A look back at 10 years of accidents and statistics

by Gordon Gilbert

Over the last 10 years business aviation safety has improved immensely. During the same period, the entire aviation industry has been subject to a number of equipment, avionics and procedural requirements designed to reduce accidents. The question is, has safety improved because of these requirements or have they been a financial, maintenance and procedural drain not justifying the elimination or reduction of the accidents they were intended to prevent? As for most complex things in life, the answers are not always clear and depend in many cases on the specifics of the situation.

One thing is clear: over the last decade, nearly all segments of business aviation flying have become safer (see chart on page 29). Corporate aviation (defined by safety analyst Robert E. Brelling as all aircraft types flown for business by salaried crews) had its safest year in 2003 in terms of accident rates (accidents per 100,000 flight hours) and its safety record was better than the scheduled airlines’ in every year during the last decade.

However, as the chart on page 29 also shows, the rate of accidents involving turboprops has improved little during the same period, with accidents involving specifically the Cessna Caravan and the Mitsubishi MU-2 having a major effect on the statistics. As you will read later in this article, both models are now getting special attention from safety investigators and the FAA in an effort to stem their accident involvement.

Throughout the article are charts intended to provide additional background statistics to assist the reader in evaluating the justification for and the usefulness of equipment and procedures that have been mandated over the last 10 years.

In fact, that is the purpose of this article—to relate the accidents of some specific aircraft models, accidents in general and types of accidents to equipment and procedural requirements enacted to help prevent future accidents.

Simultaneously, this article will also show how accidents over the last 10 years have led to systems and procedures designed to provide more data for investigators to better determine the probable cause of accidents, as well as finding accident locations and possible survivors more quickly. A case in point is the recent adoption of emergency locator transmitter requirements.

ELT Equipment

The 2004 mandate for emergency locator transmitters (ELTs) on transport aircraft resulted from an act of Congress in response to a single fatal crash of a Learjet 35 in 1996 in EMC on approach to Lebanon Municipal Airport in New Hampshire. Searches gave up trying to locate the wreckage, which was accidentally found two years after the crash.

Starting July 1, 2008, all airplanes operating internationally will need to carry at least one emergency locator transmitter, according to a proposed standard from the International Civil Aviation Organization (ICAO). The proposal, if enacted, also states that beginning July 1, 2008, “automatic” (406-MHz) ELTs must be carried on all international operations of both commercial airline authorized to seat 19 passengers or fewer and private aircraft with any number of passenger seats that obtain their certificate of airworthiness after that date.

International operations of commercial airplanes authorized to carry more than 19 passengers and that obtain their certificates of airworthiness after July 1, 2008, would have to be equipped with at least two ELTs, one of which must be a 406-MHz unit.

Current ICAO standards call for ELTs only on airplanes operated on extended overwater flights and on flights over designated land areas where search-and-rescue operations are a particular challenge. Congress (pushed by the lobbying efforts of then avionics maker Sundstrand) was also responsible for the 1974 mandate for airplanes to equip with ground proximity warning systems (GPWS). But controlled flight into terrain (CFIT) accidents continued until the advent of enhanced GPWS in 1996.

The technological upgrade in ground proximity warning devices came after an American Airlines 757 crashed in Cali, Colombia, in 1995. It hit a mountaintop on its approach to the airport, killing 160 of the 164 on board. Investigators believed that a more sophisticated warning device NTSB investigators, the air-ambulance flight crashed into Otay Mountain at 12:30 a.m., about two minutes after taking off from Brown Field near San Diego. The crew took off under VFR intending to pick up their IFR clearance in the air. The two pilots and three aeronautical staff were killed. Said the Safety Board in its May 23 final report: “The airplane was scheduled to have a terrain awareness and warning system (TAWS) installed in January 2005”—about three months before the March 29 compliance deadline.

Helicopter Safety Record

TAWS has not provided the same benefits for the rotorcraft sector. Currently, there are no requirements for TAWS on turbine helicopters, but that could change before the end of the decade. In June, the FAA asked the RTCA to develop specifications for a helicopter TAWS.

An RTCA review of helicopter accident data from 1994 thru 2004 “indicates that controlled flight into terrain (CFIT) is a major contributor to these accidents,” said the organization. “Development of helicop-
value. In these limited evaluations, aircraft equipped with ADS-B have had a lower accident rate than non-equipped aircraft, according to the FAA.

From 2000 through 2005, the rate of accidents for ADS-B-equipped aircraft dropped 49 percent, the agency said. These statistics come from the experience of operators in Alaska, the only region in which ADS-B is used in the U.S. Soon, however, the technology will be approved for use in the Gulf of Mexico, primarily by offshore helicopter operators.

More Regs Do Not, Always Mean More Safety

It might be assumed that the stiffer the operational requirements, the safer the operations. There is some evidence that does support that assumption. For example, accident statistics indicate that Part 121 air carriers have the lowest accident rate of all segments, but that is not the case when accidents for business jets flown under the more restrictive Part 135 are compared with accidents falling business jets flown by salaried pilots under Part 91 (see chart on this page).

Why is that? In many respects the rates of exposure at the most dangerous times—takeoff and landing—are more frequent for Part 135 operators than for Part 91 operators. However, the landing and takeoff frequency for air taxis is similar to that for fractional, yet the latter have fewer incidents and accidents. For example, although the safety record of fractional operators between 1996 and 2005 (and so far this year) is exemplary, the FAA saw fit to require fractional operations to fly under essentially the same safety requirements as Part 135 or meet an entirely new set of FARs—Part 91, Subpart K.

Has the accident rate changed significantly since Subpart K went into effect in 2003? Not really. To date, there still has been no fatal accident involving a fractional, and the sector’s accident rate (incidents per 100,000 hours) last year was the best of all segments, including general aviation.

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Addressing Icing Accidents

NTSB recommendations and FAA rulemaking often result from accident and incident investigations that indicate a trend or commonality—either by the circumstances of the accident, operational certificate or type of aircraft. General aviation turbine airplanes over the last decade presented some highly visible examples, such as the number of accidents involving Cessna Caravans and Mitsubishi MU-2s, particularly in icing conditions.

In the case of the MU-2, there have been two major FAA events in the past decade—a special safety review that got under way last year to address all aspects of flying the twin turboprop and a 2003 operational AD to address specifically MU-2 icing accidents.

More stringent training requirements for MU-2 pilots will result from the review of the turboprop twin. For Part 91 operators, the additional requirements will become part of their FAA-approved training syllabus. For Part 91 operators, which cover the vast majority of MU-2s, a special FAR will be promulgated through the usual rulemaking process. The safety review is still under way so its results cannot be evaluated yet, but the 2003 operational AD is a different story. That directive (AD 2003-22-07) was unusual because instead of requiring an aircraft repair or modification, it is used to mandate pilot training—specifically, MU-2 pilots must receive icing training regularly. Since that AD came out, there hasn’t been a single MU-2 icing accident. However, non-icing MU-2 accidents continue to occur and perhaps the safety review, once put into action, will help stem these mishaps.

The FAA might take a slightly different tack to reduce icing accidents in the Caravan turboprop single. Pilot training is expected to become a part of the FAA-approved airplane flight manual (as it is for the MU-2), but at press time an AD was not in the works. Caravan charter operator Linear Air in late August told AIN that its industry contacts mentioned not only a mandatory Cessna icing training program but also that the FAA has conducted Caravan icing tests and will release new performance charts and procedures before year-end.

Icing accidents in the U.S. and abroad in recent years involving the Challenger also led to an AD. Although the accidents were attributed to the flight crew’s failure to ensure that the jet’s wings were completely free of ice or frost before takeoff, the NTSB concluded that “for many years we have been dealing with the fact” that aircraft such as the Challenger with so-called “hard wings [that] is, those without leading-edge devices have been found to be more susceptible to the effects of icing.”

The directive (AD 2005-04-07) requires that operators of all U.S.- registered Challenger 600s, 601s and 604s and Canadair Regional Jets incorporate flight manual revisions to ensure that before takeoff the “wing leading edge and upper wing surface are completely free of ice, frost, snow or slush.” In addition to a visual inspection, the ADs require a “tactile means” to identify potential contamination.

The FAA directive followed an identical AD from Transport Canada.

As a result of its investigation of the Nov. 28, 2004, fatal takeoff accident involving a Challenger 601 in Montrose, Colo., the NTSB in December 2004 issued a special alert advising pilots of all aircraft about the detection and effects of ice accumulation on the wing.

In the aftermath of four dual flameouts involving P&W JT15D-powered Beechjets, the NTSB late last month issued an urgent recommendation to help prevent further incidents on Beechjets and a broader recommendation calling on the FAA to work with engine and airplane OEMs to develop an ice detector for new engines, as well as for retrofit.

Overruns Abundant

Turbine business aircraft accidents involving icing, loss of control and botched instrument approaches in IMC have caused the most loss of life over the past 10 years, according to data compiled by the safety analyst Robert E. Breiling of Boca Raton, Fla.

But one of the most numerous mishaps for private and commercial aircraft is the landing or aborted-takeoff overrun. There were 44 runway overruns last year involving transport aircraft, according to the International Federation of Airline Pilots’ Associations. The data served to underscore the group’s crusade to get runway-end safety areas or arrestor beds on runways at all major airports worldwide.

Although there are many overruns that are not investigated by the NTSB because they lack substantial damage or serious injury, there have been some spectacular ones that have caused fatalities and resulted in new requirements for operators of both air- craft and airports.

Failure of ground spoilers to deploy caused at least six nonfatal overruns.
involved early models of the Raytheon Premier I in the period between 2002 and 2004. These accidents led to an AD requiring Premier I operators to temporarily replace existing landing-distance and landing-weight charts in the AFM with charts that reflect the increased landing distance without the lift-dump spoilers deployed. Since Raytheon Aircraft incorporated a fix, there have been no reported overruns involving Premiers.

The February 2005 crash of a Challenger 600 after it overran a runway at Teterboro Airport in New Jersey got the ball rolling on the government’s investigation into improper charter operations. And the overun last December of a Southwest 737 at Chicago Midway Airport led to a controvertical new requirement for commercial and Part 91K operators when computing landing distance: the so-called 15-percent rule, which was scheduled to go into effect before year-end.

However, compliance with the 15-percent requirement has been delayed since some business aviation trade groups challenged the notice as being ill-conceived and illegal because it didn’t go through the notice of proposed rulemaking process, complete with a public comment period.

Overruns are included in the few accidents involving fractional operators, such as the May 2, 2002, overrun of a NetJets Citation in Leaky, Texas. The airplane touched down about 2,100 feet beyond the landing threshold, leaving just 1,875 feet in which to stop. The two crew and four passengers escaped injury, but the jet was destroyed in the post-crash fire, the only accident to date in which a fractional aircraft was completely destroyed.

The NTSB in June released the probable cause, saying the “pilots failed to land the aircraft at the proper touchdown point to allow adequate stopping distance.”

This and other overruns have led the FAA to take action to help prevent damage and injuries from overruns. Part 139 (certified) airports are now mandated to construct 1,000-foot safety areas or barriers at the ends of their main runways, where possible. Some airports have had to shorten the length of runways to accommodate safety areas. There is no requirement for safety overruns or barriers at most general aviation airports.

Engineered Materials Arresting Systems (EMAS)—designed for runways that do not have enough space for 1,000-foot-long safety areas—are being installed at several airline and non-airline airports.

To date, EMAS has been credited with preventing injury and aircraft damage in four incidents, including a Falcon 900 overrun on July 17 at Greenville Downtown Airport, S.C.

### What’s Old Is New Again

Since its inception in 1967, the NTSB has investigated more than 124,000 aviation accidents and issued more than 5,000 aviation recommendations (mostly to the FAA). Since 1990 the Safety Board has highlighted its most urgent issues on its “Most Wanted” list of safety improvements.

Keep in mind that the Safety Board has no regulatory authority and the FAA does not have to adopt its recommendations. Nevertheless, the agency has acted favorably on more than 84 percent of them. Still, some in Congress don’t believe that’s a high enough percentage and have introduced an amendment to the NTSB reauthorization bill “to make the FAA explain why the Safety Board’s Most Wanted recommendations have not been implemented.”

Of the remaining 16 percent of recommendations and have not enacted, many were initially published 10 or more years ago and the NTSB has reiterated several of them as new accident investigations raise old issues that have not been resolved to the Safety Board’s satisfaction.

There are currently two recommendations that have been on the Most Wanted list since its inception nearly 17 years ago: stopping runway/taxiway incursions and reducing dangers to aircraft from airframe icing. Both of these items have been restated several times over the years because of continuing accidents or incidents involving these factors.

According to an NTSB statement late last year, “Although the FAA completed action on a number of objectives to make ground operation of aircraft safer, these incidents continue to occur with alarming frequency.”

The NTSB specifically refers to “the FAA’s anti-intrusion system provides warnings to air traffic controllers but not to flight crews, a fact that reduces the amount of time that pilots have to react to an impending incursion.”

The NTSB’s recommendations and statements notwithstanding, the number of incursions has been declining steadily, according to FAA figures. Agency statistics show that there were 383 incursions in 2001 and 324 last year.

However, the NTSB believes these figures are incorrect because it claims not all incidents are being reported, and some are being reported by ATC as “operational errors.”

In 1997, as a direct result of TWA Flight 800 a year earlier, the NTSB added to its Most Wanted list preventing explosive mixtures in transport aircraft fuel tanks. The Safety Board currently describes the FAA’s action as “acceptable, progressing slowly.”

Most Wanted recommendations that the FAA responded to in a manner acceptable to the NTSB in the last 10 years include reducing accidents from wake vortex turbulence (added in 1995, removed in 1998), improving commuter airline safety (added in 1995, removed in 1996) and pilot background checks (added in 1996, removed in 1998).

### CVRs Not Good Enough

Flight data recorders (FDRs) have gotten better—both in the quality of their structure and the quantity of their data—as the result of accident investigations in the period from 1996 to 2005 and the current prodding by the NTSB. The Safety Board is also disappointed that cockpit voice recorders (CVRs) are not required in all turbine airplanes and is unsatisfied with the quality of those that are installed.

In several business aviation accidents the Safety Board expressed its frustration about the fact that a CVR was either not required or, if it was installed, failed to operate properly. For example, during its investigation into a May 9, 2005, Sabreliner accident in which a birdstrike was implicated, the Safety Board said the CVR recorded insufficient data for such poor quality it was useless for accident investigation purposes.

The NTSB decried the lack of recorders on a LearJet that was involved in a fatal crash on Dec. 23, 2003. The airplane was not equipped with a CVR or FDR and federal regulations did not require them. “This is another example of where a recording device—whether a voice recorder, data recorder or a video recorder—would have greatly helped investigators determine what happened,” the Safety Board said. “An opportunity to improve aviation safety was lost here.”

The NTSB specifically refers to lack of properly important data because the CVRs weren’t working in the investigations of the Oct. 9, 1999, incident in which an Amway Falcon 900B experienced a series of serious pitch oscillations and the May 21, 2000, fatal accident of an Executive Airlines BAE Jetstream 31 that apparently suffered fuel starvation.

The NTSB also believes that current requirements for retaining information recorded on a CVR do not go far enough in ensuring that pertinent data is available after portable accidents or incidents. Because of this longstanding concern, the Safety Board in 2002 asked the FAA to require operators to deactivate the CVR immediately after an incident or accident and to require a functional check of the device before each flight of the day.

In February last year, partly in response to the NTSB’s urgings, the FAA published a notice of proposed rulemaking to improve both the quality and quantity of information from CVRs and FDRs. The rule, still in the proposed stage...
stage, has been criticized by NBAA and the National Air Transportation Association. The associations claim the agency failed to conduct even a cursory review of the feasibility and economic impact of the rule for aircraft operated under Parts 135 and 91. “This oversight has resulted in substantial flaws in the FAA estimates of time to complete CVR retrofits, the overall costs of the upgrades and the number of small businesses impacted.”

Six years ago, the Board recommended that the FAA require CVRs, in lieu of flight data recorders, in smaller turbine-powered aircraft frequently employed in Part 135 operations. And about three years ago, the NTSB added to its Most Wanted list a requirement for cockpit video recorders on all transport aircraft. To date those recommendations carry an “unacceptable response.”

Under Part 135, CVRs are required on turbine-powered airplanes or helicopters with a passenger configuration of six or more and for which two pilots are required. Under Part 91, CVRs are mandatory on all transport-category airplanes regardless of their number of seats. That leaves a new category of airplanes off the hook—very light jets operated under Part 91 or Part 135.

While this article has shown that some recent rules, procedures and systems have helped to prevent accidents, the NTSB for many years has determined that the flight crew is at fault in more than 75 percent of all accidents. This figure seems to indicate that pilots always have the ability to ignore, overcome or bypass systems, rules and procedures designed to prevent accidents. As long as pilots make the final decision in the cockpit, it is unlikely that there will ever be a system, rule or procedure that is 100-percent foolproof.