and European aviation routine weather report (METAR) codes "//" and "99" indicate that runway friction measurements are "unreliable."

Consequently, should we ask the regulator to rewrite CAP 493 to allow braking reports to be passed to pilots under *all* conditions? The Norwegian CAA already has done this by adapting the ICAO recommendations to the Norwegian winter climate. This has enabled the Norwegian airport operator Avinor to develop a reporting matrix for its own environmental conditions. Airport personnel are trained to make an assessment based on a visual inspection of the runway to measure the contaminant, friction measurements (which cannot be solely relied upon), current weather conditions and runway maintenance activities such as treatment with deicing/anti-icing fluid, sand, etc. After the results of the assessment are interpreted using the matrix, a braking action report is produced for pilots. This has not solved the problem completely; Norway still has runway excursions. However, Avinor continues to develop tools to deal with this complex subject, the most recent being the Integrated Runway Information System, a computer program that will aid airport personnel in assessing the runway state and braking action, based on automatic meteorological measurements.

**Runway Friction Measurements**

| Measured or Calculated Coefficient of Friction | Estimated Braking Action | MOTNE METAR Code |
|---|---|---|
| 0.40 and above | Good | 95 |
| 0.39–0.36 | Medium/ good | 94 |
| 0.35–0.30 | Medium | 93 |
| 0.29–0.26 | Medium/ poor | 92 |
| 0.25 and below | Poor | 91 |
| If for any reason the reading is considered unreliable | — | 99 |

MOTNE = Meteorological Operational Telecommunication Network Europe; METAR = aviation routine weather report

Source: U.K. Civil Aviation Publication 493

**Table 1**

## Across the Pond

On the other side of the ocean, the philosophy with regard to braking action reports differs between the FAA and Transport Canada (TC). The FAA recognizes the difficulty of assessing the surface condition of contaminated runways and reporting the information to pilots. It also acknowledges that the data provided by friction measuring devices do not necessarily represent aircraft braking performance. Consequently, the FAA recently recommended that airport operators no longer provide Mu readings (measured friction coefficients) to pilots. It believes that pilot weather reports (PIREPs) are an invaluable source of information for pilots and should be used in support of runway condition reports. After the Chicago Midway runway excursion in 2005 (*ASW*, 2/08, p. 28), the FAA set up a workshop on runway condition reporting. Participants developed a table that correlates braking action reports with estimated runway surface conditions (Table 2). The table has been provided to pilots by Boeing and is now used by a number of U.K. airlines.

TC has eliminated some of the issues caused by conflicting readings from friction measuring devices by using only decelerometers. The measurements conform to Canadian Runway Friction Index (CRFI) values comprising mostly fractions from 0 to

**Braking Action Correlations***

| Braking Action | | Estimated Correlations | ICAO | |
|---|---|---|---|---|
| **Term** | **Definition** | **Runway Surface Condition** | **Code** | **Mu** |
| Good | Braking deceleration is normal for the wheel braking effort applied. Directional control is normal. | Water depth of 1/8 in or less<br>Dry snow less than 3/4 in depth<br>Compacted snow with OAT at or below –15° C | 5 | 40 and above |
| Good to Medium | — | | 4 | 39–36 |
| Medium (Fair) | Braking deceleration is noticeably reduced for the wheel braking effort applied. Directional control may be slightly reduced. | Dry snow 3/4 in or greater in depth<br>Sanded snow<br>Sanded ice<br>Compacted snow with OAT above –15° C | 3 | 35 –30 |
| Medium to Poor | — | | 2 | 29–26 |
| Poor | Braking deceleration is significantly reduced for the wheel braking effort applied. Potential for hydroplaning exists. Directional control may be significantly reduced. | Wet snow<br>Slush<br>Water depth more than 1/8 in<br>Ice (not melting) | 1 | 25–21 |
| Nil | Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain. **Note:** *Taxi, takeoff and landing operations in nil conditions are prohibited.* | Ice (melting )<br>Wet ice | — | 20 and below |

ICAO = International Civil Aviation Organization; OAT = outside air temperature

*The correlations are estimates, only. Mu values — reported runway friction coefficients — can vary significantly.

Source: Boeing Commercial Airplanes

**Table 2**

1, with 1 being theoretically equivalent to maximum friction on a dry runway. Although TC has considerable confidence in this system, some contaminants, including slush and loose snow, remain outside the system's capabilities. The Transportation Safety Board of Canada (TSB) forwarded an aviation safety advisory to TC after a runway excursion in 2002.[3] As a result of the recommendations made in the advisory, TC now highlights the limitations of runway surface condition reports and CRFI reports, particularly when ambient temperatures are near freezing.

Contaminated runway operations will always be the exception in the United Kingdom due to our climate, and clearing should be the first option. However, when operating under SNOWTAM code 9 or METAR codes // or 99, crews should be provided with a similar level of safety from the airport operator as would be expected under normal conditions. This is something British crews are likely to receive when operating at airfields with traditionally harsher winters. Unless the regulator changes its policy on when braking action reports can be issued, airport operators are unlikely to invest in new tools to help assess braking action. The easy option is to continue with the status quo and hope last winter was one in a million. However, if it was not and next winter we have a serious runway excursion, who will be accountable?

*David Thomas is a captain for Thomas Cook Airlines. This article originally was published by the British Airline Pilots Association in its bimonthly journal, "The Log."*

## Notes

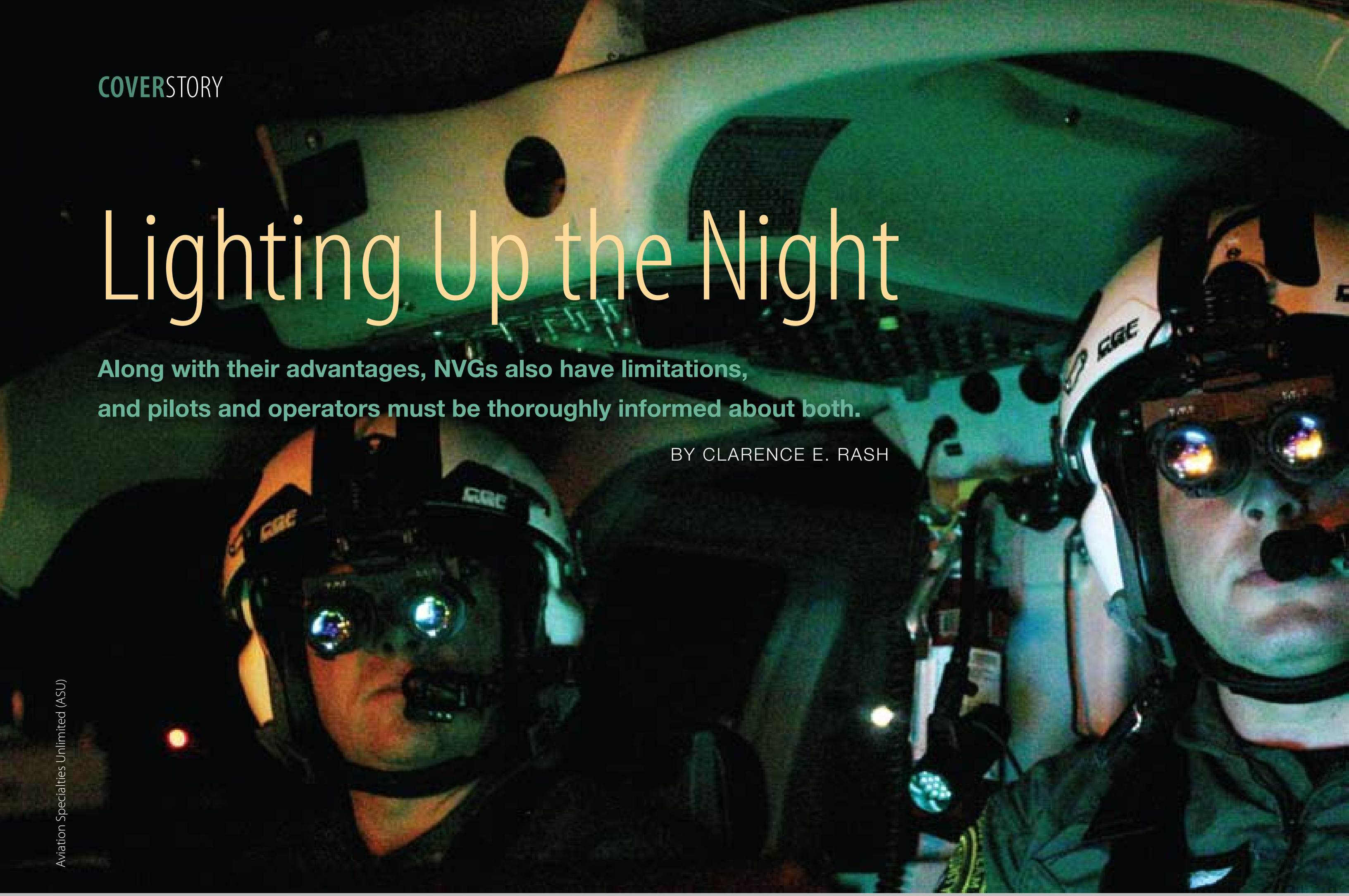
1. Friction measuring devices include continuous friction measuring equipment and spot measuring equipment (decelerometers).
2. U.K. CAA. Flight Operations Division Communication (FODCOM) 19/2006, *Winter Operations*. Oct. 30, 2006.
3. TSB Aviation Investigation Report A02A0038. *Runway Excursion: Air Canada Regional Airlines (Jazz) Fokker F-26 MK-1000, C-FCRK, Saint John, New Brunswick, 27 March 2002.*

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

# Lighting Up the Night

**Along with their advantages, NVGs also have limitations, and pilots and operators must be thoroughly informed about both.**

BY CLARENCE E. RASH



Aviation Specialties Unlimited (ASU)

Users of night vision goggles (NVGs) are acutely aware of the advantages these devices offer in improving a pilot's ability to see in darkness and enhancing safety during night flight. They may be less cognizant, however, of some of the limitations that NVGs impose on night visual performance.

As NVG use in helicopter operations increases, pilots and operators must be educated about the capabilities and limitations imposed by NVGs, and the often-misleading effects of NVG imagery on visual perception.

Since 1999, when the U.S. Federal Aviation Administration (FAA) issued the first supplemental type certificate (STC) to permit use of NVGs by a civilian helicopter emergency medical services (HEMS) operator in the United States, NVG use has steadily grown.[1,2]

## Brighter Nights

The brighter scene provided by NVGs — which makes it possible for pilots to see objects not otherwise visible — increases situational awareness, enhances safety and improves flight capability.

However, as impressive as these devices are at increasing the ability to see and fly at night, the technology, as many researchers say, "does not turn night into day." Unfortunately, too many pilots carry a mental model of daytime flight into their night operations, not being aware that, even with NVGs, their visual performance is compromised.

Perhaps the most common mistake by pilots flying with NVGs is "overflying" the aircraft — flying too fast to allow for adequate reaction to the sudden detection of an obstacle.

Such a scenario raises the need for two additional operational metrics that should be, but often are not, applied to NVG flight: detection range and recognition range. Detection range is the distance at which the presence of an object can be discovered; recognition range is the distance at which a detected object can be identified as belonging to a category, such as wires, buildings, vehicles or people.

## Limitations

The consequences of specific limitations of NVGs (Table 1, p. 16) can be significant, and their cumulative effects in degrading night visual performance provide pilots with a challenging flight environment.[3]

For example, because pilots rely on the quantity and quality of visual information available to them to make decisions that are integral to maintaining safe flight conditions, the NVG's

Although NVGs enable pilots to see objects in the dark that are not visible to the naked eye, they do not "turn night into day."

reduced field of view (FOV) and resolution are the most significant limitations.

The NVG's 40-degree circular FOV is smaller than the normal human binocular visual field of 120 degrees (vertical) by 200 degrees (horizontal). Pilots describe their impression of viewing the outside world through NVGs as "looking through a soda straw." To compensate for this reduced FOV, pilots must continuously scan from side to side, as well as up and down. This is fatiguing, and on long flights, pilots may fail to maintain the scan. Although unaided side and "look-under" vision is important to scan instruments and identify colors of lights outside the cockpit, unaided side vision also is important in detecting other aircraft outside the NVG FOV.

NVG resolution, which describes the amount of detail in a scene, has greatly improved since the earliest NVGs were manufactured. Those early devices gave pilots visual acuity of approximately 20/50 — or the metric equivalent, 6/15.[4]

A new generation of cockpit lighting design will allow for internal viewing of instruments but will not artificially lower NVG performance.

Aviation Specialties Unlimited (ASU)

Modern systems provide resolution equivalent to 20/25 (6/8) visual acuity. However, obtaining this high resolution requires optimal environmental conditions, including high illumination and contrast, clear weather, and an absence of fog, dust and glare sources. During any flight, it is not uncommon for available resolution to be as good as 20/25 and as poor as a completely washed out image.

In addition to reduced FOV and resolution, NVGs have additional limitations that include reduced depth perception, loss of color information and the presence of image noise — which looks sparkly and obscures fine detail — and other defects.

## External vs. Internal Light

Perhaps the most overlooked limitation of NVGs is their inability to discriminate between light originating from the external world and light originating inside the cockpit.

NVGs have an "automatic gain control (AGC)," which reacts to the ambient light level by increasing the multiplication factor when the ambient light level decreases and decreasing the multiplication factor when the ambient light level increases. As a result, if the lower light levels in the cockpit can be "seen" within the FOV of the NVGs, then the AGC reduces the system gain. This results in a system gain that is not optimized for the external illumination level, possibly reducing the pilot's night vision capability. This dilemma has driven a new generation of cockpit lighting design, one that will allow for internal viewing of instruments but will not artificially lower NVG performance.[5]

## Weighing the Advantages

Operators must weigh the advantages and disadvantages before deciding whether to implement an NVG system.

CareFlight, an Australian HEMS operator, recommends in its *NVG Implementation Guide* that any operator contemplating implementation of an NVG system first conduct a detailed analysis and formulate a business plan.[6]

"Operators considering the NVG technology often have to justify a significant investment and expenditure without having … any clear way of determining the suitability and benefits to their particular operation, let alone a method to determine the implementation costs," the guide says. "If after the analysis phase, it is decided that NVG technology *is* justified in the particular organization, operators are then confronted with trying to implement both a new piece of equipment and a fundamentally new cultural shift."

It outlines a 13-step plan that begins with an analysis of night mission data — "night scene landing conditions, search requirements, terrain encountered and frequency of night operations" — to help determine whether NVGs would benefit the operation. Other steps include determining the availability and cost of NVG technology; assessing client perceptions and expectations; deciding what cockpit modifications are required, their costs and how they should be implemented; and outlining NVG training requirements.

The guide recommends training one or two crews, which then fly for at least three months using NVGs before the operator evaluates their experiences and determines whether changes are needed before other crews undergo training.

"Remember, NVGs will only be of benefit if [their] implementation and ongoing management are properly resourced and structured," the document says.

**NVG Limitations and Their Effects on Performance**

| Visual Limitation | Effects on Performance |
|---|---|
| Reduced field of view (FOV) | 40 degrees circular (normal FOV is 120 degrees by 200 degrees) |
| Reduced resolution (visual acuity) | Early systems (20/40); newer systems (20/25), but greatly dependent on ambient lighting[1] |
| Loss of color information | Typically shades of green (or white) against black background |
| Degraded standard night vision | Reduced light adaptation resulting from NVG imagery in eyes |
| Presence of halos | Although halo sizes have been reduced in newer systems, bright lights appear surrounded by a glow (halo)[2] |
| Distortion | Reduced binocular depth perception; problematic only in older devices |
| Reduced depth perception | Decreased ability to judge distances; can induce visual illusions |
| Presence of image "noise" | Obscures fine details; problem increases as ambient light level decreases; appears as sparkles or scintillations |
| Image defects | Can cause distractions; obscures fine detail; defined as various cosmetic blemishes in the NVG imagery resulting from dirt or debris trapped in the system during the manufacturing process (e.g., black spots and white spots) |

NVG = night vision goggles

**Notes**

1. 20/40 vision (metric equivalent 6/12) refers to a person's ability to see clearly from a distance of 20 ft (6 m) what someone with normal vision sees from 40 ft (12 m). The metric equivalent of 20/25 vision is 6/8.
2. The primary concern involves halos that are significantly different in size between right and left NVG tubes and within the FOV. The images do not fuse and appear out of focus.

Source: Clarence E. Rash

Table 1

Aviation Specialties Unlimited (ASU)

## Education and Training

Once a decision has been made to implement an NVG system, operators and pilots must be thoroughly familiar with the advantages and disadvantages of flight using NVGs. This can be achieved through educational courses covering the essentials of night vision technologies, offered by the operator or an outside training company. These courses should consist of material that describes the basic principle, design, operation, and care and maintenance of NVGs. FAA requirements also call for instruction in relevant aeromedical factors such as depth perception, range estimation and visual illusions; scene and terrain interpretation; and abnormal operational characteristics of NVGs.

An educational program is not necessarily limited to classroom lectures but may also include use of an eye lane — in which a pilot stands at one side of a dark room and looks through NVGs at an eye chart on the opposite wall to learn to focus the goggles; a terrain board — a miniature layout of the type of terrain where the pilot will operate; or a simulator, as well as computer-based or Web-based training.[7]

Following an initial classroom introduction to the principles and limitations of NVGs, the next step is to allow pilots to experience these limitations firsthand via operational flights. The chief goal of an effective flight training program is to expose pilots to the perceptual differences in NVG-aided night flight, compared with unaided day flight, to dispel any misconception that NVGs can turn night into day.

Flight training should be conducted by a qualified NVG pilot and should include both basic and mission-specific tasks and maneuvers, including NVG operational checks and the impact of internal/external lighting systems on NVG performance; airspace surveillance and obstacle avoidance; departures and approaches, with and without NVGs; NVG malfunction procedures; recovery from inadvertent entry into instrument meteorological conditions; and transitioning between NVG-aided flight and unaided flight.[8]

Research and experience show that pilots need early and continued exposure to the night environment across a broad range of operational conditions and environments to develop good night flying skills and practices.[9]

## Hardware

NVG hardware considerations fall into three categories: procurement, inspection, and maintenance and repair. Available systems may include the earliest generation (GEN) of NVGs, or they may be the newest — GEN III+ intensifier tubes; they are priced accordingly (see "How NVGs Work,").

Aviation Specialties Unlimited (ASU)

As with any electro-optical system, sustained proper operation requires regular inspections. On a nightly basis, pilots should conduct a brief preflight operational inspection. First, NVGs should be checked for functionality — checking battery installation and tube luminance balance — and for obvious

### How NVGs Work

The night vision goggles (NVGs) used in civil aviation rely on image intensification ($I^2$) technology to convert both visual light — which can be seen by the naked eye — and near-infrared (IR) light — which cannot — to electrons, which are multiplied (amplified), and converted back into visible light.

All aviation NVGs that are in common use are binocular, helmet-mounted systems with two $I^2$ tubes and a dual compartment power pack that gives the pilot immediate backup power. The power pack uses AA alkaline batteries.

NVG tubes have three basic components — a photocathode, a microchannel plate and a phosphor screen. All three are sandwiched between two sets of optical elements — input optics that focus the incoming photons onto the photocathode and an eyepiece that focuses the outgoing photons into the eye.

Since their introduction into military aviation in the 1970s and their integration into civil aviation in the 1990s, NVGs have undergone several design changes — mostly based on improvements in $I^2$ tube performance — referred to as generations (GEN). The current commonly available version, which was fielded in the 1980s, is referred to as GEN III. GEN III+ was developed in 2001 and was intended to be designated as GEN IV (filmless), but was changed back to a thin film design. Technical characteristics of GEN III+ NVGs include a fully overlapped, binocular 40-degree circular field-of-view, and a resolution designed to result in visual acuity of 20/25 (6/8).[1]

User adjustments are provided for fore-aft positioning, vertical height, tilt, interpupillary distance, and both objective and eyepiece focus. If one or more of these adjustments is incorrect, NVG imagery can be degraded.

— Clarence E. Rash

#### Note

1. 20/25 vision (metric equivalent 6/8) refers to a person's ability to see clearly from a distance of 20 ft (6 m) what someone with normal vision sees from 25 ft (8 m). Normal vision typically is considered to be 20/20 (6/6).

damage, such as a loose mounting bracket, broken knobs/levers or loose wires. Second, all user adjustments should be verified as functional and then optimized by the pilot for his or her requirements. Most important of these is the focus setting. If a commercial NVG focusing apparatus is available, it will produce the most precise focus setting; otherwise, focusing should be performed according to the manufacturer's instructions. Finally, cockpit lighting should be viewed through the NVGs to ensure compatible instrument lighting, dimming as required.

The FAA and NVG manufacturers recommend that NVGs be inspected every 180 days.

Routine care and maintenance by users is necessary to reduce problems during regular use. NVGs should be handled like any device that has delicate optical components in which optical alignment is essential to proper operation.

When NVGs are not in use, the lens caps should be in place, and the device should be stored in its case to reduce the possibility of shock and damage. Batteries should be removed if the device will not be used for an extended period. Regular care should include cleaning lenses with high quality lens cleaning supplies and wiping the exterior with a soft cloth to remove dirt.

If a system is suspected of being defective, repairs should be performed only by certified repair personnel. Users should never attempt to disassemble NVGs.

A logbook should be used for each set of NVGs and should contain a record of hours of usage, reported problems, inspection and calibration dates, and repairs. A record of battery use will ensure that extremely fatigued batteries will not be placed in operational use.

## Guidelines and Regulations

The FAA and other civil aviation regulatory agencies around the world have recognized the advantages of using NVG devices in civil aviation to enhance situational awareness during night operations. Standardized terminology, policies and practices are essential for the efficient and effective incorporation of NVGs into civil aviation — and this is only possible through government regulation.

Progress in developing comprehensive regulations and guidelines has been slow, spanning the nearly two decades since NVGs began appearing in civilian helicopters.

Nonetheless, over this period, the FAA has been soliciting and incorporating recommendations from various aviation organizations. In 1999, as a collaborative effort involving the FAA and RTCA,[10] along with EUROCAE, the European Organisation for Civil Aviation Equipment, special committees were formed to develop guidance for introducing NVGs into civil aviation. This effort produced three guidance documents.[11] In addition, in September 2004, the FAA published a technical standard order that discussed minimum performance standards.[12]

*Clarence E. Rash is a research physicist with 30 years experience in military aviation research and development. He has authored more than 200 papers on aviation display, human factors and aircraft protection topics.*

### Notes

1. Salazar, G.J.; Nakagawara, V.B. "Night Vision Goggles in Civilian Aviation." *FAA Aviation News* Volume 40 (May–June 2001): 21–22.
2. FAA. *Fact Sheet: Helicopter Emergency Medical Service Safety*. June 8, 2010. <www.faa.gov/news/fact_sheets/news_story.cfm?newsld=6763>.
3. Rash, C.E.; Manning, S.D. "On the Flight Deck, Lighting Must Satisfy a Variety of Needs." *Human Factors & Aviation Medicine* Volume 50 (September–October 2003).
4. 20/50 vision (metric equivalent 6/15) refers to a person's ability to see clearly from a distance of 20 ft (6 m) what someone with normal vision sees from 50 ft (15 m). Normal vision typically is considered to be 20/20 (6/6).
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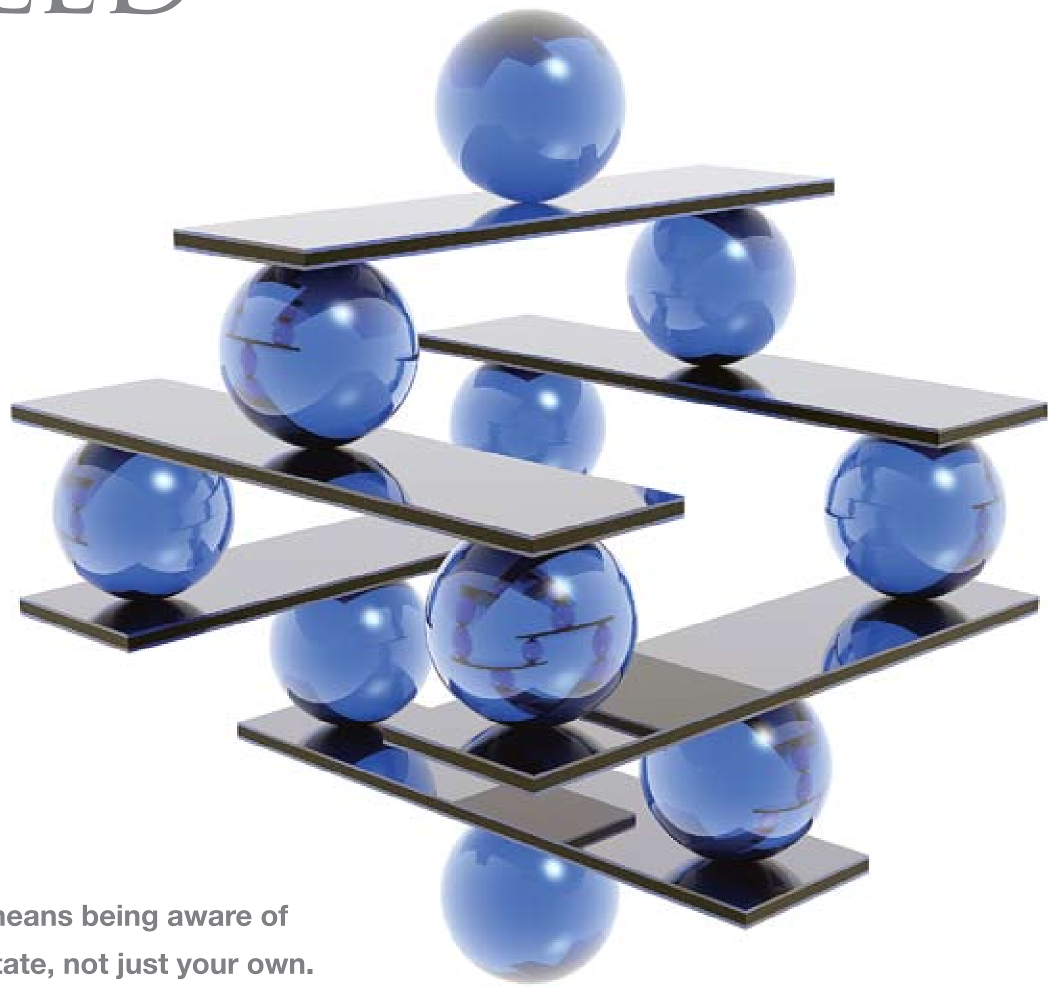
8. New requirement per August 2009 modification to U.S. Federal Aviation Regulations Part 61.31(k), "Additional training required for night vision goggle operations."
9. Ruffner et al.
10. RTCA — organized in 1935 as the Radio Technical Commission for Aeronautics but now known only by the abbreviation — is a nonprofit corporation that develops consensus-based recommendations regarding communications, navigation, surveillance, and air traffic management system issues. RTCA functions as a federal advisory committee, and its recommendations are used by the FAA as a basis for policy, program and regulatory decisions.
11. The documents are DO-268, *Concept of Operations, Night Vision Imaging System for Civil Operators*, published in 2001; DO-275, *Minimum Operational Performance Standards for Integrated Night Vision Imaging System Equipment*, published in 2001; and DO-295, *Civil Operators' Training Guidelines for Integrated Night Vision Imaging System Equipment*, published in 2004.
12. FAA. Technical Standard Order TSO-C164, *Night Vision Goggles*. 2004.

# Emotionally Enabled

BY SHARI FRISINGER



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**‘Emotional Intelligence’ means being aware of an entire crew’s mental state, not just your own.**

We watched in astonishment when Chesley Sullenberger in early 2009 skillfully piloted US Airways Flight 1549 to a safe landing in the Hudson River, and listened in horror a month later when we heard of Colgan Air Flight 3407 crashing into a Buffalo, New York, U.S., suburb.

Among the factors that caused one perfectly good aircraft to fall out of the sky, killing 50 people, while another very crippled aircraft made a safe water landing that resulted in only a few minor injuries, technical flying skills obviously play a major role. However, success or failure to a large degree can be linked to the captain’s ability to control his own emotions in order to think clearly, while being aware of the crew’s emotional and mental states.

When the role pilots play in aircraft incidents and accidents is considered, the initial focus of the U.S. National Transportation Safety Board (NTSB) and many analysts is on the technical abilities of the pilots: When was their last recurrent training? How many flight hours did they have in the aircraft type? How many total hours of flight experience?[1]

But some time ago it was realized that technical skills are not the only desirable traits a captain should have.


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**A major factor in maintaining the safety of the crew and passengers is the combination of the leader's objective thought process and his or her emotional awareness.**

Many years ago, airlines implemented cockpit resource management (CRM) techniques to enhance crew coordination. This new concept was partially based on a U.S. National Aeronautics and Space Administration investigation that discovered a common theme in many accidents — *failure of leadership and ineffective crew interaction*.

CRM focused on how the crew interacted in the cockpit, not necessarily on acceptable or appropriate cockpit behaviors. During the first decade of CRM use, it morphed into *crew* resource management, to include helping all crewmembers work more effectively as a team, improving situational awareness and providing techniques to break the error chain.

CRM has become a training mainstay. To date, CRM has included only the technical skills and thinking abilities — analytical, conceptual and problem solving. However, research beginning in the 1980s demonstrated that emotions greatly influence a person's cognitive abilities.

To be effective, the next level of CRM needs to include more of the "people" side — self-confidence, teamwork, cooperation, empathy and flexibility in thoughts and actions. A major factor in maintaining the safety of the crew and passengers is the combination of the leader's objective thought process and his or her emotional awareness.

The word "emotion" may conjure up negative elements that tend to degrade safety: anger, fear, crying, shouting and other unhelpful behaviors, but everyone every day experiences more subtle varieties of emotion.[2] In the cockpit this might include satisfaction for having achieved a smooth landing, pride in maneuvering around turbulence, excitement in getting desirable days off, irritation when plans don't work out, and sometimes annoyance with others.

Regardless of the situation, there always exists some degree of emotional response, and emotions are simply another type of information that must be considered in making effective decisions, especially in a team environment.

A high degree of situational awareness relies on a person being attentive to the environment. Internal situational awareness consists of understanding one's own emotions and emotional triggers. External situational awareness involves insights into team members' moods and unspoken communication, and appropriately addressing them.

The cornerstones of *emotional intelligence* (EI) are consciousness of one's thoughts and moods, of how the behaviors resulting from those impact and influence others, and of the moods and behaviors of others.[3] People with a high level of EI recognize and control their own emotional outbursts, step back from the heat of any situation, analyze it objectively and take the appropriate action that produces the most desirable results.

A person's perception of reality shapes emotions and feelings, and these drive thoughts and behaviors. Status quo is maintained until new strong feelings are experienced. Simply being unhappy in a job is usually not enough to warrant a change. Getting passed over for a promotion, accompanied by the belief that the decision was wrong, usually sparks anger and an active job pursuit.

The *amygdala* is the part of the brain that controls a person's level of emotional reactivity. It never matures, and, if left unchecked, it can bring chaos to a life. To compound the problem, the human brain instinctively cannot distinguish between a real threat and an imagined one.

Sitting in a theater, watching a panoramic or 3-D movie, the sudden loud sound of an airplane approaching will make most people reflexively duck. Intellectually, they know the airplane is not real, but the emotional brain hears the loud sound and tells the body it needs to avoid getting hit. When a situation changes, the emotional brain determines if the stimulus causing the change is a threat. If a threat is sensed, awareness becomes heightened and physiological changes take place to cope with this new danger. Adrenaline is released to pump the heart faster and prime the muscles for action. If the situation is later deemed to not be a threat, logic and objectivity take over again, but it takes four hours for the adrenaline to dissipate from the body.

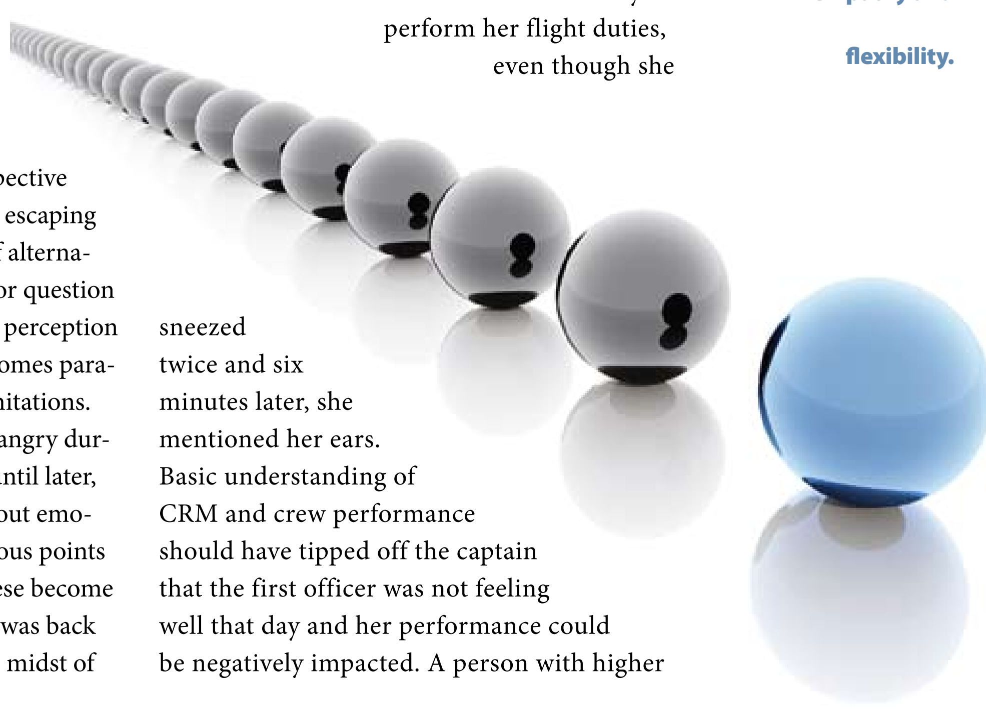
Today's fears, threats and dangers are not unlike those of prehistoric man. A flight department manager who needs to justify the expenses of his department can experience the same "fight or flight" reaction that the caveman did when faced with a saber-toothed tiger. A similar reaction occurs when people feel their reputation or credibility is threatened. Fear and stress envelop thinking and people over-focus on a narrow selection of solutions, disregarding alternative approaches.

When people allow their stressed brains to overtake thoughts, the perspective narrows and the main focus becomes escaping from the situation. Unable to think of alternatives, they don't see the "big picture" or question assumptions. At this level of thought, perception of the complexity of the situation becomes paralyzing, and the focus is on current limitations. Remember the last time you became angry during an argument? It probably wasn't until later, after you could see the situation without emotion, that you thought of several obvious points that could have helped your case. These become apparent because your rational mind was back in control. Your primary focus, in the midst of that argument, was to defend yourself. Success is more assured when this emotionally downward-spiraling thinking is halted and the problem is addressed more creatively.

The captain in the Colgan Air 3407 accident chose the "flight" reaction; he chose to avoid a developing situation.[4] When the first officer brought up the icing conditions — "I've never seen icing conditions. I've never deiced. I've never seen any, … I've never experienced any of that" — the captain's response was, "Yeah, uh, I spent the first three months in, uh, Charleston, West Virginia and, uh, flew but I — first couple of times I saw the amount of ice that that Saab would pick up and keep on truckin' … I'm a Florida man … ." Then he added, "There wasn't — we never had to make decisions that I wouldn't have been able to make but ... now I'm more comfortable." The captain was still unaware of what was rapidly developing around him, chatting while the aircraft's airspeed rapidly decayed. His failure to quiet his instinctive emotions narrowed his perception to the point that airspeed, one of the most basic elements of flying an airplane, no longer had his attention.

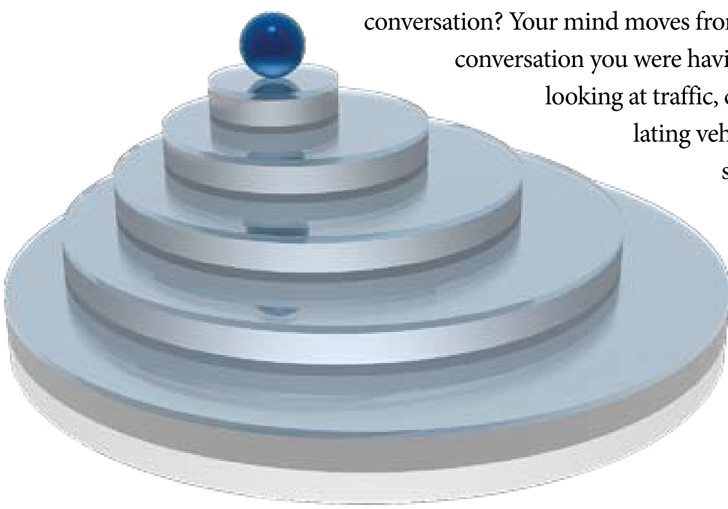
There were few instances when the captain referred to the first officer's health. He did not ask how she felt about her ability to perform her flight duties, even though she sneezed twice and six minutes later, she mentioned her ears. Basic understanding of CRM and crew performance should have tipped off the captain that the first officer was not feeling well that day and her performance could be negatively impacted. A person with higher

**The next level of CRM needs to include more of the 'people' side — self-confidence, teamwork, cooperation, empathy and flexibility.**



EI could have recognized that, and probably would have been empathic to her condition and her inability to actively participate as a viable crewmember.

The captain told stories for most of the flight. At one point, he rambled for over three minutes while the first officer only said 34 words, most of which were "yeah" and "uh-huh." Research on how the mind processes information has revealed that people can only consciously execute one task at a time, and unconsciously perform one additional task. When driving in heavy traffic or merging onto a freeway, are you able to continue your conversation? Your mind moves from the conversation you were having to looking at traffic, calculating vehicle speeds and analyzing the best opportunity to speed up and merge. Your automatic mind does not have the ability to safely handle non-routine driving tasks.





**Captains infected with 'captainitis' are so absorbed in their own world that they lose their situational awareness.**

A classic example is United Airlines Flight 173, a McDonnell Douglas DC-8, which in 1978 was destroyed when it crashed during an approach to Portland (Oregon, U.S.) International Airport.[5] The captain's intense preoccupation with arranging for a safe emergency landing prohibited him from considering other anomalies. His concentration was so focused on the emergency landing checklist that he did not modify his plans when the first officer and flight engineer twice warned him about their airplane's dwindling fuel supply. Ten people were killed when the aircraft crashed into a wooded area due to fuel exhaustion.

The NTSB said, "The probable cause of the accident was the failure of the captain to monitor properly the aircraft's fuel state and to properly respond to the low fuel state and the crewmembers' advisories regarding fuel state. … His inattention resulted from preoccupation with a landing gear malfunction and preparations for a possible landing emergency."

This accident was one of the key events driving the adoption of CRM in airline training.

Contrast the reactions and situational awareness of the Colgan and United crews to those of the captain of the US Airways A320 that landed in the Hudson River. Sullenberger kept his emotions under control and remained focused on doing his job — to safely land the plane.

The captain's words "my airplane" when he took over the controls after the bird strike could have been trigger words, words to focus on, snapping his rational brain into action and putting him into a safety frame of mind. He repeated the commands from the first officer, indicating that during those critical seconds there was no room for any misunderstanding. This flight crew's emotional intelligence was as good as it gets, which enabled their processing information quickly and using every resource available to them at the time.

The captain of United Airlines Flight 232, a McDonnell Douglas DC-10 that in 1989 attempted to land in Sioux City, Iowa, U.S., with catastrophic hydraulic and flight control systems failures, could have reacted to his challenges by becoming indecisive, shutting out the crew or dictating orders to them.[6] If he had responded in any of these ways, the captain would have reflected the emotional pressures he was experiencing, and, as a result, his crew would have had his pressures added to their own. Instead, he worked as part of the crew, alternating between giving direction and explaining his actions and taking input from anyone in the cockpit, including a training pilot. Emotions are contagious, and the strongest expressed emotion will be felt unconsciously by others and mimicked. In this case, the captain's calm demeanor was mirrored by the crew and they were able to contain their emotional reactivity.

Aviation history is overflowing with accidents due to pilot error. Many of them could have been avoided if the crews were more aware of their own emotional reactivity and those of the others. Captains infected with "captainitis" are so absorbed in their own world that they lose their situational awareness. The captain in Colgan Air 3407 was self-absorbed, talking about himself for nearly 20 minutes of the last 40 minutes of the flight, missing a number of clues that eventually led to the crash; on the other hand, the captain of US Airways 1549 maintained his composure throughout his short flight and focused on every element of the emergency.

Why is EI relevant? The Center for Creative Leadership found that the leading causes of failure among business executives are inadequate abilities to work well with others, either in their direct reports or in a team environment. Another study of several hundred executives revealed a direct correlation between superior performance and executives' ability to accurately assess themselves.

What actions demonstrate an increased level of EI?

- When crewmembers voice their concerns in a calm, firm manner, giving evidence to back up those concerns;
- When leaders acknowledge the atmosphere and question crewmembers in a non-defensive manner to determine the causes of the uneasiness; and,
- In a crisis or stress situation, when leaders maintain their composure and communicate more frequently and more calmly with the crew.

There are several techniques that can raise your level of EI:

- Be aware of the thoughts going through your mind. Are they stuck in the past and wallowing in problems, or are they focused on the future and actively looking for solutions? Once we choose negative thoughts, they can very easily spiral downward, the cycle descending into hopelessness.
- Acknowledge your emotions. Remember they are neither good nor bad, they are what they are. Next, identify these emotions: Angry? Irritated? Defensive? Disappointed? Guilty? Frantic? Miserable? Naming your emotions makes them less abstract and helps release their influence on you. It becomes easier to detach yourself and think objectively.
- Look back over your previous reactions. How could you have made a better choice? What information and alternatives are clear now that weren't at that time? As we frantically search for quick solutions to rectify the situation, we automatically use the techniques that we have used before, whether they are the best choice or not. Our mind is not free to explore new alternatives.
- Put yourself in the other person's position. How would you react if you were on the receiving end of *your* emotions? The other person's brain will send him through the same fight/flight/freeze reaction that yours is experiencing. Imagine both people fighting for their pride or their reputation — chances are slim that the discussion will end well.

Leaders need a considerable amount of cognition.[7] The ability of the leader to broaden his or her focus from technical and task-related activities to include an awareness of the moods of the crew is critical to success. It would benefit all parties to know which skills in specific circumstances are most appropriate. A leader's behaviors directly affect the team's disposition, and the team's disposition drives performance. When the leader can analyze and manage his or her own emotional reactivity, the team members can more easily manage their own emotions. How well the leader performs this can have a direct effect on the safety and morale of the crew.

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# Beyond Redemption

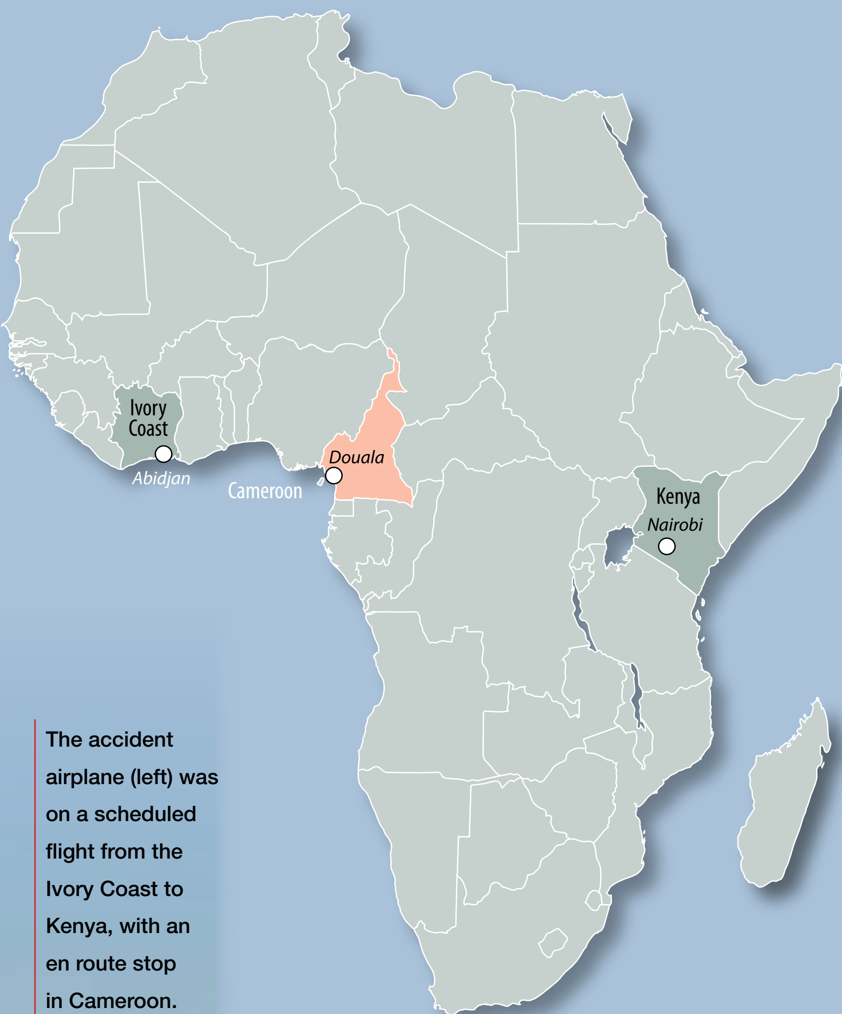
BY MARK LACAGNINA

**Spatial disorientation turned a minor upset into a major accident.**


Departing from Douala, Cameroon, on a dark night that was beset by thunderstorms, a Kenya Airways Boeing 737-800 entered a slow right roll that continued for nearly a minute without the flight crew or the autopilot engaged. The captain — the pilot flying — was preoccupied with the weather and had lost situational awareness. The first officer, who had been left out of the loop of the captain's planning, was not effectively monitoring what was going on, and he did not notice that the autopilot had not been engaged, as intended. Confusion and spatial disorientation prevailed when a bank angle warning sounded. The captain responded with erratic flight control inputs that aggravated the situation and precipitated a spiral dive. The pilots were wrestling the controls when the 737 disintegrated in a mangrove swamp, killing all 114 people aboard.

A technical commission of inquiry convened by the Republic of Cameroon found that the events leading to the May 5, 2007, accident were fraught with deficiencies in pilot performance that had been brought to light repeatedly by instructors and examiners at the airline.

Both pilots were Kenyans. The captain, 52, held type ratings in several 737 models, as well as the Airbus A310-300. He had 8,682 flight hours, including 823 hours as a 737 pilot-in-command. The final report by the technical commission of inquiry said that after he received his initial 737 type rating in 1997, "recurring shortcomings" were cited by instructors and examiners. They included deficiencies in crew resource management (CRM), knowledge of airplane systems, adherence to standard operating




Wikimedia

The accident airplane (left) was on a scheduled flight from the Ivory Coast to Kenya, with an en route stop in Cameroon.

© Montague Smith/Airliners.net

procedures (SOPs), cockpit scanning, situational awareness, planning and decision making. The pilot's performance was found to be unsatisfactory during some proficiency checks, and he was required to receive extra training before another check was administered.

A proficiency check in 2002 was converted to a training flight after the captain demonstrated inadequate knowledge of systems and procedures. During recurrent training in 2003, an instructor urged him to be more attentive to checklists and aircraft limitations, be more systematic in responding to system failures, provide more consistent briefings and adhere to SOPs. A 2004 training session resulted in recommendations that he take time to analyze system failures and to discuss them with the first officer. A 2005 line proficiency check cited deficiencies in the captain's command ability and teamwork, and his familiarity with airplane systems and SOPs; the examiner also noted that he tended to be "overbearing." A 2006 line check found the captain's performance below standard and required that he undergo another line check; the training manager told the examiner to determine if "complacency or incompetence is the issue." The captain passed the second line check, and "there was no evidence of any retraining or punitive action taken against him," the report said. An examiner's report on a proficiency check three months before the accident contained no comments.

Kenya Airways evaluated pilot performance as "not acceptable," "acceptable," "standard" (average) or "above standard." The captain's performance consistently was judged as acceptable.

The first officer, 23, had 831 flight hours, including 170 hours in type. Performance assessments issued during his training as a 737 first officer cited requirements for improvement in situational awareness, radio communications, monitoring the pilot flying and calling out deviations. "However, his overall performance during training and flight checks was judged to be satisfactory," the report said. He earned a 737 second-in-command type rating in September 2006.

The report said that Kenya Airways should have avoided pairing the pilots for flight duty because of the deficiencies observed during training and evaluation, and because of known psychological traits. The captain was described as having a strong character and a heightened ego, and was known to be authoritative and domineering with subordinates. "He seems to have been affected by the slow progress of his career and the fact that he had remained on the 737," the report said. His attitude toward the first officer during the accident flight was described as "paternalistic."

In contrast, the first officer was known to be reserved and nonassertive. The report said that during the accident flight, he appeared to be "intimidated by the meteorological situation" and "subdued by the strong personality of the captain."

## 'Disquieting Conditions'

The accident occurred during a scheduled flight, KQA 507, from Abidjan, Ivory Coast, to Nairobi, Kenya, with a one-hour stop at Douala, on the



Neither pilot noticed that the autopilot did not engage when the "CMD" (command) push button, on the right side of the mode control panel at the top this photo, was pressed.

fifth day of the crew's five-day pairing. The 737 landed in Douala on schedule at 2201 local time, but the crew was told by the airport traffic controller to taxi to a terminal gate that was different from the one at which the ground crew was waiting. That miscue, plus the captain's decision to postpone engine start until heavy rain abated, delayed the departure about one hour.

The report said that before leaving the gate shortly after midnight, the captain did not conduct a departure briefing, which was required especially in light of the "rather disquieting meteorological conditions." When he called for the "Before Taxi" checklist, the first officer began conducting the "Before Takeoff" checklist; the captain did not correct him.

Weather conditions were influenced by thunderstorm activity that had begun in the afternoon and was forecast to last until morning. A storm had passed over the airport while the 737 was parked at the gate, and there were storms in the vicinity of the airport. When the crew taxied onto Runway 12 for takeoff, visibility was 800 m (1/2 mi) in rain, and surface winds were from 050 at 10 kt, gusting to 20 kt.

While holding for takeoff, the pilots used the on-board weather radar to analyze the conditions beyond the runway. The departure clearance required that they maintain runway heading during the initial climb, and they agreed that a deviation south of the assigned course would avoid the largest cells. The captain told the controller, "After departure, we would like to maintain slightly left of runway heading due to weather ahead." The first officer corrected the captain, who then radioed, "Sorry, slightly right." The controller approved the request.

The captain, the pilot flying, then initiated the takeoff although neither he nor the first officer had requested or received clearance from the controller. The flight directors and autothrottle were engaged in the takeoff/go-around mode, with a selected heading of 118 degrees and a selected climb speed of 150 kt. The airplane lifted off at 0006.

## Tendency to Roll Right

The report said that the airplane had a tendency to roll right likely because of a slight mispositioning of the rudder trim control and/or because of an inherent trim asymmetry that resulted during its construction in 2006.[1] The captain used his control wheel to counter the roll tendency until the selected heading was changed from 118 degrees to 139 degrees as the airplane climbed through 1,000 ft. He told the first officer, "I will keep somewhere around here." About this time, all action on the flight controls ceased, the report said, noting that the crew's attention likely was focused on using the weather radar to avoid thunderstorms.

The airplane was banked 11 degrees right, turning through a heading of 127 degrees and climbing through 1,600 ft when climb power was selected and the captain said, "OK, command." This was a reference to engagement of the autopilot, which, according to company SOPs, is accomplished and called out by the pilot flying and cross-checked by the pilot monitoring. However, the first officer said nothing in response to the captain's callout, and neither pilot noticed that the flight mode annunciator indicated that the autopilot was not engaged.

Recorded flight data showed that the "CMD" (command) push button on the mode control panel had indeed been pressed to engage the autopilot, but the report said that the autopilot likely failed to engage because forward pressure was being applied manually to a control column at the same time. The report said that the captain's subsequent behavior indicated that he believed the autopilot was engaged and that trim inputs effected by the autothrottle in response to excessive airspeed changes might have reinforced that impression.

The airplane was climbing through 2,400 ft when the air traffic controller issued a new altimeter setting. "The two pilots executed the change of altimeter setting without noticing or interpreting the deteriorating flight parameters that were clearly visible on the EADI [electronic attitude director indicator], on which, incidentally, they were reading the altimeter setting," the report said.

As the airplane turned through the selected heading, 139 degrees, the flight director roll-command bars moved left. The selected heading was changed to 120 degrees, but the airplane continued turning right, now with a 20-degree bank angle. The 737 was turning through 190 degrees and climbing through 2,600 ft when the first officer asked, "I continue with heading?" The captain did not respond, but the selected heading was changed from 120 degrees to 165 degrees.

## 'We Are Crashing'

At 0007:19, the captain uttered an expression of surprise when the enhanced ground-proximity warning system generated an aural warning: "bank angle." A flight simulation later conducted by Boeing showed that the airplane easily could have been returned to wings-level flight without excessive control inputs at this point — *if* the pilot flying was not spatially disoriented. However, the report said that the captain responded with control inputs that were "erratic." He moved the control wheel 22 degrees right, 20 degrees left, 45 degrees right and then 11 degrees left.

The airplane was banked 50 degrees right and was climbing through 2,770 ft at 0007:23, when the captain again attempted to engage the autopilot by pressing the "CMD" button on the mode control panel. However, because the flight director roll-command bars were more than one-half scale from center, the autopilot engaged in the control wheel steering mode. Thus, the autopilot did not respond to the selected flight modes; its sole input was to reduce the bank angle to 30 degrees.

The report said that the captain apparently did not understand the airplane's reaction to the engagement of the autopilot; he resumed his "confused and intense" movement of the flight controls and applied "several bursts" of right rudder.

At 0007:28, the captain said, "We are crashing." The first officer agreed: "Right, yeah, we are crashing."

The airplane was at 2,900 ft and banked 90 degrees right at 0007:31, when it entered a rapid spiral dive that was precipitated by the captain's rudder inputs. The first officer apparently recognized what needed to be done to recover but mistakenly called, "Right, captain." He then corrected himself, exclaiming, "Left, left, left … correction, left."

At this point, the pilots made conflicting control movements. The first officer tried to roll left and lower the nose while the captain held full right roll and nose-up pitch control. "The first officer's action was corrective, while the captain's action was aggravating, but the situation was already beyond redemption," the report said.

The 737 was in a 60-degree right bank and a 48-degree nose-down pitch attitude, and descending at 14,000 fpm with an airspeed of 287 kt, when it struck terrain at 0007:42. The emergency locator transmitter was damaged on impact and did not emit a usable signal; the wreckage was not found until 1730.

Among the recommendations generated by the accident investigation was that all pilots should receive formal upset recovery training.

*This article is based on the technical commission of inquiry's report, "Technical Investigation Into the Accident of the B737-800 Registration 5Y-KYA Operated by Kenya Airways That Occurred on the 5th of May 2007 in Douala." The full report is available at <www.ccaa.aero/surete-et-securite-aerienne-141>.*

### Note

1. The report also discussed the little-known phenomenon of *thermal effect*, which can cause a rudder to deflect left when the airplane encounters colder air, as during climb, or to deflect right when the air becomes warmer, as during descent. Maximum rudder deflection that can be caused by thermal effect is 0.75 degrees, the report said.

# Data Development

BY LINDA WERFELMAN


Air Methods

**A Foundation-backed project will use FOQA data to fight HEMS safety risks.**

Flight Safety Foundation and Air Methods, the world's largest air ambulance operator, have begun a two-year project designed to use flight operational quality assurance (FOQA) — sometimes known as flight data monitoring — to gather safety information on helicopter emergency medical services (HEMS) operations.

The project — financed through a grant to the Foundation from the estate of Manuel S. Maciel, founder of Manny's Sonoma Aviation, a full-service fixed base operation in Santa Rosa, California, U.S. — is designed to identify safety risks in HEMS operations and develop procedures to eliminate them.

The HEMS industry in the United States has experienced a surge in accidents in recent years, including 146 HEMS crashes between 1998 and 2008 — 50 of them fatal. In 2008 alone, there were 13 accidents, including nine fatal accidents, and 29 fatalities, according to data developed by Ira Blumen, M.D., program and medical director of the University of Chicago Aeromedical Network.[1] More recently, a published report cited 11 crashes of EMS helicopters in the United States since September 2009; those accidents resulted in 19 fatalities.[2]

In response, government and private agencies have conducted studies and issued recommendations. Flight

L-3 Communications

Quick access recorders, like the one pictured here, are being installed in Air Methods helicopters as part of a FOQA data development project.

Safety Foundation has been among them, with the release in 2009 of the *Industry Risk Profile* developed by Aerosafe Risk Management, which criticized the widely varying standards and conflicting practices throughout the industry.[3]

The risk profile was especially critical of the absence of a "publicly visible accountability structure for the industry," the variations in standards for HEMS professionals and the "lack of confidence by the stakeholders that effective health care can be effectively delivered."

The new study by the Foundation and Air Methods, along with companies in other segments of the aviation industry — including Aerobytes, Appareo Systems, L-3 Communications and the Office and Professional Employees International Union, AFL-CIO — will use FOQA to develop a better picture of the procedures being used by HEMS operators and pilots.

"We don't know exactly how these pilots are flying their approaches to the landing sites," said Robert Vandel, a retired FSF executive vice president who is now a Foundation fellow working on the study. "We can't begin to figure out how to solve this problem because we don't know exactly what's going on, considering the divergence of standard operating procedures. We need to get enough data to analyze and then assemble experts — safety personnel, pilots and manufacturers — to identify the best practices and improve what we can."

Eric Lugger, Air Methods corporate safety manager, said that plans call for the company to use 10 of its helicopters in the study, retrofitting all 10 with quick access recorders. After the recorders have been installed, a one-year data-collection period will begin, followed by a period of data analysis and writing a report on the study, he said. The goal, Lugger said, is "quality improvement in the operation of the aircraft."

Vandel said that the study should be complete in mid-2012 and that, "by then, we'll have data to build on."

The study's findings will be used to help the International Helicopter Safety Team (IHST) in developing recommendations to improve the overall safety of HEMS operations. Vandel said that the concepts developed by the IHST also will ultimately help individual HEMS operators to implement a safety management system (SMS) — typically described as a predictive mode of managing safety in which data collection and analysis enable risks to be identified and addressed before they cause an accident or serious incident.

Air Methods already has implemented an SMS, and FOQA will be a major component of that initiative, Lugger said.

The U.S. Federal Aviation Administration (FAA) estimates that there are about 840 EMS helicopters in operation nationwide. The FAA has calculated the HEMS fatal accident rate at 1.18 per 100,000 flight hours, compared with 1.13 per 100,000 flight hours for all general aviation and air taxi flights, 1.0 for turboshaft helicopters and 1.94 for all piston helicopters. However, the FAA said, "the number of HEMS accidents nearly doubled between the mid-1990s and the HEMS industry's rapid growth period from 2000 to 2004."

The U.S. National Transportation Safety Board (NTSB), which issues an annual "Most Wanted" list of transportation safety improvements, added a new category in 2008: improving the safety of EMS flights. The NTSB's specific recommendations call for stricter regulations for EMS flights conducted with medical personnel aboard; implementing flight-risk evaluation programs for EMS operations; requiring formalized dispatch and flight-following procedures, including current weather information; and installing terrain awareness and warning systems (TAWS) on EMS aircraft.

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BY WAYNE ROSENKRANS | FROM ORLANDO

# SPECIAL PURPOSES

**Dual HGS, practical stall scenarios and unreliable-airspeed rehearsals help pilots manage risk of airplane loss of control.**

Defenses against loss of control in flight (LOC-I) figured prominently in recent conference presentations to pilot training specialists from major and regional airlines. A recurrent theme was how to apply lessons learned from transport airplane accidents that happened in unremarkable flight conditions with properly functioning autoflight systems.

During the World Aviation Training Conference and Trade Show (WATS 2010), presenters from two early-adopter airlines also outlined a related rationale for equipping fleets with dual head-up guidance systems (HGS) and mentioned plans for HGS-qualified first officers to land aircraft after approaches to Category III minimums. Others at the April gathering in Orlando, Florida, U.S., called for stronger emphasis on pilot understanding of aerodynamics and the adoption of updated stall recovery guidance from Airbus and Boeing Commercial Airplanes.

Several presenters concurred that despite measurable improvements since the 1980s, the LOC-I trend of the last five years should ring alarms (Table 1, and Figure 1, p. 32). "If we are going to lower the overall accident rate, we have to address loss of control in flight because it stands alone as the largest threat," said John Cox, president and CEO of Safety Operating Systems.

## Regaining Control

Avoidance, recognition and recovery remain essential elements of the LOC-I solution, Cox said. "The first and most critical skill is avoidance — how we teach crews to not put the airplane in a state that has the potential for upset and how to recognize when it is near an upset condition," he explained. "[The industry must teach] not only the incoming, next-generation pilots but equally — or even more importantly — the cadre of pilots on the flight deck today."

A "flawed impression" may exist in the airline industry of the baseline understanding of aerodynamics among today's average pilots, he added, citing answers he heard to questions about aerodynamics that he posed informally to professional pilots from various backgrounds. "Up to a point, they understood the potential consequences of high–angle-of-attack flight," Cox said. But in his opinion, only about 10 percent of the pilots he polled in 2009 and 2010 demonstrated an adequate knowledge of aerodynamics, the limitations of LOC-I training in flight simulation training devices (FSTDs) and recent changes in the response to stall indications recommended for large commercial jets.

"One of the things the industry has taught [inappropriately in FSTDs] is 'power out' recoveries," he said. "We need to rethink this because there are parts of the flight envelope — particularly in high altitude and high drag conditions — where pilots do not have excess thrust, and the airplane will not accelerate out of a stall. There is a high drag coefficient at the critical angle-of-attack near stall, and powering out may not always be possible. 'Powering out' certainly was the way I was taught to fly Boeing 737s in 1981, so we may have been teaching the wrong recovery for a long time."

In those days of 737 training, the hardest maneuver was to set up the airplane for what he used to call a "precision stall." "Trim it carefully, let the airplane slow down, [wait for] stick shaker [to activate], add power and do not lose a foot of altitude," Cox explained. "Those were the criteria; people are still teaching that flawed approach. It's flawed because if pilots don't reduce angle-of-attack and don't accept some altitude loss to quickly get flow reattachment to the wing, they are not maximizing the aerodynamic performance and they are decreasing the likelihood of a successful outcome."

The new aspect is the commitment to accept some altitude loss as a matter of survival. "We should make sure that the pilots in flight decks today — and the incoming generation — learn this well," Cox added. "In April 2010, the U.K. Civil Aviation Authority issued a flight crew training notice in which they said 'reduce angle-of-attack; it is the primary stall recovery step.'

"In recent weeks, Airbus and Boeing have changed their stall-recovery procedures, and I commend both organizations. [The updated procedure] is to reduce angle-of-attack, lower the

**Fatal Accidents: Loss of Control in Flight vs. CFIT**
**Worldwide Commercial Jets, Selected Periods, 1988–2009**

| Period | 1988–1993 | 1991–1995 | 1992–2001 | 1993–2002 | 1994–2003 | 1997–2006 | 1998–2007 | 1999–2008 | 2000–2009 |
|---|---|---|---|---|---|---|---|---|---|
| **Percentage of all fatal accidents in period** | | | | | | | | | |
| LOC-I | 34.23 | 27.1 | 27.7 | 25.7 | 30.5 | 21.3 | 24.4 | 24.2 | 22.5 |
| CFIT | 36.8 | 28.8 | 24.1 | 22.9 | 22.9 | 22.5 | 20.0 | 18.7 | 18.0 |
| **Percentage of all fatalities in period (onboard and external if reported)** | | | | | | | | | |
| LOC-I | 25.5 | 39.2 | 34.3 | 31.5 | 39.3 | 30.4 | 36.7 | 40.1 | 35.2 |
| CFIT | 53.6 | 32.1 | 31.1 | 29.6 | 25.0 | 30.7 | 21.0 | 19.3 | 18.3 |
| **Rate of fatal accidents in period (per million departures; multiply value shown by $10^{-7}$)** | | | | | | | | | |
| LOC-I | 3.29 | 2.27 | 1.90 | 1.69 | 1.90 | 1.06 | 1.21 | 1.18 | 1.06 |
| CFIT | 3.54 | 2.41 | 1.66 | 1.51 | 1.42 | 1.12 | 0.99 | 0.91 | 0.84 |

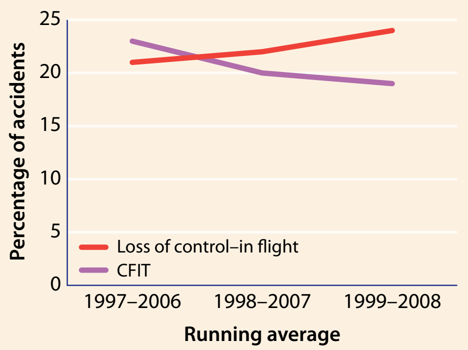
CFIT = Controlled flight into or toward terrain; LOC-I = Loss of control – in flight

Note: Periods are examples selected from 1988–2009 editions of the Boeing Commercial Airplanes *Statistical Summary of Commercial Jet Aircraft Accidents*. Editions vary in the number of years covered, accident-category definitions and onboard/external fatalities counted.

Source: Adapted from Boeing Commercial Airplanes

**Table 1**

**Fatal Accidents:**
**Loss of Control in Flight vs. CFIT**




CFIT = controlled flight into or toward terrain

**Note**: Data are percentages of total fatal accidents involving worldwide commercial jets, based on data published by Boeing Commercial Airplanes.

Source: John M. Cox

**Figure 1**

nose, level the wings and increase thrust, understanding that with engines mounted under the wing, the pilot may be adding to the [resulting] nose-up pitch. That may have to be countered, so pilots may want to be a bit judicious in how rapidly they apply thrust with very high bypass–ratio fan engines. It is a consideration. [Then the pilot should] reduce speed brakes or retract them, and return to normal flight. … There is a caveat: If the airplane manufacturer has specific [actions for known] flight characteristics, follow them first."

## Unreliable Airspeed

Early avenues of inquiry into the Air France Flight 447 accident investigation — the June 1, 2009, crash of an Airbus A330 in the Atlantic Ocean — prompted Czech Airlines to reconsider how it trains pilots to recognize and safely handle situations involving unreliable airspeed, according to Roman Hurych, a captain and chief flight instructor for the company. Recurrent line-oriented flight training (LOFT) with an unreliable speed indication began in September 2009, and ironically around the time the training was introduced, an actual event occurred.

"We reacted very quickly [to Flight 447]," he said. "We realized it could happen to anybody at any time. … We also had to admit that the last time the [typical] pilot operated the aircraft with unreliable speed was during his or her type rating course. So that was the main reason, to give all of our pilots the chance to practice again how to fly the aircraft without the speed indication and, at the same time, to fly manually at high altitude."

The airline designed the FSTD scenario so flight crews would be briefed a few days beforehand that unreliable airspeed could occur any time during the simulated flight from Prague to Moscow. Elements included the auxiliary power unit inoperative per provisions of the minimum equipment list (MEL) and assignment of a departure runway with a tail wind. "We wanted them to come to our recurrent training already prepared," Hurych said. "Our target was to show pilots the behavior of the aircraft and let them practice solving this very difficult situation. They were advised to use all airplane documentation … including an Airbus presentation on unreliable speed, which is of great value."

Early in this simulator exercise, the instructor inserts a frozen standby pitot tube condition and thunderstorms on the weather radar display. Later, in cruise flight, the instructor inserts simultaneous faults on both airspeed channels along with an air data reference–frozen fault. "If this appeared shortly before reaching the [assigned] flight level, the pilot flying still had the speed indication, but unfortunately it was wrong," Hurych said.

"Shortly after, the crew lost all the [airspeed] indications, had to start with the memory items and then had to revert to the paper checklists for unreliable speed indication. The scenario's intent was for the flight crew to bring the aircraft back to Prague. The emergency was declared, and while using the paper checklists, the crew began their descent in preparation for approach and landing."

Czech Airlines found that the advance briefing and pre-exercise preparation made all crews hyperattentive to any airspeed fluctuation as a possible anomaly, and some began troubleshooting suspected unreliable-airspeed indications caused by normal turbulence encounters during climb. "They knew what was to happen, but they didn't know when," he said. "We saw crews comparing indications that they almost never compare and monitor during normal line flying. Generally, all crews came very well prepared for the session and coped very proficiently with all [aspects] of the scenario."

The real incident in late 2009 also occurred during a flight from Prague to Moscow. During climb on autopilot, the crew noticed their altitude modes disappear, and then the autopilot disconnected. Airspeed on one side showed 170 kt while the other side showed 210 kt. "An instructor in the right seat took over the controls and continued to climb out using the initial pitch and thrust as per memory items," Hurych said. "At about thrust-reduction altitude, they were in clean configuration because they had retracted flaps before recognizing the speed discrepancy."

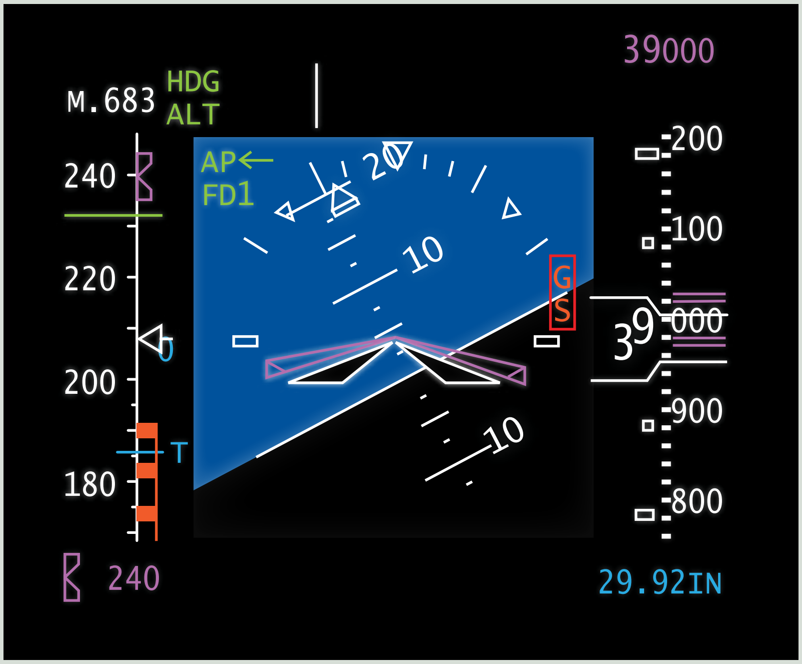
Effective crew resource management helped the crew to maintain control, compute pitch and thrust values for level off, perform actions on the paper checklist, declare an emergency, turn back to Prague and complete an uneventful landing, he said. The cause of this unreliable airspeed was still under investigation as of April. The basic procedure being taught in recurrent training, however, worked as advertised.

## Approach to Stall

In just a five-week period in 2009, three fatal airline accidents involving stalls occurred while flight crews were flying approaches to land with the autopilot engaged, said Paul Kolisch, manager, flight operations training, Mesaba Airlines. "My contention is that these pilots were not trained for these events," he said. "I don't know any pilot in the airline business, or operating sophisticated corporate airplanes, who has arrived at an inadvertent stall while hand flying the airplane. … Traditional [FSTD] stall training has shifted to an artificial choreography where the pilot stops trimming in order to keep good control of the airplane during the recovery, sits there and waits until [the stick shaker activates], then recovers. Not one of the 2009 accidents happened that way."

Mesaba has adopted what it calls "practical training for approach to stalls" from a conviction that unrealistic traditional training generates unsafe expectations of what actually will occur. "We do the training primarily in a classroom or briefing room prior to going into the simulator," Kolisch said. "When we get into the simulator, we don't do a 'stall series.' Those two words don't occur together in our syllabus. [Instead,] at some point, the pilot encounters the stall as a surprise … if at all possible. We will use any [tactic] necessary for distraction."

A U.S. Federal Aviation Administration (FAA)–industry working group that studied stall training was concerned that misconceptions about the practical implications of the agency's practical test standards could amount to negative training. "The practical test standards say that the applicant for a pilot certificate 'recovers to a reference airspeed, altitude and heading with a minimal loss of altitude,'" Kolisch said. "We do our approach-to-stalls [in airplanes] at practical high and low altitudes, including at 400 ft." Mesaba's




Source: Paul Kolisch, Mesaba Airlines; Illustration: Susan Reed

training strongly emphasizes the "recovers to a reference altitude" and de-emphasizes "minimal," which it considers difficult to define. No training injuries or fatalities have resulted despite the intentional distractions that startle pilots, he said.

Exposure to high-altitude stalls in an FSTD will lack some fidelity but reinforce awareness of the risk factors in line flying.

One concern of FAA-industry committee members was the fidelity gap between the stall characteristics of typical FSTDs and aircraft performance in stalls, he said. "I am opposed to trusting computer 'speculation' when we fly the simulators — we just don't know how the airplane would behave," Kolisch said.

"If we don't take pilots up high in these jet airplane simulators, they won't understand this [gap]. … If the first time they experience a high-altitude stall event is in an airplane, they're going to be in big trouble." Based on review of Mesaba's videos, the opinion of some airplane upset specialists was that some stall recoveries that were successful in an FSTD would have been an airplane upset in reality, he added.

### Head Up Constantly

JetBlue since 2007 has deployed dual Rockwell Collins HGS-5600 HGSs on its Embraer 190 regional jets. From the last quarter of 2009 through the first quarter of 2010, Lufthansa CityLine partnered with the company to do the same for its 190/195 fleet after more than three and a half years of preparation, said Christof Kemény, a captain with Lufthansa CityLine, in a joint presentation with Mark Maskiell, a captain with JetBlue. The systems are now used routinely by all pilots in all weather conditions, and safety enhancement remains high on their lists of objectives, they said.

Lufthansa had analyzed advantages and disadvantages of HGS compared with autoland systems and envisioned how HGS could be used in the context of air traffic management transformations imminent in Europe, the United States and elsewhere.

Kemény cited findings of the most recent Flight Safety Foundation study of safety benefits from HGS technology (*ASW,* 5/10, p. 38) as a reinforcement of Lufthansa CityLine's conclusions that the technology could deliver significant safety advantages. Analysis of company Bombardier CRJ landings with crews using HGS also demonstrated unprecedented, consistent touchdown-zone accuracy compared with landings by crews flying non-equipped CRJs.

"By its design and certification, autoland is not capable of any advantage for required navigation performance approaches or nonprecision approaches, whereas a head-up display [HUD] can be used from taxi before takeoff until after landing," he said.

Among HGS capabilities most relevant to safety are the speed error tape, graphically depicting the offset between the selected speed and aircraft speed; an acceleration carat that transforms to an energy symbol; and tail-strike advisory information. "Every time the pilots look out of the [forward windshield through the combiner (i.e., the HUD screen)], they see the energy status for precise energy management of the aircraft with the flight path," Kemény said. "After landing, we have the same capability as an instantaneous indication of the aircraft brake performance. This is an immediate decision-making tool; after the touchdown, the pilots have the picture of deceleration values."

If unsafe deceleration on a contaminated runway or brake problems occur, the flight crew sees the remaining runway and the point at which the aircraft will stop — rather than relying on imprecise sensations that something is going wrong after landing, he added.

During HGS training, Lufthansa CityLine had to encourage pilots "to be patient with themselves" as they advanced through four levels of proficiency (Table 2), learning the new skills and presentation of the world outside the aircraft. About six months typically elapse from the first day in an HGS FSTD to line flying at level 4, in which the pilot is fully "proficient using HUD as another flight deck tool," he said.

The decision to replace autoland with dual HGS worked out as expected, Kemény said. "Analysis of results showed that we have increased situational awareness for both pilots," he explained. "The conformal flight path vector of the HUD is comparable to what pilots would see head down, and we have real-time aircraft energy monitoring and improved assessment of deviations. … After six months of operating, the data are proving that with the Embraer 190, we see much less deviation on the glideslope and localizer, and in speeds during the final portion of the approach. This means increased landing accuracy. There is good reason to believe that we also have a reduced risk of hard landings and tail strikes. The visual indication of our brake performance after landing is something no other system provides while looking out of the window."

**"We see much less deviation on the glideslope and localizer, and in speeds during the final portion of the approach."**

The present and future role of HGS as an aid in unusual attitude recovery has been especially gratifying, Kemény said. "We have intuitive guidance during abnormal situations such as unusual attitude recoveries, engine failures and traffic-alert and collision avoidance system resolution advisories." For further enhancement of aid to unusual attitude recovery, the platform can be configured to display g-loads in the combiner, he said.

At the beginning of 2011, Lufthansa CityLine will qualify all first officers to conduct Category III approaches. Steep approaches using HGS in the 190 already have been approved by European authorities along with constant descents on all nonprecision approaches, he added.

JetBlue's Maskiell said that as of April 2010, 40 of the airline's 190s have dual HGS. Acquiring the capability — and the requisite FSTDs — was on the agenda from the company's founding. On the training side, all of the company's FSTDs have dual HGS. "More than a handful of pilots have shared with me that maybe the most challenging event they'd had was conducting a flight without dual HGS when the system was [inoperative per provisions of] the MEL for some reason. … They become very reliant on that device — not to the point of being unsafe [without it] but definitely to the point of knowing that there is a difference. … In four years, there has not been a single [HGS-induced] safety event noted."

## Human Factors

LOC-I also has been linked with concerns about how best to instill safety attitudes and a positive culture of professionalism from one generation of pilots to the next, said Cor Blokzijl, director flight operations, Mandala Airlines. Unease about pilot professionalism (*ASW,* 6/10, p. 24) has been increasing in some parts of the world — especially the perception that within today's generation of pilots new to their airline careers, some lack self-motivation or are too distracted by other pursuits to study beyond minimum requirements or to read aviation safety media. "This affects their in-flight situation recognition," Blokzijl said.

Preparation to manage automation and LOC-I risks also requires a distinction between recitation of rote facts about airplane systems — knowing only the standard operating procedures and the flight crew operating manual (FCOM) — and genuinely understanding systems.

"Nowadays, understanding systems is of much more value than knowing information by heart," Blokzijl said. "I have pilots in my airline who can recite the Airbus FCOM backwards and forwards without a mistake … but they are unable to transfer that knowledge into practical [application] in the aircraft. If we can make them understand why things are happening and the influence of certain failures in the system on the rest [of the system], a 'light goes on' and the pilots are able to do what's required."

Continual transfer of expertise to less experienced pilots ought to bridge the gap between practicing narrowly focused tasks during recurrent training in FSTDs and truly enhancing cognitive skills. Understanding of systems, system interfaces and dynamics of system failure — "if this is failing, what else?" — have become a key factor today in successful threat management, he added.

*To read an enhanced version of this story, go to <flightsafety.org/asw/aug2010/pilot_training.html>.*

**Four HGS Proficiency Levels in Pilot Training**

| | |
|---|---|
| **Level 1** | **Initial introduction** |
| | Tunneling, fixation and adaptation can be reduced using an FTD |
| **Level 2** | **Secondary awareness** |
| | Prioritizing the information acquisition (FFS phase) |
| **Level 3** | **A world beyond the combiner** |
| | Integration of HGS into conformal world and combining other cockpit information |
| **Level 4** | **The HUD as another flight deck tool and the HGS as the primary flight display reference** |
| | Final stage of proficiency; symbology becomes second nature |
| | Pilot becomes more aware of air mass effect and performance of aircraft |

HGS = head-up guidance system; FTD = flight training device;
FFS = full flight simulator; HUD = head-up display

Source: Christof Kemény, Lufthansa CityLine

Table 2

# mystery illness

BY LINDA WERFELMAN

© Alex Beltyukov/Airliners.net

**Investigators can't determine why five crewmembers and a number of passengers on an A319 became ill.**

The Irish Air Accident Investigation Unit (AAIU) says its investigators were unable to pinpoint the cause of a May 2008 incident in which five crewmembers and an undetermined number of passengers on an Airbus A319-132 became ill, with symptoms ranging from drowsiness to a loss of sensation in their limbs.

In its final report on the incident, the AAIU ruled out one hypothetical cause after another, saying there was no evidence of air contamination, poor air quality or inadequate air supply in the cabin or on the flight deck. There also was no indication of depressurization.

The incident occurred around 1245 local time on May 27, 2008, about 12 minutes after departure from Dublin for a flight to Cologne, Germany.[1] Six crewmembers and 119 passengers were aboard.

The first indication of a problem occurred as the airplane climbed through 10,000 ft, the report said.

"The purser called the cockpit on the intercom and reported that something was wrong — that almost all the passengers had fallen asleep and that the [cabin crewmember] near her appeared unresponsive," the report added. She later told investigators that it was unusual for so many passengers to be sleeping so early in the flight.

As the flight crew discussed the purser's comments, the captain said that he felt "somewhat unwell." The report said that later, he "recalled a tingling sensation in his right arm, comparable with the arm 'falling asleep.'"

The flight crew at first suspected a pressurization problem, but the electronic centralized aircraft monitor (ECAM) showed no warnings or failures and the cabin altitude indication was 1,700 ft. Nevertheless, the flight crew donned oxygen masks, declared an emergency and began a descent, telling air traffic control (ATC) that they wanted to return to Dublin. They declared an emergency with Dublin ATC at 1243, and the captain directed the cabin crew to use portable oxygen cylinders. The airplane was landed in Dublin at 1257.

After the flight crew donned oxygen masks, the captain's symptoms disappeared.

Airport emergency personnel met the airplane, the Irish national police were notified, and "a decision was made to hold the aircraft at a remote ramp position," the report said. After about one hour, the A319 was towed to a terminal stand (gate), and at 1308, AAIU investigators arrived at the scene.

Police and airport authorities talked with the crew and agreed to allow the passengers to leave the airplane. After disembarking, everyone who had been in the airplane was offered medical attention, but no one accepted the offer, the report said.

At the time of the incident, there was no medical practitioner at the airport, and the only medical services available were from first-response medical personnel, the report said.

## Crew Interviews

Investigators interviewed crewmembers, including the purser, who said that she had begun to feel "unwell" after takeoff.


© Chris Sorensen Photography

The three other cabin crewmembers said that after takeoff, they felt tired. One said that he might have been "unable to perform his cabin service task," another complained of dizziness, and the third — who had only three weeks of experience on the job — said she was tired and "somewhat unwell," the report said. The report did not discuss the first officer's condition.

Investigators also talked with passengers seated in different parts of the cabin and found that some passengers, most of whom were described as "at the older end of the age spectrum," felt drowsy. Others said that they "had not noticed anything unusual or any feeling of drowsiness or lack of well-being," the report said. "Many said their first indication of anything unusual was when they noticed that the aircraft was descending."

The cockpit voice recorder (CVR) recorded the entire event, as well as part of the previous flight, and showed that the flight deck environment during both flights was "very relaxed and jovial before the purser expressed her concerns" — so jovial, in fact, that investigators initially were concerned that the pilots might have been "affected by a contaminated atmosphere." After the flight crew declared the emergency, however, they were "focused completely on the task in hand," the report said.

## Inconclusive Tests

A series of tests failed to determine the cause of the event.

An air composition check in the flight deck, cabin and baggage hold found no unusual levels of methane, hydrogen sulfide, carbon monoxide or oxygen.

Examination of baggage in the baggage hold revealed nothing suspicious, nor did a thorough examination of the cabin.

The next day, after the airplane was moved to a maintenance facility, a series of tests were conducted to determine whether oil from the engines or the auxiliary power unit (APU) had gotten into the cabin air supply. The tests involved running the engines, the APU and other equipment, and taking swabs from several locations on the airplane, especially near air outlets. No evidence was found to indicate any problem with oil contamination.

"At one point during these tests, two members of the inspecting team, which numbered up to 15 people, reported a strong smell in the cabin," the report said. "However, the other members of the team reported nothing unusual."

**The report said the most toxic substance found in the analysis was nicotine, also in very low concentrations.**

The tests were repeated with special test equipment, and again, no problems were found.

"After three days of testing, it was decided, in consultation with the operator and the aircraft manufacturer, that the aircraft be flown to the manufacturer's facility at Toulouse [France] for further tests," the report said. "The flight to Toulouse was flown, unpressurized, at 10,000 ft, operated by two pilots from the operator and an AAIU inspector in the jump seat. The handling pilot remained on portable oxygen for the entire flight. Toward the end of the flight, the pilot monitoring started to feel slightly unwell and went on oxygen briefly. His feeling of being unwell disappeared. …. The AAIU inspector, who was not on oxygen, reported no ill effects."

Six days of tests at Toulouse revealed no anomalies and found only traces of toluene, ethylbenzene and styrene that typically are found in aircraft exhaust, and traces of volatile organic compounds — all well below the exposure limits. The report said the most toxic substance found in the analysis was nicotine, also in very low concentrations. In addition, a laboratory analysis of the cabin air failed to find any trace of the oil used in the engines and the APU.

Authorities agreed to return the aircraft to service. In the ensuing months, there was no recurrence of the problem, the report said.

## 'An Ongoing Issue'

The continuing investigation determined that passenger baggage was the only cargo on the aircraft and that, "in particular, dry ice (a solid form of carbon dioxide) was not carried on the aircraft," the report said.

All six crewmembers had started their duty day between 0315 and 0345, and all had worked the previous day until between 1300 and 1700. Fatigue-monitoring software used by the operator showed that the flight crew had no "exposure to excessive fatigue" during the month before the incident; two cabin crewmembers had "slightly elevated fatigue exposure" for one day about two weeks earlier.

The AAIU said that poor cabin air quality "has been an ongoing issue in commercial air transport operations. A number of recurring faults and defects have [been] found to be the cause in many cases."

Air quality typically has not been a problem in A319s or related airplanes, however, the report said.

In this case, investigators ruled out the "faults and defects" that have typically been cited in the past. There was no evidence of a leak in the engine or APU oil seals, a gaseous discharge from the air conditioning system or from a fire extinguisher, or smoldering electrical wires, the report said. The galley ovens were not being used, and the aircraft did not undergo preflight maintenance or heavy cleaning. In addition, no problems were reported on the previous flight.

"During the exhaustive and prolonged tests undergone by this aircraft, no re-occurrence of the problem was found," the report said. "Furthermore, the aircraft has subsequently returned to service for an extended period, and no re-occurrence of the problem has been reported during this time.

"The investigation noted that, in the months that followed this event, three further cabin air quality events, relating to fumes in the cabin, cabin crew reporting feeling unwell, unusual smells, etc., were reported to the AAIU. In each case, different operators and aircraft types built by different manufacturers were involved. In none of these cases was a definite source of the problem identified."

## Possible Contaminants

The report said that, in most cases, poor cabin air quality results from contamination associated either with solid or liquid particles such as oil and fuel, which produce gaseous byproducts with residues that can be detected, or with highly volatile substances that are dispersed through an airplane's air conditioning system and outflow valve and leave little, if any, residue.

"In the environment of a modern passenger aircraft, the list of potential cabin air contaminants is large … [and] the task of detecting possible contaminants is daunting," the report said. "Volatile organic compounds (VOCs) are [particularly] challenging contaminants from the point of view of detection. These compounds evaporate and are pumped overboard by the aircraft's air conditioning system and so disappear, without leaving a trace, in a relatively short period of time. The investigation of this event demonstrated the difficulties of finding evidence of contamination after a reported event, in spite of significant resources available to, and utilized by, the investigation."

The report praised the purser for being "positive and proactive" in promptly notifying the flight crew of the conditions she had observed in the cabin, enabling their quick response.

On the ground, however, the delay in deciding how to handle the situation prolonged the time spent by the passengers and crew in the airplane — and prolonged their exposure to the potentially contaminated air supply, the report said.

The report added that investigators could not explain what caused the problem or "why only some of the passengers complained of any symptoms and [why] the symptoms of the affected passengers were limited to drowsiness (i.e., no passengers reported feeling unwell). The fact that those who reported the symptoms recovered rapidly after landing would indicate the absence of any toxic contaminant. The failure to detect any abnormal residues within the aircraft after the event would also suggest the absence of toxic contaminants."

## Recommendations

The AAIU recommended that the Irish Aviation Authority (IAA) review its licensing requirements for the country's major airports to ensure that they comply with International Civil Aviation Organization (ICAO) guidelines, specifically with guidelines calling for major airports to maintain adequate medical services.

The IAA *Manual of Aerodrome Licensing* says that airports should be equipped with medical supplies appropriate to the size of the airport, but it does not require that they be staffed with medical personnel.

ICAO says, however, that a medical clinic should be established at any airport with at least 1,000 employees. ICAO also calls for airports to be staffed during their busiest hours with "at least one person trained to deal with … basic measures for treatment and protection of spills or leaks of radioactive materials, toxic or poisonous substances." The AAIU report said that this event "could have been dealt with more effectively if such expertise was available at the scene."

The AAIU also recommended that the Dublin Airport Authority review the medical services that it provides at the airport, as well as the "response procedures to ensure that passengers and crew are not unduly detained in a potentially toxic environment following cabin air quality events."

*This article is based on AAIU accident report 2010-008, published July 15, 2010.*

### Note

1. The accident report did not name the operator but identified the airplane by using its registration number, which is that of an A319 operated by Germanwings, a low-cost carrier based in Cologne/Bonn, Germany.

Amid negotiations for the reunification of Cyprus, risks of pilot confusion persist in the Nicosia FIR.

# Uncivil Aviation

BY WAYNE ROSENKRANS

Members of airline pilot unions worldwide have received the third safety bulletin since 2001 spotlighting the protracted political dispute that has created uncoordinated and potentially conflicting air traffic services (ATS) in part of the Nicosia Flight Information Region (FIR).[1] The airspace of concern extends northward to Turkey from the Turkish Cypriot–governed northern part of Cyprus, an island nation in the eastern Mediterranean Sea (Figure 1).

The bulletin from the International Federation of Air Line Pilots' Associations (IFALPA) reminds flight crews about unique operational risks in this part of the Nicosia FIR, especially the potential for confusion about which ATS area control center (ACC) has authority. IFALPA urged pilots to be aware of consensus recommendations from global aviation organizations on how to handle communications. The recommendations address the fundamental issue of controllers from the Greek Cypriot ACC and the Turkish Cypriot ACC providing instructions to aircraft crews although these ACCs do not communicate directly with each other.

The International Civil Aviation Organization (ICAO) recognizes only the Republic of Cyprus, the southern part of the island governed by Greek Cypriots, and its Nicosia ACC as responsible for ATS in the Nicosia FIR. The Turkish Cypriot community, however, since 1977 also has asserted authority over its air transportation system and ATS, which primarily has evolved into flights on ATS Route A-28 between Ercan International Airport and Turkey.

This airport is located east of Nicosia in the part of the island that Turkish Cypriots and Turkey call the Turkish Republic of Northern Cyprus (TRNC), a political entity unrecognized by the United Nations (U.N.) that was established in 1983 after the 1974 occupation of about 36 percent of the island by Turkish military forces. The U.N. Peacekeeping Force in Cyprus controls a military buffer zone, called the Green Line, between the two parts of the island, and the U.N. Good Offices Mission to Cyprus assists in negotiations now under way for reunification of the island.

A June safety briefing to IFALPA's Air Traffic Services Committee by a representative of the Nicosia ACC prompted IFALPA's bulletin. The representative discussed 2006–2009 ATS events in the area of concern and their significance (Table 1, p. 42), said Carlos Limon, president of IFALPA and captain for Mexicana Airlines. The events were categorized as pilot deviations from Nicosia ACC controller clearances, unauthorized penetrations of Nicosia FIR airspace — meaning entry of an aircraft without traffic coordination at least 10 minutes in advance — and deviations from the published air traffic management procedures, he said.

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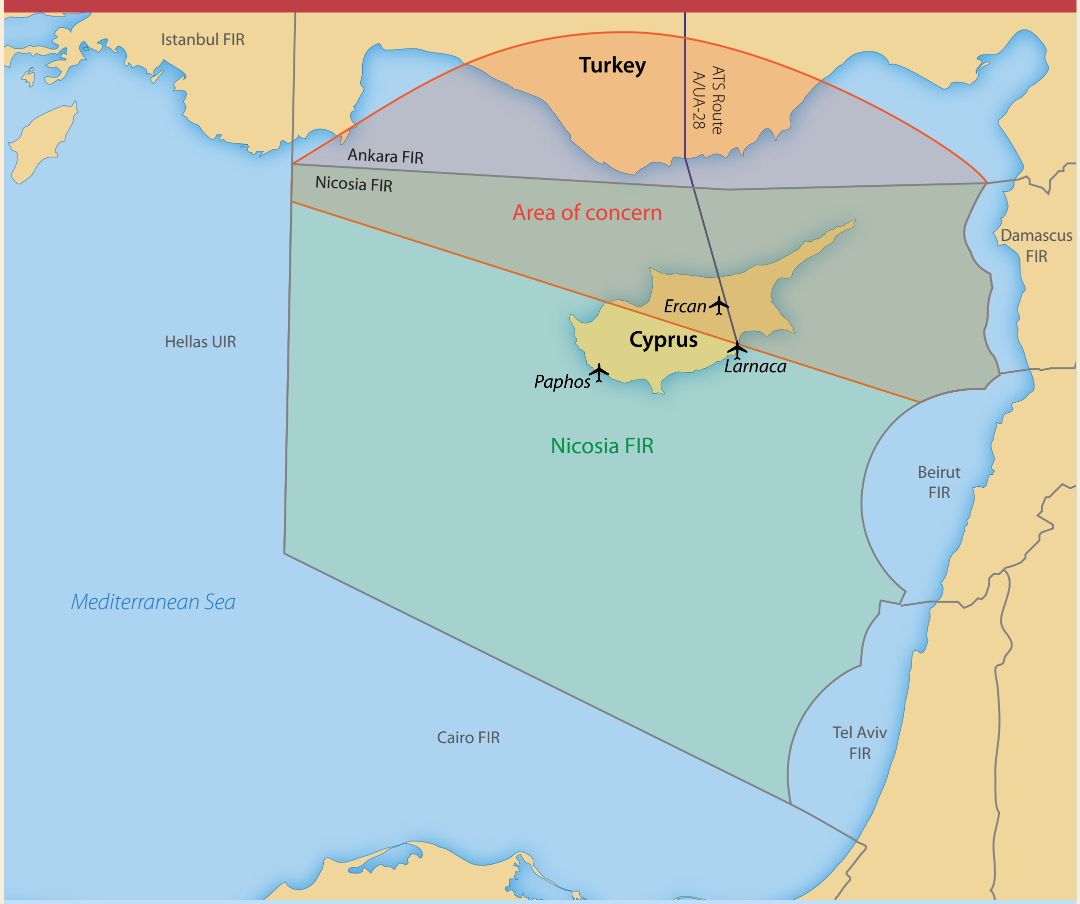
"The issues between the northern part of the Nicosia FIR and parts of the Ankara FIR have been known to us for a long time," Limon said. "IFALPA classifies that particular part of the airspace as 'critically deficient' in particular because of the problems with Ercan, which is not recognized by ICAO. The ATS communication issues — such as who designates levels, etc. — can become quite complicated, particularly to flight crews that have not operated before in that airspace. Sometimes in the past, IFALPA had received safety reports, but to be fair, IFALPA has not directly received reports concerning this particular airspace for a couple of years."

The intent of the bulletin was to highlight that the problem continues, and to remind flight crews of IFALPA's recommendations, he said. They are a brief subset of comprehensive measures endorsed by the United Nations and

**ATC Deviation Issues in Nicosia FIR**




ATS = air traffic service; FIR = flight information region; UIR = upper information region

**Note**: The Ercan International Airport, Ercan Terminal Control Area and Ercan Advisory Area are not officially recognized by the Republic of Cyprus, which has responsibility for all Nicosia FIR airspace by decision of the International Civil Aviation Organization.

Source: Department of Civil Aviation of the Republic of Cyprus and Flight Safety Foundation

**Figure 1**

published as Jeppesen Briefing Bulletin FRA 99-A, "Nicosia FIR/UIR IATA Communications/Control Procedures (extract from *IATA Information Bulletin*)."

Finding an ATS solution acceptable to all concerned has been "incredibly difficult" despite technical initiatives and negotiations facilitated by ICAO and European organizations, Limon added. "The problem appears to be political, and it needs to be resolved because clearly there are flight safety issues.

**Nicosia ACC Reports of Failures to Coordinate Flight Plans and Deviations From ATC Instructions**

| Type | Year 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|
| Deviations from published ATM procedures | 396 | 443 | 497 | 458 |
| Deviations from ATC clearance | 55 | 32 | 49 | 100 |
| Unauthorized penetration of airspace (Nicosia FIR) | 373 | 429 | 450 | 390 |

ACC = area control center; ATM = air traffic management; ATC = air traffic control; FIR = flight information region

**Note**: Data were furnished in June 2010 to IFALPA by the Department of Civil Aviation, Ministry of Communications and Works, Republic of Cyprus.

Source: International Federation of Air Line Pilots' Associations (IFALPA)

**Table 1**

"We're just trying to make sure that people who have to operate in this airspace can operate safely. We certainly would not want to appear to judge the issue, we just want it resolved."

## FSF Perspectives

The consensus guidance from IFALPA and other aviation organizations advises flight crews to comply with ICAO expectations by monitoring but politely disregarding communication from Ercan ACC controllers, said William Voss, president and CEO of Flight Safety Foundation. Flight crews that operate to and from Ercan International Airport and Ercan Terminal Control Area (TMA) do so outside of the ATS system recognized by ICAO.

"ICAO has said that Nicosia FIR is the only legitimate FIR for Cypriot airspace," Voss said. "The United Nations only recognizes Northern Cyprus as an occupied territory — not as a sovereign state — so Ercan TMA and Ercan Advisory Airspace do not exist officially. Nevertheless, aircraft crews are being switched from Ankara ACC to Ercan ACC on a routine basis. That is causing quite a bit of confusion, as indicated by the reports we have seen. This is one of the last of a handful of disputed pieces of airspace left in the world, but Nicosia FIR sees quite a bit of traffic out of Beirut and Damascus, and major Middle East air carriers have to transit this airspace."

The existence of contested airspace itself creates problems incompatible with regional harmonization of ATS risk reduction efforts. Eurocontrol's Single European Sky ATM Research (SESAR) project and the advent of ATS safety management systems hopefully will encourage resolution, Voss said. "There's just no way for alternative ATS and airspace, which circumvent what ICAO has allocated, to align with the SESAR goals," he said.

European organizations have tried unsuccessfully so far to develop a technical workaround that would reduce risk on an interim basis given the practical realities. "With the type of telecommunications technology available, there are means available to mitigate the risk in Nicosia FIR without upsetting the underlying political issue — if the politicians are willing to yield and allow safety to become a priority," Voss said. "For example, a solution that would make a lot of sense would be to simply make sure that all the controllers have all the aircraft on their displays."

A past obstacle to this workaround was lack of an official ICAO airport identifier code for Ercan International Airport, impeding the exchange of flight plan data via the networks used in air navigation planning throughout the world. "To directly connect Ercan to another location, ICAO would have had to assign this identifier, which basically would have legitimized the existence of an unrecognized facility," he added.

Other proposals would have set up sharing of flight plan data through third parties, Voss said. "This might not be possible directly between Ercan and the rest of the world, but via Ankara

ACC so that the exchange would stay within the Turkish government," he said. "Data simultaneously would be retrievable by authorized third parties. A datalink between Ercan ACC and Ankara ACC would enable sharing data with Eurocontrol — something Ankara does today with its own data — then Eurocontrol could give real-time access to Nicosia ACC and so on.

"By routing the communications that way, there would be no need for ICAO or any other party to formally recognize the disputed airport. That's still two sets of controllers working the same airspace, but at least they would see each other's traffic in addition to monitoring the communications."

## Northern Cyprus Perspective

Hasan Topaloglu, director of the Civil Aviation Department of the TRNC, told *AeroSafety World* that Turkish Cypriots decided to operate Ercan International Airport and the associated ATS infrastructure to counteract a historic policy of isolating them. "Perhaps one of the most important restrictions [by the Greek Cypriot side] was one against freedom of travel, preventing direct flights to and from the Turkish Cypriot side with the [sole] exception of [flights to and from] the Republic of Turkey," he said. "The Ercan ACC and Ercan International Airport, established as a necessity due to the rejection of [requests to] the Greek Cypriots to provide service to the north of the Green Line, have been in service for over 30 years and are technologically up-to-date and effective to ensure flight safety."

Having made that fundamental policy decision, domestic law of Northern Cyprus was amended to obligate the Civil Aviation Department to implement ICAO standards and recommended practices to accomplish "safe, regular and swift navigation of the aircraft landing to or taking off from the Turkish Cypriot airports as well as using TRNC airspace," he said. The position taken is that the legal basis for exercising air traffic control of such flights on ATS Route A-28 is an agreement between the Civil Aviation Department of Northern Cyprus and the Directorate General of Civil Aviation of Turkey, he said. This agreement specifies that for safety purposes, Northern Cyprus controllers have responsibility for air traffic within the southern part of the Ankara [FIR] and on ATS Route A-28, he added.

"Implementation of our Systematic Modernization of Air Traffic Management Project in 2008 enabled us to integrate [two new radar surveillance sensors in Northern Cyprus] with all the radar systems of Ankara ACC, which increased security and safety, and enabled the Ankara ACC to extend assistance where we deem necessary," Topaloglu said. "We have also increased the number of our controllers, and we are constantly working in close cooperation with the Ankara ACC in order to ensure the safe conduct of all flights in the region. We also monitor the Nicosia ACC controllers' contacts to make sure safety rules are applied properly." Total investment in Ercan ACC, control tower buildings and radar sensor replacement was approximately $25.4 million, he said.

"Approximately 600 aircraft per day pass through the Ercan Advisory Airspace," he said. "In 2009, 1.8 million passengers used Ercan International Airport. Our prediction is that the traffic will continue to increase, and these figures will be multiplied by two or three in the next decade."

From the perspective of Ercan controllers, "Nicosia ACC causes problems by contacting flight crews and telling them to ignore Ercan Advisory Area's guidance, which is very important for the safety of the flights," he said. "Under these circumstances, the refusal of the Nicosia ACC to cooperate with the Ercan ACC hinders our efforts to increase flight safety in this area and discourages some flights, which take a detour."

Examples of issues that Greek Cypriot and Turkish Cypriot aviation safety professionals might be able to address cooperatively include sharing of ATS safety event data and recordings of related pilot-controller communication; lack of coordination when Nicosia ACC routes aircraft off published airways; and differences in how Nicosia ACC controllers and Ercan ACC controllers handle aircraft departing to the south from Antalya, Turkey, in the Ankara FIR under their respective agreements with Ankara ACC, he said.

"These problems can only be solved with good will," Topaloglu said. "As Turkish Cypriots, we have underlined on many occasions that this is a technical matter, not a political matter, that requires close cooperation of both sides on the island. Since the negotiations for a comprehensive settlement are being conducted under the auspices of the United Nations, we believe that the technical expertise of ICAO, as an expert agency of the United Nations, could facilitate the establishment of such [cooperation] on the island. … The Turkish Cypriot side is ready to find mutually acceptable technical and operational arrangements, without prejudice to the political and legal positions of the parties."

## Note

1. IFALPA. "ATC Deviation Issues in the Nicosia FIR." *Air Traffic Services Briefing Leaflet* no. 11ATSBL01, August 2010.

BY PAUL ESCHENFELDER AND RUSS DEFUSCO

# Bird Strike Mitigation *beyond the airport*

**Pilots must be prepared for bird strike avoidance and damage control.**

Damage to left-engine fan blades of a Boeing 767-432-ER following the ingestion of gulls after takeoff at Rome Fiumicino Airport, July 2007.

Agenzia Nazionale per la Sicurezza del Volo (ANSV)

Between November 2007 and January 2009, U.S. civil aviation experienced four major accidents caused by bird strikes. The accidents demonstrated the range of aircraft categories and types affected by this threat, and served as a reminder that the entire aviation community is challenged. A Piper Seneca, a transport helicopter, a Cessna Citation business jet and an Airbus A320 were all destroyed, and 17 people died.[1–4]

Three months prior to the US Airways A320 bird strike accident, a similar accident occurred at Rome Ciampino Airport. A Ryanair Boeing 737-800 encountered a large flock of starlings during its approach. The flight crew attempted a go-around, but birds were ingested into both engines, and both lost thrust. The crew landed the aircraft on the runway, but the left main landing gear collapsed. Although no one was killed, there were 10 injuries and the airplane was damaged beyond repair.

Before the Ryanair accident, an A320 operated by Balkan Holidays encountered a flock of gulls while departing the seaside resort of Bourgas, Bulgaria. Both engines were damaged by bird ingestion and lost thrust. The crew had pre-briefed an immediate return plan and successfully executed their plan. The airplane was landed safely, but a total of 32 fan blades on both engines had to be changed.

Turboprops are likewise at risk, but for different reasons. Propellers with composite material tend to shatter when struck. A de Havilland DHC-8, on landing at Toronto City Airport, struck geese just at touchdown. Both propellers lost large chunks of the blades and vibrated so severely that the crew had to shut down the engines on the runway. The airport management had been tolerating the geese on the field until this incident.

While general aviation airplanes typically do not have the same engine ingestion concern as transport category jets, their overall design and certification make them much less able to resist damage from bird strikes. Mid-size to large birds can penetrate the windshields and can cause pilot incapacitation or disorientation, resulting in loss of control. The drag caused by the loss of the windshield has also resulted in accidents because enough thrust is not always available to overcome the huge drag increase. Likewise, collision-caused deformation of wing or tail surfaces can increase stall speed considerably and affect handling qualities, especially at slower speeds.

Other aspects of the problem have received concentrated attention and reduced hazards on airports. While not always properly implemented, well-developed and documented standards exist for airport habitat management, means for deterring wildlife from entering airfields, active dispersal of birds and other wildlife, and even lethal methods when population control must be employed.

Such efforts must continue and be constantly monitored, but these strategies will not solve the problems of off-airport hazards, communication failures, inadequate pilot training and procedures, or lack of operational guidelines by aircraft owners and regulators that led to the primary causes of the accidents cited.

What is missing is a comprehensive, integrated plan that involves all parties: airports, aircraft operators, air traffic controllers, aircraft and engine manufacturers, regulators and others.

What would an effective bird strike mitigation policy look like? In the US Airways accident, the New York area airports were well known for the large bird populations affecting

them. La Guardia Airport has had a problem with resident Canada geese for some time. John F. Kennedy International Airport is located across the fence line from a U.S. government wildlife refuge with a very large gull colony, protected by federal law.

The U.S. Air Force Bird Avoidance Model (BAM) had shown the risk of high bird concentrations in the New York area during the A320 accident period.[5] The presence of large numbers of birds in the area should have been cause for action by aircraft operators, but was not.

No aviation hazard today is successfully mitigated without effective policy guidance for the flight crews and adherence to that policy.

In the Ryanair 737 accident, the crew response was incorrect in our view. In many low-altitude scenarios, the commonly used response is to increase thrust and climb to avoid the hazard. But the problem with this technique in connection with bird encounters is that it increases the kinetic energy of impact, which equals one-half of the mass times velocity squared. In this case, velocity is determined by engine rotation. By selecting maximum allowed thrust, the crew placed the engine at risk of a high-energy collision, almost guaranteeing damage.

A better technique based on current guidelines for confronting large flocks of birds close to the airport is to fly *through* the flock at low engine rotation speed, allowing the engine to bypass the bird remains around the engine core without cascading damage to the compressor blades.[6,7]

But the crew had no training on the current technique. Nor is training required by any regulator. Nor is any training available.

In another serious event in 2007 in Rome, a Delta Air Lines 767-400 was taxiing for departure. The crew observed a large number of gulls on the runway and in their departure path. The crew discussed the situation but did not report the gulls, ask for bird dispersal prior to takeoff or delay takeoff waiting for the birds to move. Instead, they took off into the birds and ingested gulls into both engines, the impact causing serious vibrations and significant loss of thrust in both engines. The aircraft was returned safely, but both engines were damaged beyond repair.

Fast forward to February 2010 and another Delta flight conducting a departure from Tampa, Florida, U.S. Warned that large birds were in their departure path by the airport traffic controller and by the crew of the Airbus that preceded them, the Delta crew took off, and bird strikes damaged their aircraft. Delta Air Lines reportedly had no policy for its crews to mitigate this hazard.

Hazard avoidance is superior to application of emergency procedures. Avoidance can take a number of forms, many of them simple and cost-free. If birds are in the takeoff path, the pilot should notify the airport operator and delay departure until the birds move or are scared away. Another alternative is to depart via another runway that is free of hazard. Likewise, for landing, flight crews should use a different runway if birds are reported on the landing runway. Or go around and wait for the birds to leave.

## Bird Dispersal Goes Digital

Airport bird dispersal is becoming, if not an exact science, at least an organized and highly sophisticated one.

One example of a high-tech tool is the Ultima, a tablet touch-screen personal computer offered by Scarecrow Bio-Acoustic Systems of Uckfield, East Sussex, England. Combined with an airfield vehicle–mounted processor and loudspeakers, the system emits recorded distress calls of as many as 20 species to drive birds away, while logging all actions and GPS locations in real time. The system creates a database featuring date, time, location, system operator, species, flock size and dispersal direction, all of which can be used for data analysis and to store records for program documentation and auditing.

The Ultima includes a report-generation function that allows sorting by combined factors such as dates, species, location and operator name. Printouts are available in spreadsheet or graphical formats.

Ultima has been installed at airports in Pittsburgh; London Luton; Belfast, Northern Ireland; Cancun, Mexico; and Christchurch, New Zealand. The company reports that it has sold more than 70 units since the product's introduction in 2008.

— Rick Darby


Bundesstelle für Flugunfalluntersuchung (BFU)

**An Air Berlin Boeing 737-700 windshield after encountering a flock of white-fronted geese at about 2,150 ft and 226 kt indicated airspeed.**

Another important area where study and action are needed is the lack of adequate aircraft design specifications. This problem is complex, because many interrelated systems are involved: aircraft design and operation, engine design and operation, airport mitigation, bird population control, airport habitat, training, warning systems, policy, etc. It is complicated, because there is no one answer but, as with all aviation hazards, an interdisciplinary approach is required.

The majority of bird strikes occur below 3,000 ft. If departing from an airport in a high-bird-threat environment, jets should use International Civil Aviation Organization Noise Abatement Procedure 1.[8] This rapid climb to above 3,000 ft above ground level would, in all likelihood, have prevented the US Airways accident. General aviation aircraft should depart at best angle-of-climb speed. Those techniques enable the aircraft to clear the hazard zone below 3,000 ft faster and climb at a lower speed, which can lessen the severity of impact. When landing in an area of high bird activity, the aircraft should remain at 3,000 ft or above if possible until necessary to descend for landing.

If birds are encountered en route, on climb or descent, the flight crew should pull up — consistent with good piloting technique — to pass *over* the birds. If birds see the aircraft, they will treat it as an obstacle, but may misjudge the closing speed because the threat is usually beyond their experience. Birds may turn or dive as avoidance maneuvers, but they rarely climb. So pulling up is the best and fastest avoidance maneuver.

If the aircraft is capable of high-speed flight at low altitude … don't do it. The kinetic energy formula applies to airframes and windows. While modern heated windows should resist a gull or duck, larger birds may penetrate them or shower the pilots with glass as the inner pane of the window spalls or shatters. Likewise, the small bird that bounces off like a tennis ball when struck at slower speed suddenly becomes a bowling ball when struck at high speed. Below 10,000 ft, limit aircraft speed to 250 kt indicated airspeed or less.

Aviation operations successfully mitigate a variety of hazards every day. The industry has built strong defenses against them. We can do the same with the birds.

*Capt. Paul Eschenfelder is the lead instructor for Embry-Riddle Aeronautical University's Airport Wildlife Training Seminar, the only such course approved by the FAA for full compliance with FAA training guidelines.*

*Dr. Russ DeFusco is a former associate professor of biology at the U.S. Air Force Academy and formerly chief of the USAF Bird Aircraft Strike Hazard Team.*

## Notes

1. In October 2007, a Piper Seneca collided with a flock of Canada geese during night-time operations. The strike significantly damaged the aircraft and was followed by a loss of control and crash that killed both crewmembers.
2. A Cessna Citation was climbing through 3,000 ft after departing from Wiley Post Airport, Oklahoma City, Oklahoma, U.S., in March 2008. It struck a flock of migrating white pelicans, causing right-engine failure and wing damage. Loss of control followed, with the ensuing crash killing all five occupants.
3. A Sikorsky S-76 helicopter, flying at low altitude in January 2009, encountered a large bird that penetrated the front canopy. Either the crew or the controls were disabled by the collision, and the helicopter crashed, killing eight of the nine occupants.
4. In January 2009, a US Airways Airbus A320 ingested Canada geese in both engines, necessitating a ditching on the Hudson River. No occupants were killed, three sustained serious injuries and the aircraft was destroyed.
5. The BAM is an interactive risk calculation tool, accessible on the Internet at <www.usahas.com/bam>.
6. Airbus. *Flight Operations Briefing Notes: Operating Environment, Birdstrike Threat Awareness.* October 2004.
7. U.K. Civil Aviation Authority. "Operational Considerations in the Event of Multiple Bird Strikes to Multi-Engine Aeroplanes." Aeronautical Information Circular AIC 28/2004. April 29, 2004.
8. ICAO. *Review of Noise Abatement Procedure Research & Development and Implementation Results: Discussion of Survey Results.* Preliminary edition, 2007, p. 11.

BY RICK DARBY

# Fewer Runway Excursions in 2009

**Fatal accident rate for 2000–2009 also shows improvement.**

The 2009 picture of fatal accidents in worldwide commercial aviation showed no overall improvement from 2008, but in one important category, there was good news. Runway excursion accidents — targeted by the Flight Safety Foundation Runway Safety Initiative and the *Runway Excursion Risk Reduction Toolkit* — were fewer, according to newly released data from Boeing Commercial Airplanes.[1]

Twelve of the 62 total accidents, or 19 percent, were overruns or veer-offs, both classified as runway excursions (Table 1).[2] Of the 53 accidents in 2008, 16 — 30 percent — were runway excursions. In 2007, the Boeing data included 10 excursions, 26 percent of the 38 total accidents.

One of the 2009 excursion accidents involved fatalities, compared with three in 2008. Some of the latest excursions involved equipment failures rather than faulty takeoffs or approaches. One excursion resulted from the inability to fully extend the left main landing gear; another, right main landing gear failure and collapse; a third, engine thrust-reverser failure and uncoordinated thrust.

**2009 Airplane Accidents, Worldwide Jet Fleet**

| Date | Airline | Model | Accident Location | Phase of Flight | Description | Damage Category | Onboard Fatalities (External Fatalities) | Major Accident? |
|---|---|---|---|---|---|---|---|---|
| Jan. 6 | China Southern Airlines | 777-200 | Pacific Ocean | Cruise | Flight attendant broken ankle | | | |
| Jan. 15 | US Airways | A320 | New Jersey, U.S. | Climb | Multiple bird strikes, ditching | Destroyed | | ● |
| Jan. 17 | Iran Air | F-100 | Yazd, Iran | Parked | Fuselage struck by ambulift | Substantial | | |
| Jan. 19 | Iran Air | F-100 | Tehran, Iran | Landing | Veered off runway | Substantial | | |
| Feb. 9 | Air Méditerranée | A321 | Paris | Landing | Overshot runway turnoff | Substantial | | |
| Feb. 13 | BA CityFlyer | RJ-100 | London | Landing | Nose landing gear collapse | Substantial | | |
| Feb. 16 | Air Algérie | 737-400 | In Aménas, Algeria | Landing | Overran runway | Substantial | | |
| Feb. 19 | Atlasjet Airlines | A320 | Istanbul, Turkey | Tow | Towbar failure | | | |
| Feb. 23 | Royal Air Maroc | 737-800 | Medina, Saudi Arabia | Takeoff | Tail strike | Substantial | | |
| Feb. 23 | Lion Air | MD-90 | Batam, Indonesia | Landing | Gear-up landing | Substantial | | |
| Feb. 25 | Turkish Airlines | 737-800 | Amsterdam, Netherlands | Landing | Crash during approach | Destroyed | 9 (0) | ● |
| March 2 | CityJet | RJ-85 | Dublin, Ireland | Tow | Aircraft struck tug | Substantial | | |
| March 9 | Lion Air | MD-90 | Jakarta, Indonesia | Landing | Veer-off | Destroyed | | ● |
| March 20 | Emirates | A340 | Melbourne, Australia | Takeoff | Tail strike | Substantial | | |
| March 23 | FedEx | MD-11 | Tokyo | Landing | Hard landing | Destroyed | 2 (0) | ● |
| April 4 | Air China | A321 | Beijing | Landing | Tail strike | Substantial | | |
| April 9 | Aviastar Mandiri | BAe 146 | Wamena, Indonesia | Approach | Struck hill | Destroyed | 6 (0) | ● |
| April 12 | Wizz Air | A320 | Timisoara, Romania | Landing | Hard landing | Substantial | | |
| April 16 | Jade Cargo International | 747-400 | Incheon, South Korea | Landing | Veer-off | Substantial | | |
| April 20 | Royal Air Maroc | 767-300 | New York. | Landing | Hard landing | Substantial | | |
| April 27 | Magnicharters | 737-200 | Guadalajara, Mexico | Landing | Gear-up landing | Substantial | | |

**Table 1**

(continued next page)

## 2009 Airplane Accidents, Worldwide Jet Fleet

| Date | Airline | Model | Accident Location | Phase of Flight | Description | Damage Category | Onboard Fatalities (External Fatalities) | Major Accident? |
|---|---|---|---|---|---|---|---|---|
| April 29 | Bako Air | 737-200 | Massamba, DR Congo | Cruise | Crashed en route | Destroyed | 7 (0) | ● |
| May 4 | Northwest Airlines | A320 | Denver | Landing | Tail strike | Substantial | | |
| May 6 | World Airways | DC-10 | Baltimore | Landing | Hard landing | Substantial | | |
| May 7 | NAS Air | A320 | Alexandria, Egypt | Landing | Hard landing | Substantial | | |
| May 8 | Saudi Arabian Airlines | MD-90 | Riyadh, Saudi Arabia | Taxi | Veer-off | Substantial | | |
| May 8 | Asiana Airlines | 747-400 | Frankfurt, Germany | Approach | Flap departed, punctured fuselage | Substantial | | |
| May 19 | American Airlines | 777-200 | Miami | Parked | Employee fall | | (1) | |
| June 1 | Air France | A330 | Atlantic Ocean | Cruise | Crashed into Atlantic Ocean | Destroyed | 228 (0) | ● |
| June 3 | China Cargo | MD-11 | Urumqi, China | Landing | Hard landing | Substantial | | |
| June 3 | Aeroflot-Nord | 737-500 | Moscow | Cruise | Heavy hail encounter | Substantial | | |
| 6 June | Myanma Airways | F-28 | Akyab, Myanmar | Landing | Departed runway | Destroyed | | ● |
| June 8 | United Airlines | 777-200 | Pacific Ocean | Cruise | Flight attendant broke ankle | | | |
| June 9 | Saudi Arabian Airlines | MD-11 | Khartoum, Sudan | Landing | Hard landing | Substantial | | |
| June 27 | US Airways | 737-400 | Tampa, Florida, U.S. | Landing | Hard landing | Substantial | | |
| June 30 | Yemenia | A310 | Indian Ocean | Approach | Crashed into Indian Ocean | Destroyed | 152 (0) | ● |
| July 7 | Rossiya Russian Airlines | A320 | St. Petersburg, Russia | Landing | Tail strike | Substantial | | |
| July 17 | Transaero Airlines | 737-400 | Moscow | Landing | Tail strike | Substantial | | |
| July 21 | Aeromexico | 737-700 | San Francisco | Tow | Landing gear collapse | Substantial | | |
| Aug. 3 | Saha Air | 707-300 | Ahwaz, Iran | Initial Climb | Uncontained engine failure | Substantial | | |
| Aug. 4 | Sata Internacional | A320 | Ponta Delgada, Portugal | Landing | Hard landing | Substantial | | |
| Aug. 10 | All Nippon Airways | 737-800 | Tokyo | Landing | Tail strike | Substantial | | |
| Sept. 4 | Air India | 747-400 | Mumbai | Taxi | Fuel leak, fire | Substantial | | |
| Sept. 13 | Lufthansa Cargo | MD-11 | Mexico City | Landing | Hard landing | Substantial | | |
| Sept. 14 | Contact Air Flugdienst | F-100 | Stuttgart, Germany | Landing | Gear-up landing | Substantial | | |
| 1 Oct. | Wind Jet | A319 | Catania, Italy | Cruise | Turbulence, hail | Substantial | | |
| Oct. 2 | Malaysia Airlines | 737-400 | Kuching, Malaysia | Tow | Landing gear collapse | Substantial | | |
| Oct. 6 | Boliviana de Aviación | 737-300 | Cochabamba, Bolivia | Cruise | Hail encounter | Substantial | | |
| Oct. 20 | Centurion Air Cargo | MD-11 | Montevideo, Uruguay | Landing | Hard landing | Substantial | | |
| Oct. 21 | Sudan Airways | 707-300 | Sharjah, United Arab Emirates | Initial Climb | Struck terrain | Destroyed | 6 (0) | ● |
| Oct. 30 | Pegasus Airlines | 737-800 | Malatya, Turkey | Taxi | Wing stuck light pole | Substantial | | |
| Nov. 2 | Delta Air Lines | MD-90 | Phoenix | Climb | Bird strike | Substantial | | |
| Nov. 18 | Iran Air | F-100 | Isfahan, Iran | Landing | Landing gear collapse | Substantial | | |
| Nov. 19 | Compagnie Africaine d'Aviation | MD-82 | Goma, DR Congo | Landing | Overrun | Destroyed | | ● |
| Nov. 28 | Avient Aviation | MD-11 | Shanghai | Takeoff | Overrun | Destroyed | 3 (0) | ● |
| Dec. 1 | TAF Linhas Aéreas | 727-200 | São Paulo | Taxi | Struck maintenance stand | Substantial | | |
| Dec. 2 | Merpati Nusantara Airlines | F-100 | Kupang, Indonesia | Landing | Veer-off | Substantial | | |
| Dec. 17 | TAF Linhas Aéreas | 727-200 | Manaus, Brazil | Approach | Wind shear | Substantial | | |
| Dec. 21 | Merpati Nusantara Airlines | 737-300 | Makassar, Indonesia | Landing | Hard landing | Substantial | | |
| Dec. 21 | Canadian North | 737-200 | Calgary, Canada | Parked | De-icer fall | | (1) | |
| Dec. 22 | American Airlines | 737-800 | Kingston, Jamaica | Landing | Overrun | Destroyed | | ● |
| Dec. 29 | Wizz Air | A320 | Boryspil, Ukraine | Landing | Veer-off | Substantial | | |
| | **Total accidents (62)** | | | | | | **413 (2)** | **13** |

Source: Boeing Commercial Airplanes

**Table 1**

Four of the 2009 excursions, one-third, were classified as major accidents, a category that partially overlaps with the fatal accident category.[3] Six of the excursions in 2008 — 38 percent — were major accidents.

The 37 approach and landing accidents (ALAs) accounted for 60 percent of the 2009 total, compared with 31 — 58 percent — in 2008 and 23 — 61 percent — in 2007. Although ALAs as a percentage of the total number of accidents have not changed by more than three percentage points in the past three years, their consequences were less severe in 2009. Four of the ALAs in 2009, or 11 percent, involved fatalities. The corresponding percentages for 2008 and 2007 were 19 percent and 22 percent, respectively.

Most of Boeing's data in its annual accident summaries concern the most recent year plus the previous nine years, thus offering a chance to compare successive 10-year periods. For example, the 2008 report included 1999 through 2008 numbers; the 2009 report comprises 2000 through 2009 (Table 2).

In 2000–2009, the fatal accident rate for scheduled commercial passenger operations was 0.42 per million departures, compared with 0.45 in 1999–2008 and 0.50 in 1998–2007.

The 10-year period beginning in 2000 included 301 accidents in passenger operations, a 6 percent increase over the 283 in 1999–2008 and a 5 percent increase above the 286 in the 1998–2007 stretch. The increases in the latest 10 years included both scheduled operations and charter flights, 6 percent and 17 percent respectively. Accidents in cargo operations increased in the most recent period from 79 to 81, or by 3 percent.

Fatal accidents in 2000–2009 numbered 72, 5 percent fewer than the 76 in the previous period and 8 percent fewer than in the 78 in 1998–2007. The 69 fatal accidents in scheduled service compared with 74 in the previous period, a 7 percent improvement. The number of fatal charter accidents held steady at three.

There were 4,942 on-board fatalities from 2000 to 2009, compared with 4,670 from 1999 to 2008, a 6 percent difference. That included an increase in fatalities during scheduled operations from 4,666 to 4,938. There were four fatalities in charter operations in both periods.

Among all the accidents in 2000–2009, 23 percent involved fatalities (Figure 1). The corresponding ratio for 1999–2008 and 1998–2007 was 25 percent. The fatal-accident proportion from 1959–2009, comprising most of the years of passenger-jet service, was 35 percent.

Among the 304 nonfatal accidents in the latest 10-year period, 292 — 96 percent — involved either hull loss or substantial damage.[4] A smaller proportion — 85 percent — of fatal accidents involved hull loss or substantial damage. The comparable numbers for 1999–2008 were 97 percent and 86 percent, respectively.

Boeing tabulated fatalities according to the U.S. Commercial Aviation Safety Team/International Civil Aviation Organization (CAST/ICAO) standard taxonomy (Figure 2).[5] "Loss of control in flight" (LOC-I) and "controlled flight into terrain" (CFIT) continued to be involved in the greatest number of fatalities in the most recent 10 years. However, loss of control on-board fatalities were 1.8 to 2.0 times higher than CFIT fatalities in the most recent 10-year periods. In 2000–2009, there were 1,759 LOC-I on-board fatalities and 961 CFIT fatalities. For 1999–2008, the numbers were 1,926 and 961, respectively; for 1998–2007, 1,984 and 1,137 respectively.

The combined category "runway excursion — landing" plus "abnormal runway contact" plus "undershoot/overshoot" resulted in 606 on-board fatalities in the 2000–2009 period, an increase of 49 percent over the 408 in 1999–2008. In the "system component failure — non-powerplant" category, the latest

### Accidents, Worldwide Commercial Jet Fleet, by Type of Operation

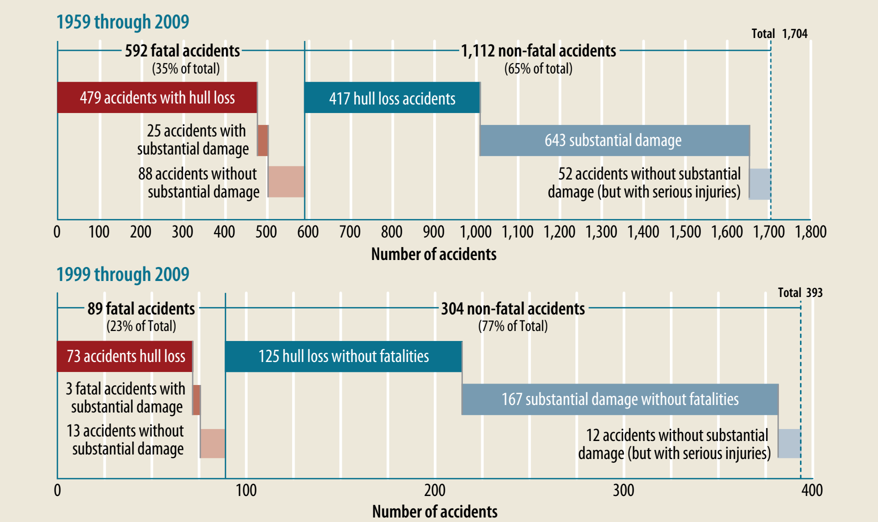
| Type of operation | All Accidents 1959–2009 | All Accidents 2000–2009 | Fatal Accidents 1959–2009 | Fatal Accidents 2000–2009 | On-board Fatalities (External Fatalities)* 1959–2009 | On-board Fatalities (External Fatalities)* 2000–2009 |
|---|---|---|---|---|---|---|
| Passenger | 1,344 | 301 | 475 | 72 | 27,833 (778) | 4,942 (171) |
| Scheduled | 1,235 | 280 | 430 | 69 | 23,719 | 4,938 |
| Charter | 109 | 21 | 45 | 3 | 4,114 | 4 |
| Cargo | 224 | 81 | 73 | 14 | 255 (329) | 42 (73) |
| Maintenance test, ferry, positioning, training and demonstration | 116 | 11 | 44 | 3 | 208 (66) | 17 (0) |
| **Totals** | **1,704** | **393** | **592** | **89** | **28,296 (1,173)** | **5,001 (244)** |
| U.S. and Canadian operators | 530 | 77 | 176 | 14 | 6,153 (381) | 355 (15) |
| Rest of the world | 1,174 | 316 | 416 | 75 | 22,143 (792) | 4,646 (229) |
| **Totals** | **1,704** | **393** | **592** | **89** | **28,296 (1,173)** | **5,001 (244)** |

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

Source: Boeing Commercial Airplanes

**Table 2**

## Accidents, by Injury and Damage, Worldwide Commercial Jet Fleet

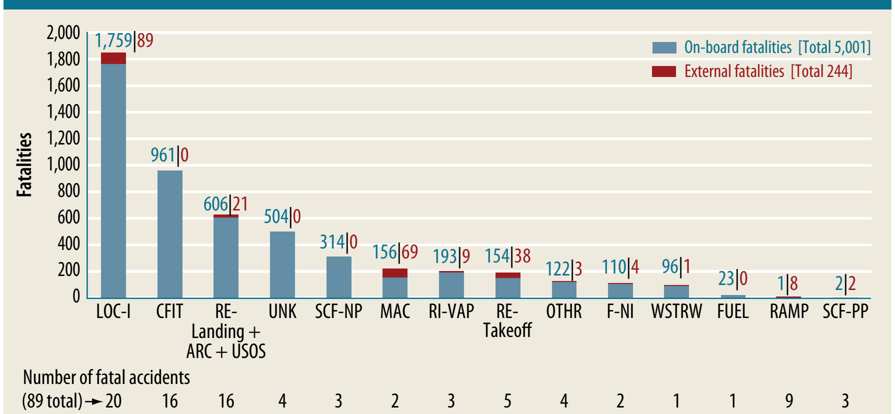



**Note**: Airplanes manufactured in the Commonwealth of Independent States or the Soviet Union are excluded because of lack of operational data. Commercial airplanes used in military service are also excluded.

Source: Boeing Commercial Airplanes

**Figure 1**

## Fatalities by CAST/ICAO Taxonomy Accident Category, Worldwide Commercial Jet Fleet, 2000–2009




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

No accidents were noted in the following principal categories: aerodrome, abrupt maneuver, air traffic management/communications, navigation, surveillance, cabin safety events, evacuation, fire/smoke (post-impact), ground collision, icing, low altitude operations, runway incursion – animal, security related or turbulence encounter.

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

Source: Boeing Commercial Airplanes

**Figure 2**

10-year period had 314 on-board fatalities, or 26 percent fewer than the 426 in the previous 10-year period. There was a surge of "unknown or undetermined" accident on-board fatalities, from 120 in 1999–2008 to 504 in 2000–2009.

### Notes

1. Boeing Commercial Airplanes. *Statistical Summary of Airplane Accidents: Worldwide Operations, 1959–2009.* Available via the Internet at <www.boeing.com/news/techissues>.

2. The data are limited to commercial jet airplanes over 60,000 lb (27,216 kg) maximum gross weight. Airplanes manufactured in the Soviet Union or Commonwealth of Independent States are excluded because of the lack of operational data.

   An airplane *accident* is defined as "an occurrence associated with the operation of an airplane that takes place between the time any person boards the airplane with the intention of flight and such time as all such persons have disembarked, in which death or serious injury results from being in the airplane; direct contact with the airplane or anything attached thereto; or direct exposure to jet blast; the airplane sustains substantial damage; or the airplane is missing or completely inaccessible." Occurrences involving test flights or resulting from hostile action such as sabotage or hijacking are excluded.

3. Boeing defines a *major accident* as one in which any of three conditions is met: the airplane was destroyed; there were multiple fatalities; or there was one fatality and the airplane was substantially damaged. Flight Safety Foundation supports the use of this term to designate the most severe accident category in preference to the traditional term *hull loss*, which the Foundation believes is more significant for insurance actuarial purposes than as a measure of risk.

4. *Substantial damage* is "damage or failure which adversely affects the structural strength, performance or flight characteristics of the airplane, and which would normally require major repair or replacement of the affected component."

5. The taxonomy is described at <www.intlaviationstandards.org>.

# Screen Test

**Some light-airplane pilots are not fully trained for electronic displays.**

## REPORTS

### No Measurable Improvement

**Introduction of Glass Cockpit Avionics Into Light Aircraft**

U.S. National Transportation Safety Board (NTSB). Safety Study NTSB/SS-01/10; PB2010-917001. March 9, 2010. 87 pp. Figures, tables, appendix.

Thanks to trickle-down technology, new light aircraft have undergone a transition from analog flight instruments to computer screens similar to those on modern transport category aircraft. The "glass cockpit," in which the electronic displays integrate aircraft control, autopilot, communication, navigation and systems monitoring, represents a significant change for general aviation.

But does the glass cockpit make flying light aircraft — defined here as having a maximum gross weight of 12,500 lb/5,700 kg — safer?

So far, no. "The introduction of glass cockpits has not resulted in a measurable improvement in safety when compared to similar aircraft with conventional instruments," the study says.

The report says that the accident data analysis of conventional versus glass light airplanes included "(1) a comparison of specified aircraft models manufactured during the five years from 2002 through 2006, the years that spanned the transition of the fleet from conventional to glass cockpit displays, (2) statistical comparisons of retrospective accident data for the years 2002 through 2008 by display type, and (3) a comparison of aircraft and flight activity data obtained from the FAA [U.S. Federal Aviation Administration] aircraft registry and an analysis of GAATAA [*General Aviation and Air Taxi Activity and Avionics*] Survey data for the years 2006 and 2007." Accident data came from the NTSB Aviation Accident Database.

Of the 8,364 airplanes included in the study, 2,848 had conventional cockpit displays and 5,516 had glass cockpits. Variables selected for analysis included accident severity, weather, time of day and the purpose of the flight. Pilot information, such as age, highest certificate level, possession of an instrument rating and flight hours, also was analyzed.

The researchers identified 266 accidents between 2002 and 2008, 62 of them fatal. The report says, "The cohorts [groups of subjects with a defining characteristic] selected had similar airframes, numbers of engines and engine types but differed principally in their type of primary flight instrumentation," glass versus conventional.

"The percentage of accidents resulting in fatality was about twice as high for the glass cockpit cohort as for the conventional cohort," the report says.

For another viewing angle, researchers looked at accident rates based on flight hours.

"Those results indicate that the total accident rate per 100,000 flight hours was higher for the glass cockpit cohort in 2006 but higher for the conventional cohort in 2007," the report says, noting that the cohort rates for the combined years were roughly the same. The rates for fatal accidents in both years were higher for glass cockpit aircraft, although the report cautions that the rates were based on small numbers and therefore subject to a large standard error.

Accident rates per 100,000 flight hours for 2006 and 2007 combined were greater for conventional aircraft than for glass cockpit aircraft during the daytime, with the relative positions reversed at nighttime. Fatal accidents occurred at a higher rate for glass cockpit aircraft during both daytime and nighttime. Accident rates in visual meteorological conditions were similar for both groups but higher for glass cockpit aircraft in instrument meteorological conditions (IMC). The glass cockpit cohort had higher fatal accident rates in both meteorological conditions.

"Both cohorts experienced equally low fatal accident rates for instructional flights, but the glass cockpit cohort experienced a higher fatal accident rate during personal/business flights," the report says.

In 255 accidents for which sufficient information was available from NTSB records, the only statistically significant difference in accident event categories was a higher percentage of collision with terrain for the glass cockpit cohort — 16 percent versus 8 percent.

As a group, "accident pilots of glass cockpit–equipped aircraft were older, held higher levels of pilot certification, were more likely to hold an instrument rating and had more flight hours than those flying aircraft with conventional instruments," the report says.

Despite those pilots' relative maturity, could inexperience *with glass cockpits* have been a factor? The evidence was ambiguous. Distributions of flight time in type were not significantly different between pilot cohorts, the report says. It adds, however, that "data concerning flight experience in aircraft make and model made no distinction in cockpit design, so some pilots may have been experienced in the aircraft type while having little experience with the particular cockpit display in the aircraft."

In sum, glass cockpit aircraft had lower total accident rates. But accident and fatal accident rates were higher for the glass cockpit cohort in IMC and at night, despite the capabilities of digitally based displays, which might have been expected to be helpful in those conditions.

"The NTSB reviewed FAA and manufacturer training materials and programs applicable to glass cockpit aircraft and visited aircraft manufacturers to observe factory training available to general aviation pilots transitioning to glass cockpit avionics," the report says.

Prospective pilots must pass a knowledge test and obtain an instructor's endorsement to be eligible to take the practical test for a certificate or rating. Questions on the test do not assess the candidate's knowledge of electronic flight instruments. However, the report says, "there are general requirements for all pilots to be knowledgeable about the operation and limitations of the aircraft they fly — including all aircraft systems — and to be proficient in the use of those systems." But aside from the general requirements, there is no FAA mandate for equipment-specific training.

**Fatal accidents occurred at a higher rate for glass cockpit aircraft during both daytime and nighttime.**

"With the exception of training provided by airframe manufacturers with the purchase of a new aircraft, pilots must currently seek out and obtain equipment-specific glass cockpit training on their own," the report says.

Some of the larger avionics manufacturers provide software for personal computers that allows pilots to interact with the display. "These software simulators are not intended to replicate the functionality of an approved flight simulator or training device, but rather to serve as interactive procedural trainers that allow pilots to practice using glass cockpit avionics and experience various display system malfunctions and failures that may not be easily or safely replicated in the aircraft," the report says.

Insurance companies often require training requirements for pilots transitioning to glass cockpits as a condition for coverage. But, the report says, those requirements are tailored to individual pilots and vary among insurance companies.

"The lack of equipment-specific training requirements from the FAA and the variability of insurance company requirements result in a wide range of initial and recurrent training experiences among pilots of glass cockpit aircraft," the report says.

Researchers considered several accident case studies that raised issues about the functional differences between electronic and conventional displays.

"The wide variety of complex glass cockpit equipment designs, and their proprietary technology, demands that any discussion of these displays be system-specific," the report says. "Consequently, as electronic systems replace analog gauges, the expectation that average general aviation pilots will understand the inner workings of their cockpit instruments is no longer realistic. This problem is compounded by the fact that, unlike analog gauges, the functionality and capability of electronic display systems can continue to evolve after they are installed because of subsequent software revisions."

Glass cockpit displays may fail differently than conventional displays. The report describes one accident in which a blocked pitot tube, which would have affected only the airspeed indicator of a conventional cockpit display, resulted in the loss of airspeed plus altitude and rate-of-climb information in a glass cockpit display. "The information provided to the pilot indicated only that the air data computer had failed, with no indication of why it had failed or whether the situation could be safely corrected in flight," the report says. "The NTSB concludes that pilots are not always provided all of the information necessary to adequately understand the unique operational and functional details of the primary flight displays in their airplanes."

The NTSB made six recommendations to the FAA, including these:

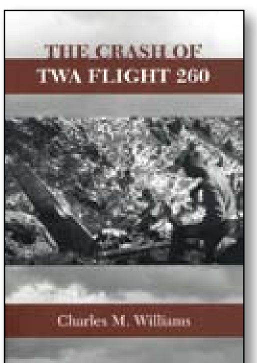
"Revise airman knowledge tests to include questions regarding electronic flight and navigation displays … ;

"Require all manufacturers of certified electronic primary flight displays to include information in their approved aircraft flight manual and pilot's operating handbook supplements regarding abnormal equipment operation or malfunction due to subsystem and input malfunctions … ; [and,]

"Incorporate training elements regarding electronic primary flight displays into your training materials and aeronautical knowledge requirements for all pilots."

— *Rick Darby*

## BOOKS




### Reasons Unknown?

**The Crash of TWA Flight 260**

Williams, Charles M. Albuquerque, New Mexico, U.S.: University of New Mexico Press, 2010. 268 pp. Figures, end notes.

If TWA 260 sounds unfamiliar, it is not a sign that you are losing your memory. You may not have been born yet when the accident occurred, on Feb. 19, 1955.

The Martin 404 was engaged in a short passenger flight from Albuquerque to Santa Fe, about 60 mi (97 km) to the northeast. To avoid the Sandia Range that looms over northern and western Albuquerque — and was hidden by storm clouds at the time — the flight was routed indirectly. Something went wrong.

As Williams tells it: "At 7:12 [a.m. local time, Capt. Ivan] Spong was in the act of changing radio frequencies when the terrain-warning bell suddenly sounded its alarm. Instinctively, both pilots looked out the window. Nothing but gray cloud, but then, flashing through a weak spot in the cloud just beyond the right wing tip, they saw the sheer cliff side of Sandia Crest — an appalling shock, for they should have been 10 mi [16 km] from the mountain.

"Reacting instantly, they rolled the airplane steeply to the left and pulled its nose up. The heading indicator spun rapidly. When it was indicating a westerly heading, they started to level the wings. This was their final act. Hidden by the dense cloud, another cliff side lay directly ahead. When they struck it, they were still in a left bank, nose high. The airplane exploded."

Bad weather hindered search parties trying to reach the wreckage, of which little was visible except the airplane's tail, but that did not matter much. According to a report by a helicopter pilot, it was definitely the accident aircraft and "there was no possibility any survived."

The author, a member of a mountaineering club who had been hiking in the Sandia

Range the day before, volunteered to join one of the search parties. He was among those who reached the nearly inaccessible accident site.

Why return after 55 years to this story, involving an airliner type that has long since been retired from service and flight technology that is primitive by today's standards? Williams believes that the accident investigation by the U.S. Civil Aeronautics Board (CAB), a predecessor of the National Transportation Safety Board, reached conclusions that were seriously mistaken. Additionally, the controversy over the probable cause, which continued for years and resulted in the Air Line Pilots Association (ALPA) dissenting from the CAB findings, offers the drama of a detective story.

The CAB accident report released in October 1955 said, "The weather was such that the visibility all along the airway was good for many miles ahead to the north. … Even if all navigational aids and instruments had failed, all the captain had to do was look outside to determine that he was not following the airway.

"Therefore, from all available evidence, and the lack of any evidence to the contrary, the Board can conclude only that the direct course taken by the flight was intentional."

Williams says, "ALPA pointed out that another airline pilot had taken off minutes after Spong and had testified that the mountains and the Rio Grande valley were completely obscured by a snowstorm, but it fell on deaf ears. The weather was *good* — the report said so!

"When ALPA asked CAB whether they really believed — as their report had seemed to imply — that the TWA pilots had entered into some sort of a suicide pact, they replied, 'No. No. We meant no such implication. We believe they were taking a shortcut."

The Board's determination of probable cause was "a lack of conformity with prescribed en route procedures and the deviation from airways at an altitude too low to clear obstructions ahead."

TWA pilots and those from other airlines were overwhelmingly skeptical that the captain had knowingly changed course from the approved flight plan. "Those who had personally known the pilot, Ivan Spong, knew that he was not a happy-go-lucky fly guy recovering from a rough night on the town," Williams says. "His peers regarded him as a serious and highly competent professional who adamantly refused to deviate in the slightest degree from flying regulations."

Another TWA Martin 404 pilot, Larry DeCelles, "had recently succeeded in discovering both the nature of and the correction for some fluxgate compass errors aboard TWA aircraft," Williams says.

Williams explains that the fluxgate compass "sensed the direction of the horizontal component of the Earth's magnetic field and generated a small electrical voltage that was compatible with the commonly available electric meters already in use on the instrument panel. To maintain accuracy during the twists and turns of normal flight, the compass was kept as level as possible by mounting it on a gyroscope-and-gimbal system.

"Ironically, the Achilles heel of the system was the very stabilizing gyroscope that was the key to its reliability. Steep turns could induce torques that surreptitiously caused … erroneous readouts until it eventually realigned itself — a process usually requiring several minutes of straight and level flight."

The CAB amended its report in 1957, deleting the word "intentional." Nevertheless, says Williams, "a lengthy paragraph had been inserted that said the same thing in a roundabout way. … ALPA's arguments for an instrument malfunction were dismissed — almost contemptuously. They did not, said the Board, even 'warrant serious considerations [*sic*].' They were not a possible contributing factor."

ALPA sent the CAB a critique of its amended report in 1958, with a copy to TWA pilots. The report and ALPA's responses are reprinted in the book. Most of the CAB text and ALPA replies are too long to quote, but here is one brief sample:

The CAB report said, "It is difficult to understand why the flight took the heading it did from the airport to Sandia Mountain."

ALPA responded, "It is not difficult to understand this. The flight experienced a

**The controversy over the probable cause, which continued for years, offers the drama of a detective story.**

malfunction of the fluxgate compass system which was providing heading data to each pilot's RMI [radio magnetic indicator]. No other conclusion is reasonable."

In 1960, the CAB issued a supplement to its revised report, saying that the probable cause was "a deviation from the prescribed flight path for reasons unknown."

— *Rick Darby*

## WEB SITES

### European ATM Safety

**Eurocontrol Safety, <www.eurocontrol.int/safety/public/subsite_homepage/homepage.html>**

The Eurocontrol Safety Web site is an easy access point to air traffic management (ATM) safety enhancement programs and publications. Access points include the safety library and links to several key safety programs and their publications.

**The Safety Library.** The library is a collection of documents and materials from several ATM programs. Listed by topic for quick reference and easy access, most are in Adobe Acrobat format and may be read online or printed. Newsletters and posters, guidance and workshop materials, reports and other documents cover topics such as air-ground communications, safety improvement initiatives, airspace infringement risk analysis, Eurocontrol human factors guidelines, shift work practices, "level busts" (altitude deviations), and more.

**European Safety Programme (ESP) for ATM.** Launched in 2006, the safety plan's focus is to increase European ATM safety maturity across the European civil aviation conference states to a common minimum level through safety management, safety regulations and relevant technical topics. The ESP library contains downloadable reports, workshop presentations and "just culture" materials. Additional documents, CDs, DVDs and reports, such as *Airspace Infringement Risk Analysis*, are available in the ESP Portfolio Literature section.

**Safety Alerts Board.** Proactive messages for the ATM community identify safety concerns and best practices. Safety alerts from 2004 to the present are available. Readers may also subscribe for electronic delivery.

**Human Factors.** This section discusses human performance in safety management systems and normal safety operations. The Web site has its own publications lists and human factors newsletter.

**Eurocontrol Voluntary ATM Incident Reporting (EVAIR).** The Eurocontrol Safety Web site does not link directly to the EVAIR section; however, it does link to the latest EVAIR Safety Bulletin. The first voluntary ATM incident data collection scheme organized at a pan-European level, EVAIR receives data from air navigation service providers and airlines with the goal of improving safety by identifying issues and providing quick fixes and timely communication. Additional information about EVAIR may be accessed at <www.eurocontrol.int/safety/public/standard_page/evair.html>.

The latest EVAIR Safety Bulletin, No. 5, covering 2006–2009, says, "Currently 67 commercial airlines are providing ATM incident reports. The airlines which provide these reports to EVAIR account for more than 50 percent of the overall European air traffic."

The bulletin reports that "among six phases of flight (landing, standing, taxiing, takeoff, approach and en route) for the period 2006–2009, the statistics (in absolute figures) show that the largest number of incidents (78.8 percent) occur within the en route and approach phases." Main ATM incident contributors during this same period were "mistakes," spoken communication and operational communication.

Previous editions of safety bulletins are also available online.

— *Patricia Setze*

# Landing on the Hudson

**Ditching the A320 on the river was the only viable option after a bird strike.**

BY MARK LACAGNINA

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

## JETS

### Both Engines Lost Power

Airbus A320-214. Substantial damage. Five serious injuries, 95 minor injuries.

As the airplane climbed out from New York's La Guardia Airport the afternoon of Jan. 15, 2009, the captain briefly paused from flight deck tasks to comment, "What a view of the Hudson today." After a bird strike moments later, he realized that the airplane likely would end up in the river.

The A320 had encountered a flock of Canada geese 2,818 ft above ground level (AGL), and each engine had ingested at least two of the big birds, said the report by the U.S. National Transportation Safety Board (NTSB). Both engines had been operating with fan speeds of 82 percent. After the bird strike, left-engine fan speed decreased to 35 percent and right-engine fan speed decreased to 15 percent. The flight crew immediately activated the engine ignition systems and the auxiliary power unit.

The captain took control of the airplane and also handled radio communications while the first officer began conducting the quick reference handbook checklist for a dual engine failure. The departure controller asked the captain if he wanted to return to La Guardia or try to reach New Jersey's Teterboro Airport. The captain later told investigators that he decided the airplane was "too far away, too low and too slow" to reach either airport, and that the only viable option, the river, was "long enough, smooth enough and wide enough." Thus, he told the controller, "We're going to be in the Hudson." He made a public address announcement, instructing the passengers and cabin crew to "brace for impact."

The first officer initially attempted to relight the left engine, which was producing slightly more power than the right engine. The report noted that the checklist was designed for a dual engine failure that occurs above 20,000 ft. Thus, the A320 crew had time only to conduct a portion of the checklist and did not reach the final items, which pertain to a ditching. Also, the pilots did not know that because of core damage, neither engine could be relighted. Each engine core had ingested a goose weighing 8 lb (4 kg), which is more than three times the weight that current certification standards require an engine to withstand during bird-ingestion tests.

About three minutes after the bird strike, the first officer told the captain, "Two hundred fifty feet in the air. Hundred and seventy knots. …

Try the other one?" The captain agreed that he should attempt to relight the right engine. The first officer then advised that airspeed was 150 kt and that he had extended the flaps to position two. "You want more?"

"No, let's stay at two," the captain said. He told investigators that he chose the flaps 2 setting because he wanted to have enough energy to flare the airplane and reduce the descent rate sufficiently before touchdown; flaps 3 would have increased drag but would not have lowered the stall speed significantly.

As the airplane neared the river, the captain asked, "You got any ideas?"

"Actually [I do] not," the first officer said.

The report noted that the A320 was certified for ditching under standards that assumed in part that engine power is available and that the descent rate is 3.5 fps. Performance calculations indicated that the actual descent rate was 12.5 fps. Recorded flight data showed that calibrated airspeed was 125 kt — nearly 20 kt below the airspeed specified in the ditching portion of the dual engine failure checklist — when the airplane contacted the calm water with a pitch angle of 9.5 degrees and a right roll angle of 0.4 degrees. Damage to the lower fuselage skin allowed near-freezing water to enter the airplane.

**Damage to the lower fuselage skin allowed near-freezing water to enter the airplane.**

The 150 passengers and five crewmembers evacuated the airplane through the forward and overwing exits (*ASW*, 7/10, p. 24). NTSB attributed the survival of all aboard to the performance and professionalism of the flight crew and cabin crew, the ready availability and rapid response of rescuers, and "the fortuitous use" for the domestic flight of an airplane equipped with slide/rafts for extended overwater flight.

Post-accident tests conducted in a flight simulator showed that even if the airplane had been turned toward La Guardia or Teterboro immediately after the bird strike, it would not have reached either airport.

Based on the investigation, NTSB issued 33 recommendations, including requirements for aircraft manufacturers to develop checklists for dual engine failures at low altitude and for aircraft operators to provide pilot training on the procedures.

## Control Input Causes Hard Landing

Boeing 717-200. Substantial damage. No injuries.

Visual meteorological conditions (VMC) with intermittent rain showers prevailed at Australia's Darwin Airport the night of Feb. 7, 2008, and the 717 flight crew was cleared to conduct a visual approach to Runway 29. Per company procedure, the crew used the instrument landing system (ILS) for guidance during the approach, said the report by the Australian Transport Safety Bureau (ATSB).

The crew spotted the runway when the aircraft was at 3,100 ft and about 9 nm (17 km) from the threshold. The copilot, the pilot flying, used the autopilot's vertical speed mode to initiate a descent to capture the ILS glideslope. The report said that the descent rate increased to over 1,000 fpm, reaching a maximum of 1,600 fpm, while airspeed varied between 209 kt and 211 kt.

The air traffic controller told the crew that the pilot of a preceding aircraft had reported a rain shower on the approach and that the runway was wet.

The 717 was at 1,893 ft and descending at 1,900 fpm when the copilot disengaged the autopilot while keeping the autothrottle engaged. The aircraft was in landing configuration but still slightly above the glideslope at 1,379 ft and descending at about 700 fpm when it crossed the ILS outer marker. The descent rate increased again and was 1,840 fpm when the aircraft intercepted the glideslope at 1,159 ft; airspeed was 153 kt.

"The aircraft was then flown slightly below the glideslope," the report said. The copilot hand flew the 717 using the ILS, runway lighting and the precision approach path indicator (PAPI) as references. The pilot-in-command (PIC) activated the windshield wipers when a rain shower was encountered at 700 ft. "They could see the runway lighting and the PAPI, and continued the approach," the report said.

Airspeed was on target at 136 kt and descent rate was about 700 fpm until the aircraft descended through a radio altitude of 213 ft 15 seconds before touchdown. The descent rate increased to 1,168 fpm, and the PIC called, "Sink rate."

Company policy for stabilized approaches requires a go-around if descent rate exceeds 1,000 fpm below 400 ft in VMC. "The PIC reported that he allowed the approach to continue because the high rate of descent was considered to be momentary and the copilot had taken corrective action" by increasing the pitch attitude, the report said.

The autothrottle reduced thrust to idle below a radio altitude of 30 ft, and the copilot made an abrupt control input to increase the pitch attitude. "Had the flight crew overridden the autothrottle and increased thrust in response to the high rate of descent … the severity of the hard landing may have been reduced," the report said. Descent rate was 1,072 fpm when the aircraft touched down on the main landing gear with a vertical acceleration of 3.6 g.

The PIC assumed control and taxied the 717 to the terminal. The crew reported the hard landing to company engineers. "The damage to the aircraft included several creases to the fuselage skin above the wing area and to the underside of the fuselage behind the wing," the report said. "Several longerons in the rear cargo area were also damaged." None of the 88 passengers and six crewmembers was injured.

## Aquaplaning Ground-Loop Overrun

Embraer 145. Minor damage. No injuries.

Inbound from Zurich, Switzerland, with 16 passengers and three crewmembers the afternoon of July 18, 2005, the aircraft was nearing the destination, Nuremburg, Germany, when the crew listened to the automatic terminal information service (ATIS) broadcast, which indicated in part that surface winds were from 290 degrees at 28 kt, gusting to 40 kt.

The crew was cleared to conduct the ILS approach to Nuremburg's Runway 28, which is 2,700 m (8,859 ft) long and 45 m (148 ft) wide. "In view of the wind conditions, they increased the approach speed ($V_{APP}$) commensurately to 148 kt," or 20 kt above the reference landing speed ($V_{REF}$), said the report issued in July 2010 by the German Federal Bureau of Aircraft Accident Investigation.

The aircraft encountered heavy rain and moderate turbulence during the approach. "It was apparently quite difficult for the crew to keep the aircraft on the three-degree glideslope," the report said. "There was deviation from the glideslope both above and below." However, conditions improved as the Embraer neared the runway. The approach controller told the crew that the surface wind was from 360 degrees at 14 kt.

**Investigators found patches of melted rubber on the main landing gear tires.**

The aerodrome controller told the crew that a thunderstorm had passed over the airport and had moved east. The controller said that the runway was wet but that there was no standing water on it. Investigators determined, however, that the runway actually was covered by 3 mm (about 1/8 in) of standing water, with braking action medium to poor, and estimated that the Embraer required a landing distance of 2,312 m (7,585 ft) under the existing conditions. The estimate also assumed that "the crew flew the aircraft in accordance with all the required parameters," the report said.

However, the aircraft crossed 54 ft over the runway threshold at 150 kt and touched down 981 m (3,219 ft) from the threshold at 128 kt, in what was described by the report as a "soft landing." The ground spoilers deployed automatically. The aircraft was not equipped with thrust reversers, and "the crew reported that braking action failed to bring the aircraft to a stop before the end of the runway," the report said.

Groundspeed was about 52 kt when the PIC steered left, toward a taxiway near the end of the runway. "The aircraft ground-looped about 200 degrees to the left, leaving the runway tail-first and coming to rest with the main landing gear units on the grass," the report said.

Investigators found patches of melted rubber on the main landing gear tires — a sign of reverted-rubber aquaplaning (hydroplaning), which occurs when the wheels lock and frictional heating forms a "steam cushion" between the tires and the runway, the report said.

## Surprised by Severe Turbulence

Airbus A330-300. Minor damage. Seven minor injuries.

The A330 was more than two hours into a scheduled flight with 206 passengers and 13 crewmembers from Hong Kong to Perth, Western Australia, the night of June 22, 2009, when it encountered severe turbulence. Six passengers and a cabin crewmember, the only people who were not seated with their seat belts fastened, sustained minor injuries, the ATSB report said, noting that the seat belt sign was not on.

The PIC consulted with medical personnel aboard the aircraft and at the airline's dispatch support company, and decided to continue the flight. The A330 was landed without further incident at Perth about five hours later. The injured people were treated at a local hospital and discharged the same day. Examination of the aircraft revealed minor internal damage.

The aircraft was at Flight Level (FL) 380 (approximately 38,000 ft) when the turbulence was encountered near Kota Kinabalu, Malaysia. "The cloud associated with the convective activity consisted of ice crystals, a form of water that has minimal detectability by aircraft weather radar," the report said. "Consequently, the convective activity itself was not detectable by [the A330's] radar. As the event occurred at night with no moon, there was little opportunity for the crew to see the weather … and select the seat belt sign on prior to the onset of the turbulence."

## Communications Breakdown

Bombardier CRJ200, CRJ700. Substantial damage. No injuries.

Because there was lightning in the vicinity of North Carolina's Charlotte-Douglas International Airport the afternoon of June 28, 2008, ground crewmembers were not using headsets for communication. A CRJ200 had been pushed back from a gate, and its flight crew was awaiting taxi clearance when another ground crew began to push a CRJ700, operated by the same airline, from another gate.

"A wing walker was stationed at the [CRJ700's] left wing, in plain sight of the tug driver," the NTSB report said. "The wing walker was aware of the CRJ200, and when the pushback commenced he believed that the tug driver was only going to push the airplane about 10 ft [3 m], just enough to trigger the aircraft communication addressing and reporting system (ACARS) 'out' time."

When the tug driver pushed the CRJ700 beyond 10 ft, the wing walker signaled the driver to stop. The other ground crewmembers saw the wing walker signaling the driver to stop, and one of them ran toward the driver, trying to get his attention. "He stated that the tug driver was focused on the cockpit of the airplane and was directing the starting of the airplane's no. 2 engine," the report said.

The wing walker "continued to attempt to alert the tug driver; however, the tug driver did not observe the wing walker before the tail section of the CRJ700 struck the tail section of the CRJ200," the report said. "The empennages of both airplanes were substantially damaged." There were no injuries to the 48 people aboard the CRJ200 or to the 64 people aboard the CRJ700.

# TURBOPROPS

## Prop Control Linkage Disconnects

CASA 212. Substantial damage. Two minor injuries.

The flight crew was conducting a cargo flight on Nov. 1, 2008, from Bethel, Alaska, U.S., to Toksook Bay, where night VMC prevailed. When the first officer, the pilot flying, moved the power levers forward while turning from base to final at about 600 ft AGL, the right engine did not respond, and the airplane yawed right.

The captain took control and moved both power levers full forward to initiate a go-around. "The airplane's yaw to the right intensified, and it began to descend rapidly," the NTSB report said. "[The captain] said that he applied full left aileron and rudder to correct the yaw but was unable to maintain altitude. He observed that the left engine torque meter was indicating 100 percent torque and the right engine torque meter was indicating between zero and 10 percent torque."

The captain said that he was telling the first officer to feather the right propeller when "the stall warning horn sounded, the stall warning light illuminated, and I used both hands to pitch the aircraft forward to avoid a stall." The 212 then struck the tundra.

Examination of the airplane revealed that the mechanical linkage connecting the right power lever to the right propeller pitch control shaft had disconnected, preventing the pilots from controlling thrust. Company maintenance personnel had disconnected and reconnected the linkage when the right Honeywell TPE331 engine was removed for repairs and a leased engine was installed about two months — and 237 flight hours — before the accident. "Since the bolt that connects the propeller pitch control linkage to the splined shaft was not found, it is unknown if the bolt failed or if maintenance personnel failed to properly tighten/torque the bolt at installation," the report said.

### CFIT Near a Mountain Gap

De Havilland Twin Otter. Destroyed. Fifteen fatalities.

The flight crew was scheduled to conduct two round-trip flights under visual flight rules (VFR) between Jayapura, Papua, Indonesia, and Oksibil the morning of Aug. 2, 2009. Returning to Jayapura on the first trip, the PIC radioed company ground crew to ask for a quick turnaround because of deteriorating weather conditions that might result in clouds blocking a gap in the mountains along the route, said the report by the Indonesian National Transport Safety Committee.

The Twin Otter landed at Jayapura at 0935 local time and departed with 12 passengers, a company engineer and the two pilots at 1015 for the second flight to Oksibil. Estimated flight time was 50 minutes, and the aircraft had sufficient fuel for 2 hours and 50 minutes of flight.

About 35 minutes after takeoff, the Twin Otter crew discussed weather conditions with the crew of an Indonesian air force Lockheed C130 that was en route from Oksibil to Jayapura. The C130 crew said that the cloud base at Oksibil was low and the cloud tops over the gap were at 12,500 ft. "There were no other reports of radio transmissions from the Twin Otter, and it did not arrive at Oksibil," the report said.

A search was launched about the time at which the Twin Otter's fuel supply would have been exhausted, and the wreckage was found two days later about 6 nm (11 km) from Oksibil. The report said that the aircraft was in a climbing left turn when it struck a mountain at 9,300 ft; the emergency locator transmitter was unserviceable and did not transmit a signal.

"The aircraft had been flown into cloud while tracking toward the gap," the report said. "The accident was consistent with controlled flight into terrain [CFIT] while maneuvering in the vicinity of the gap. The location of the accident was to the northeast of the route normally flown through the gap to Oksibil."

### Momentary Incapacitation

Beech King Air B200T. No damage. No injuries.

The pilot and a crewman were conducting an infrared fire-mapping reconnaissance flight in southeastern New South Wales, Australia, the morning of Aug. 31, 2009. The pilot was flying the King Air with the global positioning system (GPS) coupled to the autopilot.

While descending from FL 200 to FL 150 to return to Bankstown, air traffic control (ATC) made several radio transmissions that the pilot did not acknowledge, the ATSB report said. The crewman, who was seated in the cabin and completing tasks associated with the reconnaissance, queried the pilot on the intercom but received no reply.

**'The pilot slumped forward, unconscious.'**

"The crewman turned toward the pilot and observed that the pilot was suffering what appeared to be a seizure," the report said. "Shortly thereafter, the pilot slumped forward, unconscious. The crewman moved the pilot back from the aircraft's flight controls and checked the autopilot and instruments to ensure that the aircraft was under control and pressurized."

The crewman was not a pilot, but he had significant experience with airborne fire-mapping operations. He declared an emergency, telling ATC that the pilot was unconscious. "The aircraft continued to track on autopilot via preloaded GPS waypoints to overhead Bankstown at FL 150 while the crewman attended to the pilot and sought advice from the aircraft operator and ATC."

The pilot slowly regained consciousness but initially was unresponsive and appeared unaware of his surroundings. After about five minutes, however, the pilot began to respond to ATC transmissions and fly the aircraft. He landed the King Air at Bankstown without further incident. He then was taken to a hospital for observation and tests, and was released that evening.

"It was later determined that the pilot had a previously undiscovered medical condition that was the likely cause of the in-flight seizure," the report said. The pilot told investigators that he had experienced a brief but very intense headache on the way to work that morning.

## PISTON AIRPLANES

### Ceiling Falls on Air Tanker

Lockheed P2V-7 Neptune. Destroyed. Three fatalities.

Before departing from an air tanker base in Missoula, Montana, U.S., for a VFR positioning flight to another wildfire-fighting base in Alamogordo, New Mexico, the morning of April 25, 2009, the first officer received a weather briefing that included areas of instrument meteorological conditions (IMC) and mountain obscuration along the route.

The first officer, the pilot flying, selected an initial cruise altitude of 11,500 ft but subsequently conducted a series of descents to maintain VFR conditions below the clouds. About two hours into the flight, the airplane was being flown southeast over Utah's Great Salt Lake at 6,000 ft — about 1,800 ft above the surface. The first officer conducted a further descent to 5,800 ft after crossing the shoreline.

He asked the captain if they were high enough to clear the upcoming terrain. "The captain did not respond, and the first officer did not challenge the captain about the issue," the NTSB report said. About 10 minutes later, and shortly after inadvertently encountering IMC near Stockton, Utah, the P2V struck a ridge about 240 ft below the summit. Witnesses said that the ceiling in the area was about 200 ft and visibility was 1/4 mile (400 m) or less in rain and fog.

### Belt Buckle Prompts Shutdown

Beech 58 Baron. Destroyed. No injuries.

Shortly after departing from a private airport in Thabazimbi, South Africa, the afternoon of Jan. 17, 2009, the pilot and the five passengers heard a loud banging noise coming from the right side of the aircraft. "The pilot observed the engine indication parameters, and they were normal," said the report by the South African Civil Aviation Authority. However, as the aircraft continued to climb, the noise became louder. "The pilot then switched off the right-hand engine [and feathered the propeller] because he thought it was problematic," the report said.

As the pilot turned back to the airport, he told the passengers to ensure that their restraints were fastened. "One of the passengers, seated on the copilot's seat, realized that he had not been strapped in [and that] his seat belt and buckle were hanging out of the aircraft and were the source of the noise," the report said.

The pilot attempted unsuccessfully to restart the right engine. "The aircraft started yawing to the right … and became uncontrollable," the report said. "The aircraft was turning toward the dead engine. The pilot looked for a safe landing area but ran out of time, as the aircraft was descending very quickly." The Baron was destroyed when it struck terrain, but no one aboard was hurt.

### 'Should Not Have Been Flying'

Cessna T310R. Destroyed. One fatality.

A witness saw the 310 fly low over her house near Latrobe, Pennsylvania, U.S., the morning of Aug. 31, 2008. She said that the airplane appeared to be descending very quickly "with the left wing up and the right wing down," and the engines sounded as if they were running at full power. She heard a thud after the airplane descended below the trees and saw a plume of smoke.

The NTSB report said that the 78-year-old pilot had lost control of the airplane after becoming incapacitated by a cardiovascular event during a local flight that originated at the Latrobe airport. The pilot did not have a current medical certificate. A coroner's report said that the pilot had been hospitalized recently for congestive heart failure and that the pilot's cardiologist "did not know the decedent was a pilot and was actively flying an airplane." The cardiologist told the coroner that the pilot "should not have been flying with his medical condition."

## HELICOPTERS

### Sun Glare, Illusion Cause CFIT

Bell 206B. Destroyed. One fatality.

While departing from a helibase in Carmacks, Yukon, Canada, the morning of Aug. 9, 2008, the pilot lifted the JetRanger into a low hover, facing away from the Yukon River and the rising sun, conducted a 180-degree pedal turn and then departed over the river. "Shortly thereafter, there was a loud impact and splash, and pieces of the wreckage drifted down the river," said the report by the Transportation Safety Board of Canada. The pilot, who had 23,000 flight hours, drowned.

The report said that the pilot's vision likely was obscured by the bright sunlight and glare from the surface of the water, and that he likely experienced somatogravic illusion when the forward acceleration caused him to believe that the helicopter was climbing rather than descending.

### Control Lost in Hover

Kawasaki-Hughes 369D. Substantial damage. Two serious injuries, one minor injury.

The helicopter was heavily loaded but not overweight when it departed from Haast, New Zealand, the morning of Aug. 11, 2008, to transport three track-maintenance workers to the Maori Saddle. Because of tall trees, the destination could be approached only from the northeast, and the pilot unknowingly conducted the approach with a tail wind of 11 kt to 21 kt, said the report by the New Zealand Transport Accident Investigation Commission.

"Nearing the landing site, the pilot brought the helicopter to an out-of-ground-effect hover, where it started an uncommanded right yaw," the report said. "The pilot attempted to correct the yaw, but the helicopter struck a tree and fell to the ground." The pilot and one passenger sustained serious injuries.

"The investigation determined that the uncommanded yaw and loss of control resulted from the approach being attempted under conditions that were noted in the flight manual to be conducive to a loss of tail rotor effectiveness," the report said.

### No Weather Brief for VFR Flight

Bell 430. Destroyed. Four fatalities.

The flight crew did not receive a weather briefing before departing from Hyderabad, India, the morning of Aug. 3, 2008, for a 225-nm (417-km) charter flight to Raipur, with an en route refueling stop in Jagdalpur. Low visibilities and ceilings, and isolated, embedded thunderstorms were forecast for the route.

The crew had filed a VFR flight plan with a requested cruising altitude of 3,000 ft direct to Jagdalpur, but shortly after departure, the PIC told ATC that they were descending to 2,500 ft because of weather, said the report by the Indian Directorate General of Civil Aviation.

About 27 minutes later, the helicopter was about 60 nm (111 km) northeast of Hyderabad when ATC lost radio communication with the crew. A search was launched three hours after the flight's estimated time of arrival at Jagdalpur. The helicopter's emergency locator transmitter failed to activate. On Nov. 13, the wreckage was found on a hill about 140 nm (259 km) northeast of Hyderabad. The aircraft had struck the hill at 2,700 ft, about 80 ft below the top. Local villagers said that there had been heavy rain in the area when the crash occurred.

## Preliminary Reports, June 2010

| Date | Location | Aircraft Type | Aircraft Damage | Injuries |
|---|---|---|---|---|
| June 1 | near Cayos Arcas, Mexico | Bell 412EP | substantial | 11 none |
| The pilot landed the float-equipped helicopter near a platform in the Gulf of Mexico after experiencing a tail rotor problem. | | | | |
| June 2 | Midlothian, Texas, U.S. | Bell 222UT | destroyed | 2 fatal |
| Witnesses said that the tail boom and main rotor separated during a maintenance test flight. | | | | |
| June 2 | Spokane, Washington, U.S. | Robinson R22 Beta | destroyed | 1 fatal |
| The solo student pilot was turning base when a main rotor blade apparently struck and severed the tail boom. | | | | |
| June 7 | Leeds, England | Cessna CitationJet | substantial | 2 none |
| The airplane overran the runway during a takeoff rejected because of an engine fire. | | | | |
| June 7 | Edenton, North Carolina, U.S. | Beech 60 Duke | substantial | 1 fatal, 1 serious |
| The pilot said that the Duke struck trees after the flight instructor retarded the left throttle on takeoff during an instrument proficiency check. | | | | |
| June 10 | Nazca, Peru | Cessna 208B | NA | 9 NA |
| The Caravan did not return from a sightseeing flight and is believed to have been hijacked. | | | | |
| June 10 | near Port O'Connor, Texas, U.S. | Bell 206L-3 | substantial | 2 minor, 1 none |
| The LongRanger was ditched in the Gulf of Mexico after the tail rotor failed en route to an offshore platform. | | | | |
| June 13 | Felipe Carrillo Puerto, Mexico | Cessna 208B | destroyed | 9 fatal |
| Visual meteorological conditions (VMC) prevailed when the Caravan crashed on takeoff. | | | | |
| June 15 | Bankstown, New South Wales, Australia | Piper Mojave | destroyed | 2 fatal |
| The aircraft stalled and crashed while returning to the airport after an engine problem occurred on takeoff for an air ambulance flight. | | | | |
| June 16 | Ottawa, Ontario, Canada | Embraer 145LR | substantial | 36 NA |
| The nose landing gear collapsed when the aircraft overran the wet runway on landing. Several injuries were reported. | | | | |
| June 17 | Ruidoso, New Mexico, U.S. | Cessna T310R | destroyed | 5 fatal, 2 serious |
| VMC prevailed when the 310 entered a steep descent and struck terrain on final approach. | | | | |
| June 18 | Buenos Aires, Argentina | MBB BO-105CBS | destroyed | 2 fatal |
| The helicopter was on an aerial photography flight when it crashed in a residential area. | | | | |
| June 18 | Chiclayo, Peru | Dassault Falcon 20 | substantial | 8 none |
| The pilots landed the Falcon on open ground after both engines lost power on takeoff. | | | | |
| June 19 | Yangadou, Republic of Congo | CASA 212-100 | destroyed | 11 fatal |
| The aircraft was on a charter flight from Cameroon when it struck a ridge near the destination (*ASW*, 6/10, p. 11). | | | | |
| June 19 | Plymouth, Massachusetts, U.S. | Cessna 401 | destroyed | 3 serious |
| The 401 struck trees and crashed after both engines lost power on final approach. | | | | |
| June 21 | Kinshasa, Democratic Republic of the Congo | McDonnell Douglas MD-82 | substantial | 101 none |
| The flight crew shut down the left engine after it ingested debris from a tire that burst on takeoff. The nose landing gear would not extend during the return to Kinshasa, and the MD-82 veered off the runway on landing. | | | | |
| June 23 | Québec City, Quebec, Canada | Beech King Air A100 | destroyed | 7 fatal |
| The King Air struck terrain shortly after one of the pilots reported an engine failure on takeoff. | | | | |
| June 23 | Puerto Barrios, Guatemala | Colemill Panther | destroyed | 2 fatal |
| The modified Piper Chieftain stalled and crashed on takeoff after a touch-and-go landing. | | | | |
| June 23 | Kotelniki, Russia | Kamov 60 | substantial | 2 serious |
| The helicopter landed hard and rolled over after birds struck the fenestron on approach. | | | | |
| June 26 | Broomfield, Colorado, U.S. | Lockheed P2V-5 Neptune | substantial | 2 none |
| The air tanker had brake problems on landing, overran the runway and struck a ditch. | | | | |
| June 27 | Dublin, Ireland | Boeing 737-800 | none | 1 serious |
| While exiting the 737, a passenger sustained leg injuries when the airstairs partially collapsed. | | | | |
| June 30 | Wiesbaden, Germany | Beech King Air 200 | substantial | 2 minor |
| An unspecified technical problem occurred during approach, and the flight crew conducted an emergency landing short of the runway. | | | | |

NA = not available

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

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