AN AOPA AIR SAFETY FOUNDATION PUBLICATION

2007 NALL REPORT

Accident Trends and Factors for 2006

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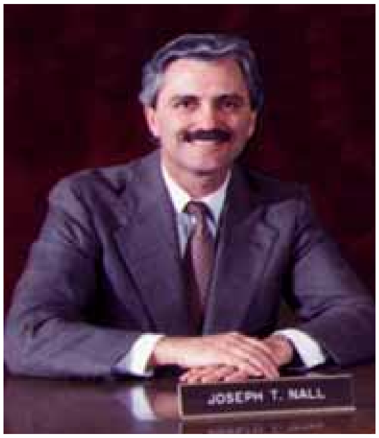

Dedication

The *Joseph T. Nall Report* is the AOPA Air Safety Foundation's annual review of general aviation aircraft accidents that occurred during the previous year. The report is dedicated to the memory of Joe Nall, an NTSB Board member who died as a passenger in an airplane accident in Caracas, Venezuela, in 1989.

Final vs. Preliminary Statistics

This report is based on NTSB reports of accidents involving fixed-wing general aviation aircraft weighing 12,500 pounds or less. To provide the pilot community with the most current safety information, ASF gathered NTSB data on 2006 accidents throughout 2007. By September 2007, the NTSB had finalized 80.7 percent of the year 2006 reports. The remaining 19.3 percent contained preliminary data.

Prior-year comparisons suggest that this mix of preliminary and final data will not significantly change the conclusions presented here when all final reports are analyzed.

As a supplement to the information contained in this report, ASF offers its accident database online. You may search the database by selecting specific criteria. To view the database, visit www.asf.org/database.

The AOPA Air Safety Foundation gratefully acknowledges the technical support and assistance of:

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2007 NALL REPORT

Accident Trends and Factors for 2006

Bruce Landsberg
Executive Director,
AOPA Air Safety Foundation

As often in life, we make progress in some areas and backslide in others. So it is with general aviation safety, and this year's report is a perfect illustration of why trend information is more reliable than yearly snapshots.

Over the five year period from 2002 to 2006, the number of GA accidents declined by 10.8 percent, while annual estimated GA flight hours decreased by 1.5 million (5.9 percent). The GA accident rate per 100,000 flight hours continues its decade-long decline, from 7.19 accidents per 100,000 hours in 1997 to 6.32 per 100,000 hours in 2006. The fatal accident rate over the same period decreased from 1.36 to 1.26 accidents per 100,000 hours or 7.4 percent.

Here are the highlights of GA accident trends for 2006:

- Maneuvering flight, which we highlighted as a concern last year, dipped significantly from 80 (33.1 percent) fatal accidents in 2005 to 54 (25.0 percent) in 2006. Fatal descent and approach accidents, on the other hand, increased from 25 (10.3 percent of fatal accidents) fatal crashes in 2005 to 41 (19.0 percent) in 2006.

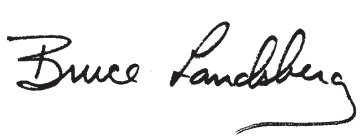
- Pilot-related weather mishaps were comparable to the previous year. As expected, the majority of fatal weather accidents in single-engine aircraft resulted from VFR flight into IMC. Unfortunately, the long-term trend for weather related accidents is increasing. One possible explanation is that more cross-country flying is being undertaken in new, technologically advanced aircraft. The negative trend in weather accidents also illustrates the difficulty of teaching judgment skills to a broad group of pilots flying under diverse circumstances. Although the numbers in question are relatively small, the cost in terms of lives and dollars lost is significant.

- Personal flying, as compared to business or instructional flight, continued to show disproportionate accident involvement. Experience, equipment, and supervision all likely play a part in the disparity. There was a noticeable improvement in fatal accidents for pilots with 1,000 hours total experience or less (from 49.7 percent to 41.8 percent), and a smaller, but still significant, reduction for pilots with 100 hours time in type or less (from 43.0 percent to 41.3 percent).

In early spring 2007, the AOPA Air Safety Foundation, in cooperation with the FAA, mailed over 180,000 CD-ROMs to instrument rated pilots on how to avoid thunderstorms and use Air Traffic Control Services appropriately in convective weather. We believe that this effort—along with a companion education program undertaken in cooperation with the National Air Traffic Controllers Association (NATCA)—will help improve the safety record.

ASF's educational outreach is expanding tremendously, and as of this writing pilots are completing more than 17,000 courses on our Web site, www.asf.org, every month. It is my belief that accident pilots are generally the ones who have *not* availed themselves of these resources, nor of the 200-plus free safety seminars we offer nationwide every year. This is a not-so-subtle suggestion to all pilots reading this report that continuing safety education pays significant benefits.

Until next year, safe flights.



Overview of 2006 Accident Trends and Factors

The AOPA Air Safety Foundation's annual *Joseph T. Nall Report* is the nation's foremost review and analysis of general aviation (GA) safety for the preceding year. It is designed to help members of the media, the public, and the aviation community better understand the factors involved in GA accidents.

GA is defined as all flying except for scheduled airline and military flights, and comprises the majority of aviation activity in the United States.

Statistics used in this report are based on National Transportation Safety Board (NTSB) investigations of GA accidents that occurred in 2006 involving fixed-wing aircraft with a gross weight of 12,500 pounds or less. Such airplanes account for about 90 percent of all GA aircraft.

The *Joseph T. Nall Report* analyzes accident data by cause and category, type of operation, class of aircraft, and other factors. This allows exploration of GA safety issues in a variety of ways. For instance, pilots can learn more about the accident profile of the particular class of aircraft they fly, or the particular type of flying they do.

The GA accident rate is relatively low, but remains significantly higher than that of the airlines. (See Appendix for an overview of GA vs. airline safety.) This is due, in part, to more diverse levels of pilot experience and training, a less restrictive regulatory structure, different aircraft capabilities, and the more challenging operating environment of GA.

Accident Analysis

The general aviation fixed-wing safety record continued its improvement in 2006, reaching historic lows for both total (1,319, down 8.3 percent from 2005) and fatal accidents (273, down 6.5 percent). The 488 total fatalities also represent a new low, decreasing by 2.0 percent. These reductions are significant because the FAA announced that estimated flight hours for 2006 rose to 24 million, a 3.9 percent increase over 2005.

Accident Statistics

	2002	2003	2004	2005	2006
Total Fixed-Wing GA Accidents	1,478	1,516	1,420	1,439	1,319
Fatal Fixed-Wing GA Accidents	312	313	292	292	273
Total Fixed-Wing GA Fatalities	527	579	528	498	488
Estimated GA Flight Hrs. (millions)	25.5	25.7	24.9	23.1	24.0

Fig. 1

Accident Trends

Cross-referencing accident statistics with flight hours provides another meaningful way to analyze aviation safety. Accident rate statistics take fleet utilization into account, and are expressed as accidents per 100,000 flight hours. Use of these rates allows accurate year-to-year comparisons.

U.S. General Aviation Accidents
per 100,000 Flight Hours 1997-2006

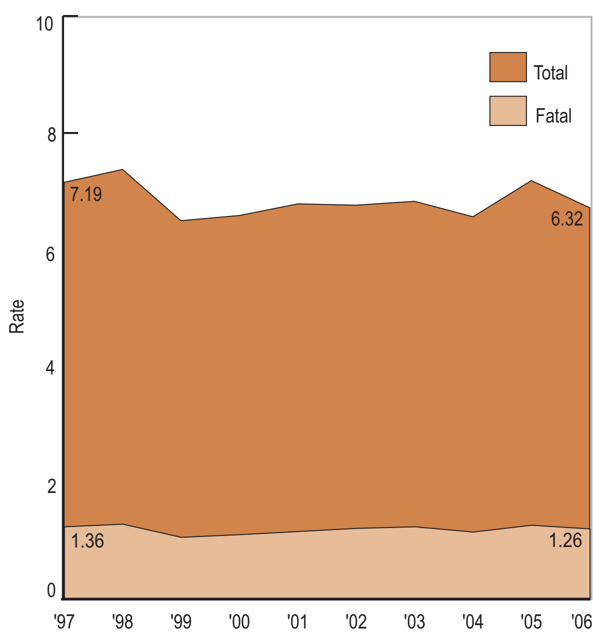


Fig. 2

With a historic low of 6.32 accidents per 100,000 flight hours for 2006, the overall trend continues to be downward. The trend for fatal accidents, however, remains relatively flat at 1.26 per 100,000 hours.

Accident Causes

For analytical purposes, it's helpful to divide the causes of GA accidents into three groups:

- **Pilot-related** – accidents arising from improper actions or inactions of the pilot.
- **Mechanical/maintenance** – accidents arising from mechanical failure of a component or an error in maintenance.
- **Other/unknown** – accidents such as pilot incapacitation and those for which a specific cause could not be determined.

Figure 3 depicts the numbers of GA accidents by cause. Percentages represent the relationship of each group to the total for 2006.

General Aviation Accidents 2006

MAJOR CAUSE	All Accidents	Fatal Accidents
Pilot	**973 (73.8%)**	**216 (79.1%)**
Mechanical/ Maintenance	**223 (16.9%)**	**27 (9.9%)**
Other/Unknown	**123 (9.3%)**	**30 (11.0%)**
TOTAL	**1319**	**273**

Fig. 3

Accident Category

Each accident cause described above can be further divided into categories. The remainder of this report provides detailed analysis of GA accidents by category. It also looks at accident statistics for the various classes of GA fixed-wing airplanes, as well as pilot experience, qualifications, and other factors.

Pilot-Related Accidents

973 total/216 fatal

Pilot-related accidents in 2006 showed a significant drop from the previous year, with a decrease of 9.6 percent for total (973 vs. 1,076) and 10.7 percent for fatal (216 vs. 242) accidents. Overall, pilot-related accidents

Accident Categories – Pilot Related

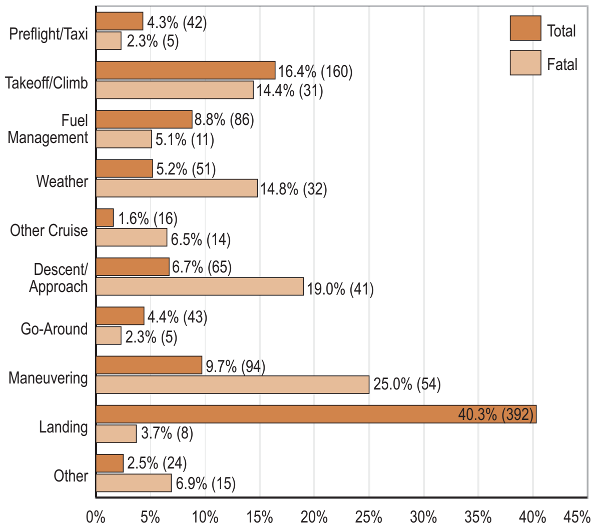


Fig. 4

Maneuvering Accident Trend

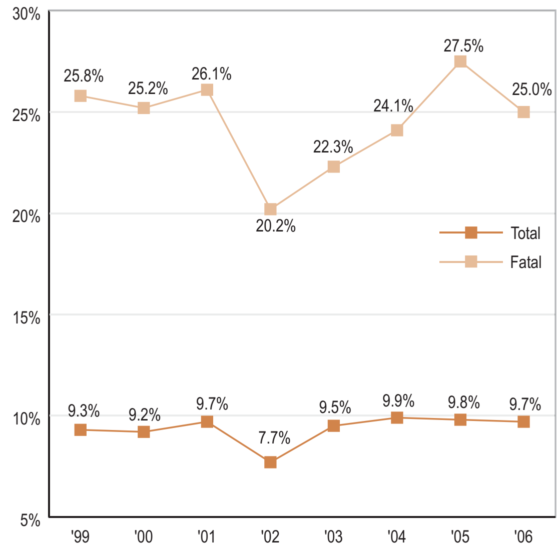


Fig. 5

accounted for 73.8 percent of total and 79.1 percent of fatal GA accidents. As previously discussed, pilot-related accidents also represented a smaller proportion of overall accidents in 2006.

The accident categories shown in Figure 4 are defined by the phase of flight in which the accident occurred (for example, landing or maneuvering), or by primary factor (such as fuel management or weather). Accidents in the categories of weather, other cruise, descent/approach, maneuvering, and "other" resulted in disproportionately high numbers of fatal accidents when compared to total accidents for that category.

Leading causes of pilot-related fatal accidents in 2006 were:

- Maneuvering: 25.0 percent (54)
- Descent/Approach: 19.0 percent (41)
- Weather: 14.8 percent (32)
- Takeoff/Climb: 14.4 percent (31)

Maneuvering accidents, which accounted for one of four (25.0 percent) fatal GA accidents, showed an improvement from the 27.5 percent recorded the previous year. These accidents often involve questionable pilot judgment, such as decisions to engage in buzzing, low passes, or other high-risk activities. The trend in maneuvering accidents shows a slight increase in the percentage of both total and fatal maneuvering accidents since 1999.

Fatal descent and approach accidents, on the other hand, increased from 11.2 percent of the fatal crashes in

Descent and Approach Accident Trend

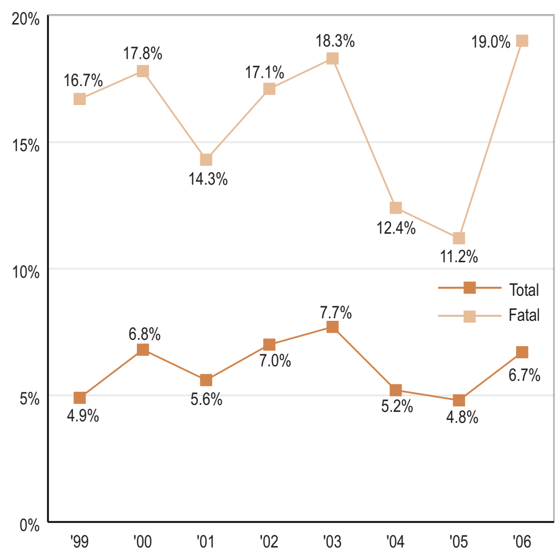


Fig. 6

2005 to 19.0 percent in 2006. This area will be tracked closely over the next several years to monitor progress.

Pilot-related weather crashes were comparable to the previous year, registering 51 (5.2 percent) total and 32 (14.8 percent) fatal pilot-related accidents. Most often, these fatal accidents resulted from pilots continuing VFR flight into instrument meteorological conditions (IMC). In the long term, weather accidents continue their gradual increase. Figure 7 charts the trend of weather-related accidents.

Weather Accident Trend

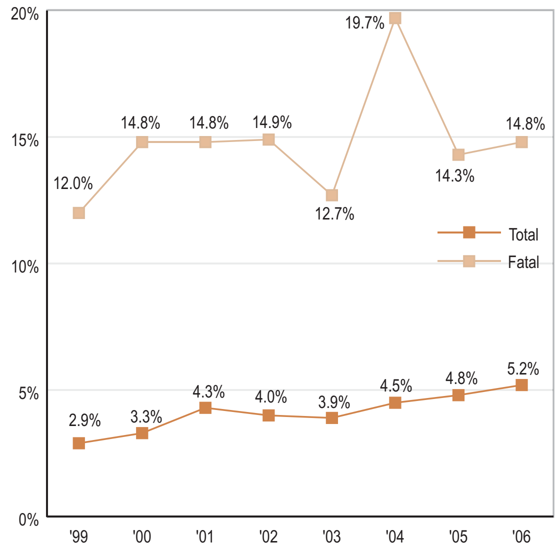


Fig. 7

Type of Operation

Type of Operation	Percent of Flying (2006)	Percent of Total Accidents (2006)	Percent of Fatal Accidents (2006)
Personal	48.2	71.5	71.8
Instructional	20.1	13.3	7.7
Aerial Application	4.6	4.3	3.3
Business	15.1	2.8	5.5
Positioning	*	1.7	2.2
Ferry	*	0.5	0.7
Other Work use	0.8	0.8	1.8
Aerial Observation	3.0	0.6	1.1
Executive/Corporate	4.0	0.7	0.4
Other/Unknown	4.2	3.8	5.5

** Included in Other/Unknown*

Fig. 8

Type of Operation

The versatility of general aviation aircraft is reflected in the wide variety of operations in which they take part, from recreational and personal flying to commercial operations. Figure 8 shows that most 2006 GA flying was for personal (48.2 percent), instructional (20.1 percent), and business (15.1 percent) purposes. Definitions for each type of operation are found in the Appendix.

Personal flying—visiting friends or family, traveling to a vacation home, or for recreation—accounted for about half of the total GA flight time, but suffered seven out of every 10 accidents (71.5 percent) and 71.8 percent of all fatal accidents in 2006, making it significantly more hazardous than other types of operations.

By contrast, instructional flying is relatively safe, accounting for 13.3 percent of all accidents and only 7.7 percent of fatal accidents. This is due, in part, to the high level of supervision and structure in the training environment.

Business flying—that done in furtherance of the pilot's own livelihood or in support of business endeavors—is one of the safest types of GA flying. It comprised 15.1 percent of operations in 2006, but accounted for only 2.8 percent of all accidents and 5.5 percent of fatal accidents. For business pilots, flying is secondary to their business or occupation. This differs from executive/corporate flying, in which professional pilots are hired solely to fly.

These three categories of aircraft use are examined in detail later in the report.

Emergency Phase of Flight

Typically, general aviation accidents are the result of a series of events and decisions that occur before and during the flight. As it investigates each accident, the NTSB attempts to determine where this "accident chain" began. Figure 9 shows the phase of flight during which the accidents began.

Emergency Phase of Flight

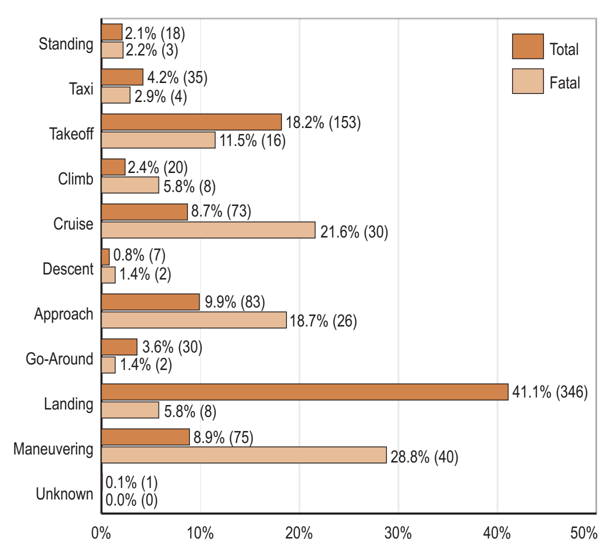


Fig. 9

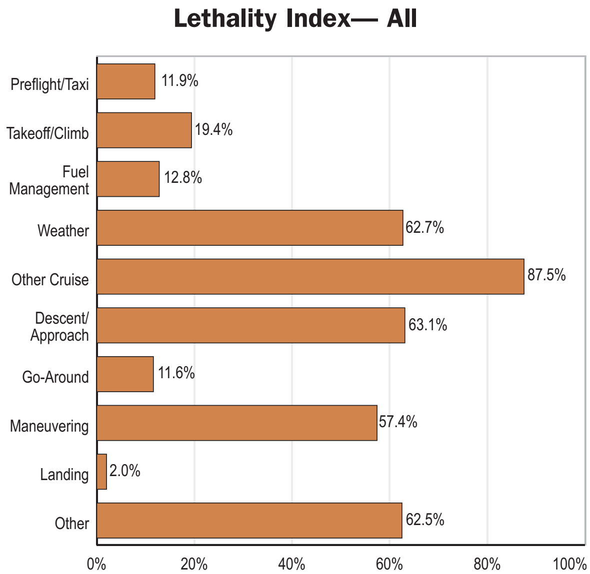


Fig. 10

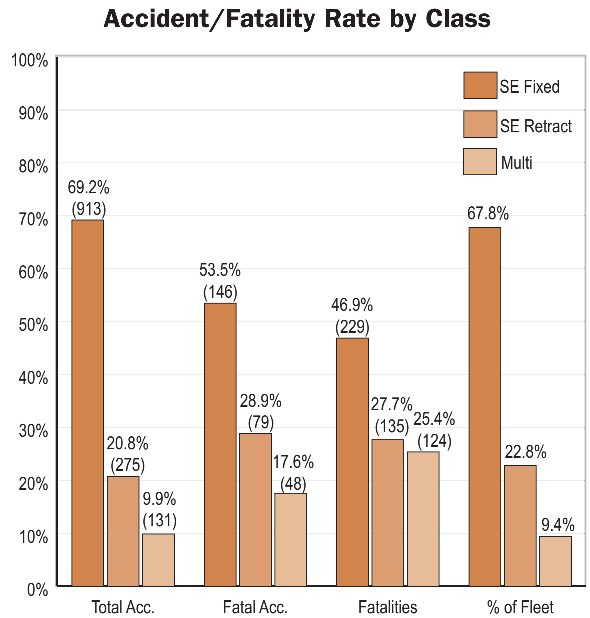


Fig. 11

As shown, takeoff and landing are the phases of flight where most accidents begin, but events leading to fatal crashes are most likely to start in cruise, approach, and maneuvering.

Note that there is some overlap in the terms used to describe the emergency phase and the accident category. For example, fuel exhaustion during cruise would be categorized as a fuel management accident, but the emergency phase of flight would be listed as cruise.

Lethality Index

The Lethality Index shown in Figure 10 provides insight into the likelihood of death in various categories of pilot-related accidents. Overall, GA lethality in 2006 was 22.2 percent.

Accidents occurring as a result of weather, other cruise, descent/approach, maneuvering and "other" all resulted in fatalities in over half of the crashes. In the case of other cruise, this represents a significant worsening from 2005's 66.7 percent, to this year's 87.5 percent of fatal accidents. Lethality of preflight/taxi and "other" also increased, reaching 11.9 percent. Fatalities during this phase are frequently the result of personnel on the ground being struck by propellers. These accidents are discussed later in the Other Accident Factors section.

The Lethality Index for each class of aircraft is presented as part of its respective discussion.

Accidents and Aircraft Class

To better understand accidents, this report studies three classes of fixed-wing general aviation airplanes: single-engine fixed-gear (SEF), single-engine retractable-gear (SER), and multiengine (ME). These classes are useful because they allow pilots and others to study safety issues relevant to the type of aircraft they operate.

Accidents by class of airplane, along with the percentage of the GA fleet represented by each class, are shown in Figure 11. This data indicates that as complexity and performance increase, so does the chance of a fatal accident. This is the result of higher speeds and the need for more advanced piloting skills in the larger aircraft. Analysis of 2006 accidents shows that the safety record for SEF airplanes has improved in all categories compared to the previous year. ME aircraft are typically operated in a wider range of weather conditions than the other two classes, accounting for their relatively high fatality rate. Also, with their higher performance and stall speeds, they are less forgiving of pilot mistakes.

The pilot-related accident categories for each individual aircraft class are examined in detail on the following pages.

Single-Engine Fixed-Gear Aircraft

706 total/118 fatal

Overview

Single-engine fixed-gear airplanes (SEF) account for two-thirds of the general aviation fleet. These versatile machines are used for a wide variety of missions, including pleasure flying, transportation, and instruction.

Total SEF accidents decreased significantly, with 11.3 percent fewer (706) in 2006 as compared to 2005's 796. Similarly, fatal SEF accidents decreased from 152 to 118 (22.4 percent). Much of this reduction came from an improvement in the maneuvering category, which dropped by one-third, from 60 fatal accidents to 40. On the downside, fatal descent/approach accidents nearly doubled from 6.6 to 12.7 percent of the total. This may reflect the change in the fleet composition to more high performance, transportation usage aircraft.

Leading causes of SEF fatal accidents in 2006 were:
- Maneuvering: 33.9 percent (40)
- Takeoff/Climb: 15.3 percent (18)
- Weather: 13.6 percent (16)
- Descent/Approach: 12.7 percent (15)

The Air Safety Foundation is carefully tracking the safety record of the latest generation of SEF technologically advanced aircraft (TAA). In mid-2007, the Foundation updated a detailed safety study examining the safety record of these aircraft. Because of their high performance and advanced technology, ASF is watching for a shift in accident statistics as pilots who formerly operated SER or ME airplanes switch to these high performance fixed-gear machines. Other factors that could affect the analysis are the tendency for new aircraft to fly more hours, and the higher usage of such airplanes in a transportation role.

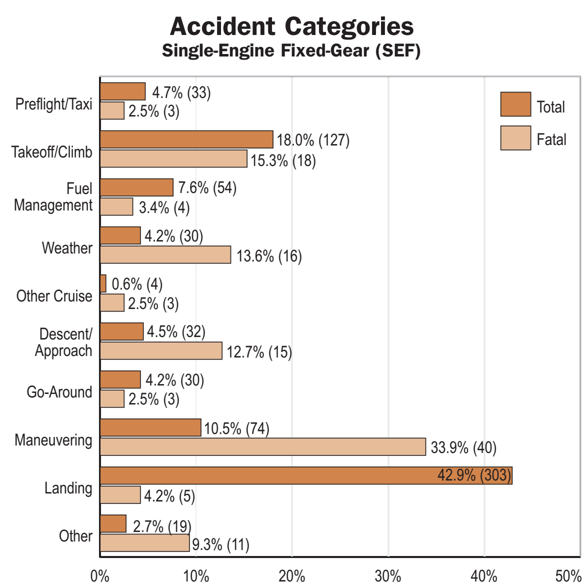


Fig. 12

Fatal Accident Factors

As noted above, SEF maneuvering accidents improved dramatically in 2006; however, this is still the leading category for fatal accidents. The three primary reasons for fatal maneuvering accidents are shown in Figure 13. Collision with terrain, wires, or trees was the most common (52.5 percent), followed by loss of control (42.5 percent). Performance of aerobatic maneuvers accounted for 5 percent of the SER fatal maneuvering crashes. Maneuvering accidents are generally preventable through the use of good pilot judgment and decision making (e.g., don't buzz under any circumstances or perform aerobatics without proper training and equipment). Some of these accidents also result from inadequate basic airmanship skills such as stall recovery and airspeed/altitude maintenance.

Weather continues to be a leading cause of fatal accidents in SEF airplanes. In 2006, weather accounted for only 4.2 percent of total accidents, but was responsible for 13.6 percent of those that were fatal. Figure 14 shows that three-fourths of these fatal weather-related accidents were due to pilot decisions to continue VFR

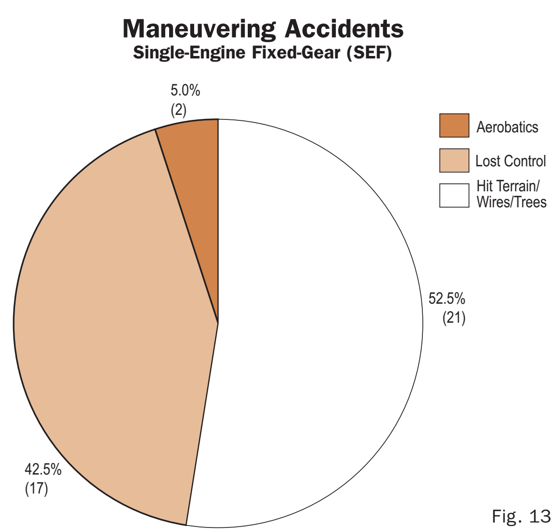


Fig. 13

flight into IMC weather conditions. In such cases, a pilot flying by reference to outside visual cues flies into clouds or low visibility conditions and loses control of the aircraft or hits terrain. Pilots must effectively assess weather-related risks to avoid these situations. In many cases, that means canceling the flight.

Due to the large percentage of SEF airplanes in the GA fleet, the lethality index for SEF is similar to the overall fleet analysis. Worthy of note is the continued drop in weather accident lethality. The rate, which dropped from 91.3 percent in 2004 to 61.1 percent in 2005, has improved further to 53.3 percent in 2006.

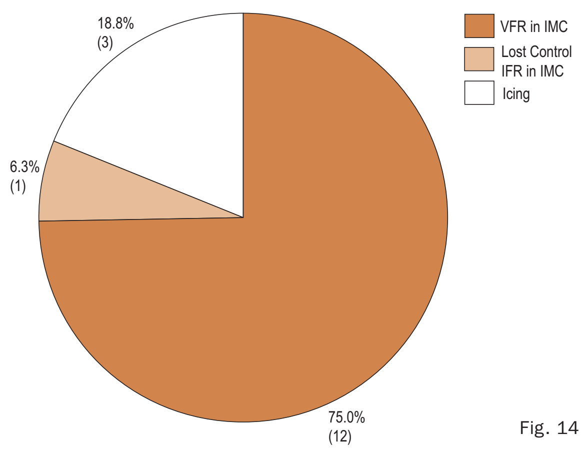


Fig. 14

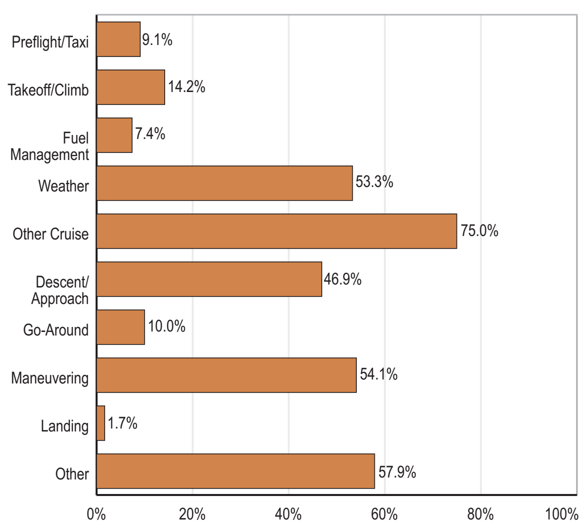


Fig. 15

[DFW06FA187]

Cessna 172; Petal, Mississippi

History of Flight

The private pilot and a passenger attempted to depart from a 1,984-foot long by 30-foot wide grass runway, with the flaps extended to the 40-degree position. The airplane impacted the tops of trees at the departure end of the runway before coming to rest in an inverted position and being consumed in a post-impact fire. According to the Cessna 172N Information Manual, "normal and short field takeoffs are performed with flaps up." The manual further states that "use of 10 degrees of flaps is reserved for takeoff from soft or rough fields," and that "flap settings greater than 10 degrees are not approved for takeoff."

Probable Cause

The pilot's improper use of flaps, which resulted in an impact with trees during takeoff and initial climb.

ASF Comments

In most aircraft, full flaps add a great deal of drag. Throw in a short runway and obstructions in the departure area, and things can go awry very quickly. This accident is a reminder of how important it is to augment memory by following a checklist.

Single-Engine Retractable-Gear Aircraft

174 total/59 fatal

Overview

Single-engine retractable-gear aircraft (SER) continue to be popular because of their high performance and usefulness in transportation missions. When used as travel tools, these airplanes expose their pilots to more complex weather and operational situations than they would if simply used for local pleasure flying.

Though the total number of accidents involving SER airplanes dropped by 21 (10.7 percent), fatal accidents remained unchanged from 2005 (59). A related factor is the decrease in fleet size for SER airplanes, having dropped by almost 10 percent since 2003, as reported in the FAA's General Aviation and Air Taxi Survey.

As with SEF, there was a drop in maneuvering accidents from 30.5 percent to 20.3 percent of total fatal SER accidents. This was partly offset by an increase in descent/approach accidents, with fatals growing from 16.9 percent to 22 percent of the fatal pilot-related accidents. Figure 16 shows the category breakdown for SER accidents in 2006.

Leading causes of SER fatal accidents in 2006 were:

- Descent/Approach: 22.0 percent (13)
- Maneuvering: 20.3 percent (12)
- Other Cruise: 13.6 percent (8)
- Weather: 11.9 percent (7)

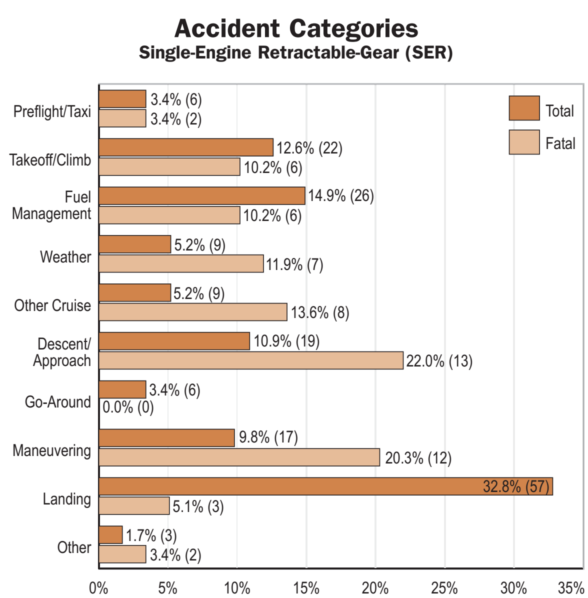


Fig. 16

Fatal Accident Factors

Fatal descent/approach accidents in SER aircraft increased compared to 2005, climbing from 16.9 percent (10) to 22.0 percent (13) of the fatal accidents. This high-workload phase of flight can lead to pilot distractions, inducing loss of control or collisions with the ground. Four of the fatal accidents occurred while operating in VMC, while nine were in IMC.

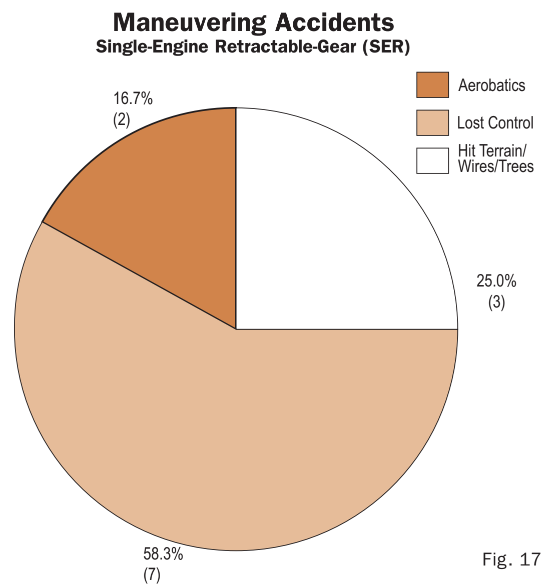


Fig. 17

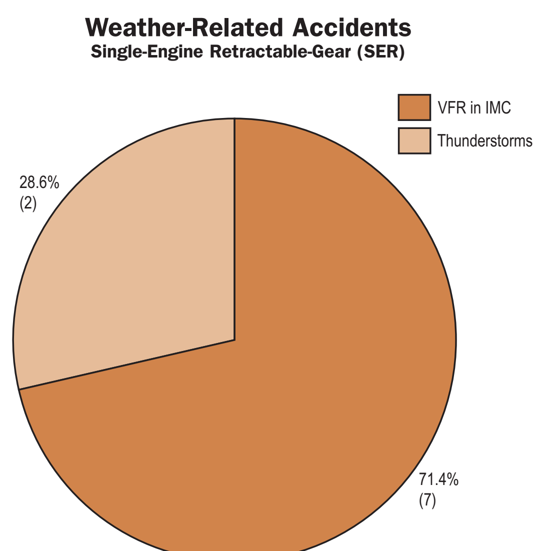


Fig. 18

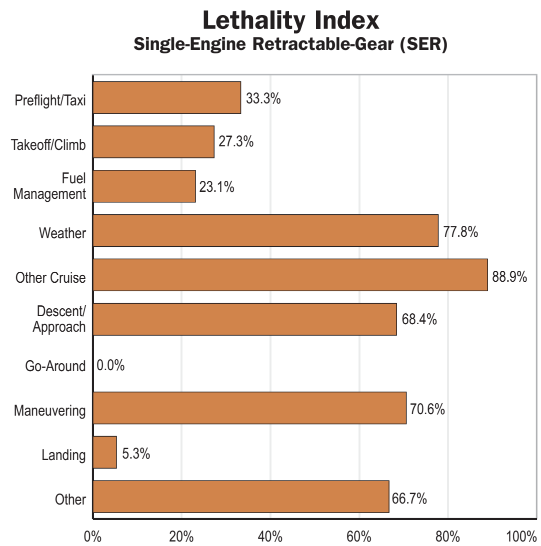


Fig. 19

After jumping dramatically the previous year, maneuvering accidents returned to historical levels in 2006 at 20.3 percent of fatal SER crashes. Over half (58.3 percent) resulted from loss of control; one-fourth from collisions with terrain, wires, or trees; and the remaining 16.7 percent the result of attempted aerobatic flight.

Fatal weather-related accidents held steady in 2006 at 7 (11.9 percent). Most (71.4 percent) were the result of continued VFR flight into IMC. The remaining two accidents involved encounters with thunderstorms.

The lethality index for SER airplanes increased to 27.3 percent for takeoff/climb accidents compared to 2005's 19.2 percent. Preflight/taxi jumped from no fatal accidents in 2005 to two (33.3 percent) in 2006.

Improvement was recorded in the maneuvering category, dropping from 85.7 percent in 2005 to 70.6 percent in 2006.

[DEN06FA111]

Piper PA-28R; Maysville, Colorado

History of Flight

The pilot and his passenger were returning to California after a flight to Wisconsin. The pilot asked local aviators about the best route to fly through Utah. He said he wanted to fly west across Monarch Pass (elevation 11,312 feet msl). It was suggested that he fly south through Poncha Pass before turning west. The airplane took off at 0945 and turned toward Monarch Pass. Witnesses reported seeing a low-wing single-engine airplane flying north up a canyon. When it failed to emerge from the canyon, the witnesses went to investigate and found the wreckage. The accident site was at an elevation of 12,020 feet msl and was surrounded by 13,000- and 14,000-foot mountain peaks. The airplane's right wing struck trees and the airplane came to rest inverted 250 feet away. The landing gear was down and the flaps were up.

Probable Cause

The pilot's inadequate preflight planning/preparation. Contributing factors in this accident were the pilot's lack of familiarity with the geographical area, his becoming lost/disoriented, his decision to disregard the advice of local pilots, the high density altitude, and the reduction in the airplane's climb performance.

ASF Comments

This pilot had numerous opportunities to avoid tragedy, beginning with preflight planning. By disregarding the advice to take an alternate route, and not reversing course when things started looking bad, he virtually guaranteed the eventual outcome.

Multiengine Aircraft

93 total/39 fatal

Overview

Multiengine (ME) aircraft share the complexity and high performance of retractable-gear single-engine airplanes. ME aircraft have a potential safety advantage in the second engine, but higher levels of pilot skill are required if one of the engines does fail, particularly during takeoff or initial climb.

During 2006, there was an increase in the number of total (93 vs. 85) and fatal (39 vs. 31) ME accidents compared to the previous year. Figure 20 shows the data on pilot-related accidents in this class. The leading categories of fatal ME airplane accidents were:

- Descent/Approach: 33.3 percent (13)
- Weather: 23.1 percent (9)
- Takeoff/Climb: 17.9 percent (7)

Fatal Accident Factors

Accidents occurring during descent/approach accounted for 15.1 percent of the total ME accidents and one-third of those leading to death. These rates are double those recorded in the previous year.

ME weather accidents also increased substantially in 2006. They totaled 12.9 percent of all ME accidents, and nearly a quarter of the fatals. As with descent/approach, this rate is about twice that of 2005. Figure 21 shows that encounters with thunderstorms was the leading cause of fatal weather-related accidents in ME airplanes (44.4 percent), with icing a close second at 33.3 percent. There was one accident each in the VFR into IMC and loss of control IFR in IMC categories.

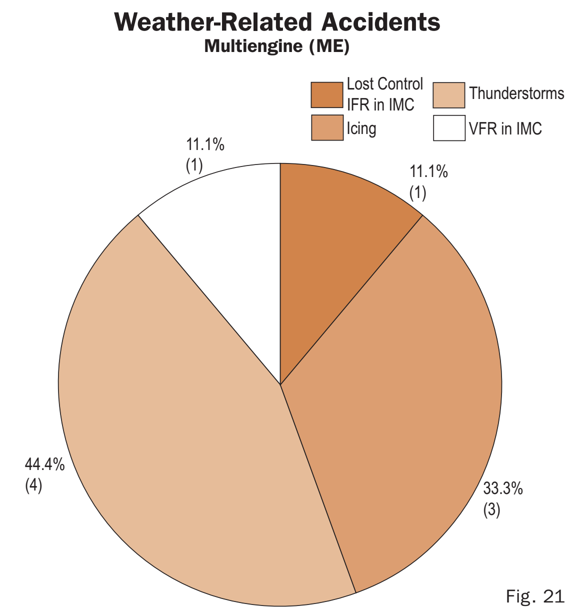


Fig. 21

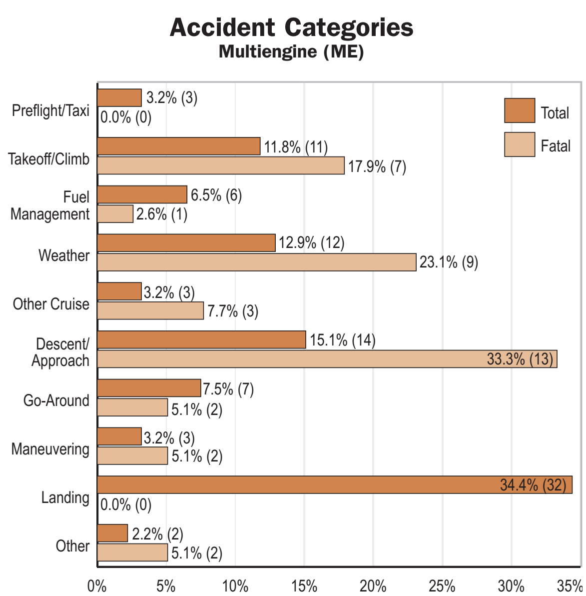


Fig. 20

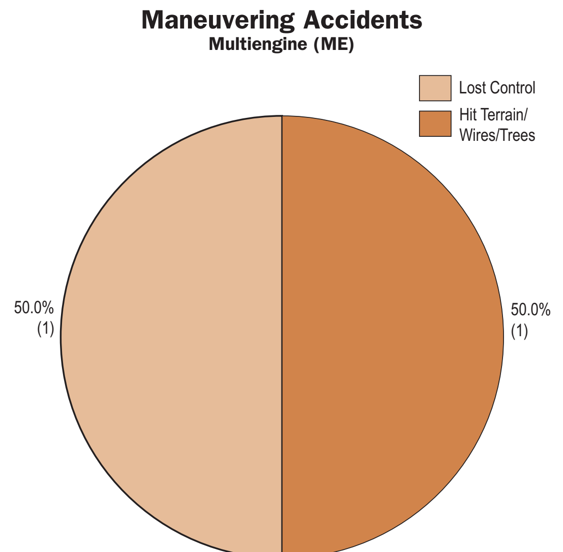


Fig. 22

Lethality Index
Multiengine (ME)

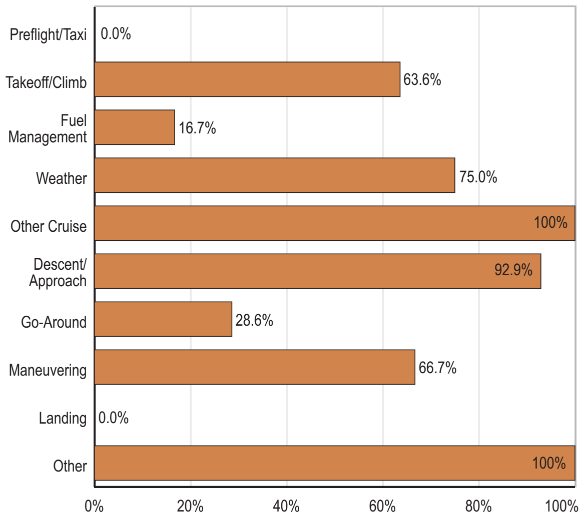


Fig. 23

The percentage of takeoff/climb accidents dropped by nearly half (from 20.0 to 11.8 percent) in 2006 compared to the previous year. This category is still the third deadliest for ME accidents, however, accounting for nearly one in five fatals. A likely contributor to this is the higher takeoff and stall speeds of ME aircraft. Also, in many ME aircraft, loss of power in one engine creates an asymmetrical thrust situation that can challenge an unprepared pilot.

Maneuvering accidents continue to be a bright spot in ME airplanes (Figure 22), with only two fatal accidents in this category for ME airplanes. One was the result of loss-of-control and the other hitting terrain/wires/trees.

The lethality index for ME airplanes (Figure 23) shows that descent/approach, weather, maneuvering, and takeoff/climb were the most deadly. A significant number of "other" and other cruise accidents also fell into this category. At 63.6 percent fatal, takeoff/climb accidents have a much higher rate of fatality than single-engine airplanes.

Accident Case Study

[ATL06FA076]

Piper PA60; Camp Hill, Alabama

History of Flight

The pilot obtained a weather briefing from FSS for a business flight from Cornelia, Georgia, to Pensacola, Florida. The briefing included information on a line of embedded thunderstorm activity along the route from Atlanta to Mobile, including SIGMETs, which advised that tops were forecast to be at 41,000 to 50,000 feet. The pilot filed an IFR flight plan from Cornelia to Pensacola at 16,000 feet. The pilot called flight service again and requested an IFR clearance. The FSS specialist responded that the clearance was on request and placed the pilot on hold. The pilot was not on the line when the specialist returned with the clearance. The pilot departed Cornelia without an IFR clearance, contacted Atlanta Center, and received an IFR clearance to fly direct to Panama City, Florida, at 16,000 feet. Atlanta Center broadcasted convective weather alerts over the radio frequency the pilot was on for the route of flight, though controllers did not issue the pilot any information about severe weather depicted on ATC radar. The airplane was observed by radar to be level at 16,000 feet at 09:19, heading southwest. The airplane was then observed to begin a continuous left turn northwest-bound at 15,700 feet at 09:20. The pilot called Atlanta Center and stated, "Aero Star six eight triple nine we're going to make a reverse," and there was no further radio contact with the pilot. The last radar return showed the airplane at 15,600 feet. The wreckage was located the next day. Examination of the wreckage revealed the right wing separated 9 feet outboard of the wing root. The separated outboard section of the right wing was never found.

Probable Cause

The pilot's continued flight into known thunderstorms resulting in an in-flight breakup. A factor in the accident was the air traffic controller's failure to issue extreme weather radar echo intensity information to the pilot.

ASF Comments

This pilot may have been under pressure to complete this business flight, leading to his decision to continue. Though the controller's radar depicted the presence of the forecast severe weather, this information was not passed on to the pilot. Pilots should be aware that avoidance of severe weather is primarily their responsibility, and that ATC's first priority is the separation of IFR traffic. ATC may not be able to provide pilots with timely information on the location and intensity of convective weather.

Pilot-Related Accident Factors

Flight Hours

The flight experience and flight time and level of pilot certificate held are important in understanding the overall safety picture in general aviation. The flight hours logged by accident pilots are shown in Figure 24. As in previous reports, this year the more experienced pilots were less likely to be involved in an accident. The first 500 hours are the most critical, with one-third of the total and one-fourth of the fatal accidents occurring at that level of experience. In 2007, AOPA found that 34 percent of pilot members had accumulated 500 hours or less of experience. One encouraging trend in this year's numbers is that the percentage of fatal accidents decreased in both the 0-500 (to 25.5 from 30.7 percent) and 501-1000 (to 16.3 from 19.0 percent) groups compared to the previous year.

Accident Rates by Hours of Experience

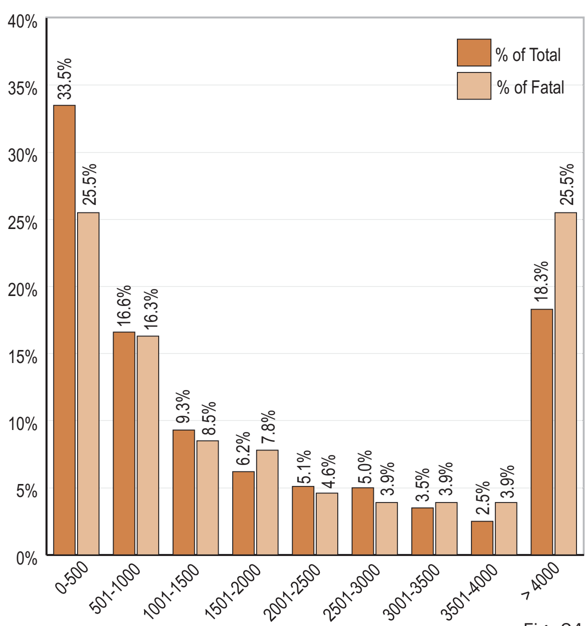


Fig. 24

Time in Type

Accident rates were also analyzed by the level of flight experience in the particular type of aircraft the pilot was flying at the time of the accident. In general, the more time-in-type a pilot has, the less likely he/she is to have an accident in that type of airplane. Pilots with fewer than 100 hours in type accounted for 46.9 percent of the total and 41.3 percent of the fatal accidents. Unfortunately, we do not have any data to correlate time in type to level of activity.

Accident Rates by Time in Type

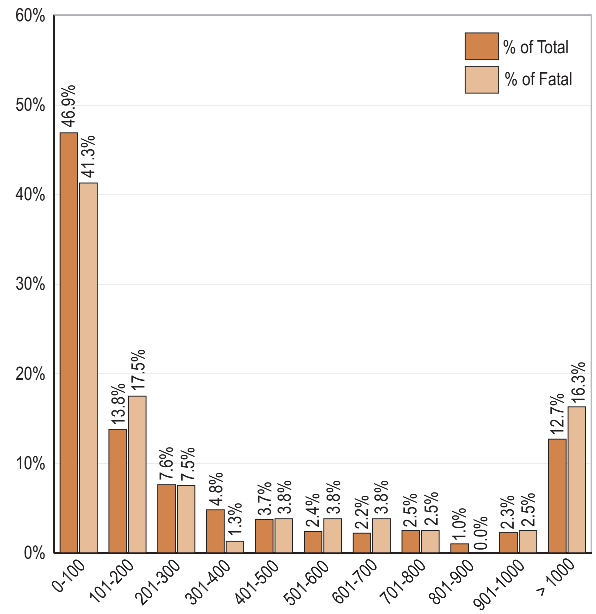


Fig. 25

Accident Rates by Certificate Level

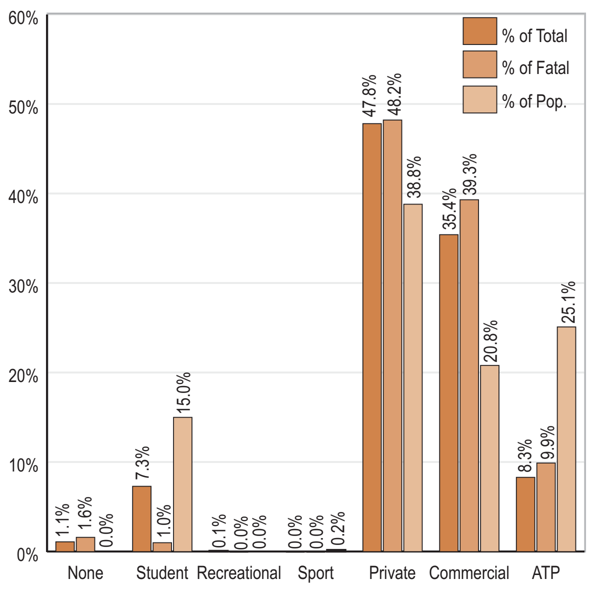


Fig. 26

Certificate Level

Analysis of the certificate level held by accident pilots reveals that student and ATP certificate holders are the safest. This is due to the high level of supervision for student pilots, and the level of experience accumulated by ATP pilots. Private and commercial pilots represent the large majority of accidents. A disturbing trend this year is a noticeable increase in the percentages of total (up 2.7 percent) and fatal (up 5.1 percent) accidents involving commercial pilots, as compared to their proportion of the pilot population.

Personal Flying

682 total/151 fatal

In 2006, personal flights accounted for nearly half (48.2 percent) of general aviation flying, but a disproportionate 71.5 percent of total pilot-related accidents and 71.8 percent of fatal accidents.

Even though this unbalanced situation applied to all accident categories, several categories improved over 2005. Improvements in total pilot-related personal accidents included:

- Weather (from 83.7 to 70.6 percent)
- Descent/approach (from 83.7 to 75.4 percent)
- Go-around (from 83.7 to 65.1 percent)
- Maneuvering (from 63.1 to 57.4 percent)

Fatal personal accidents showed similar improvements.

Proportion of Accidents — Personal Flying

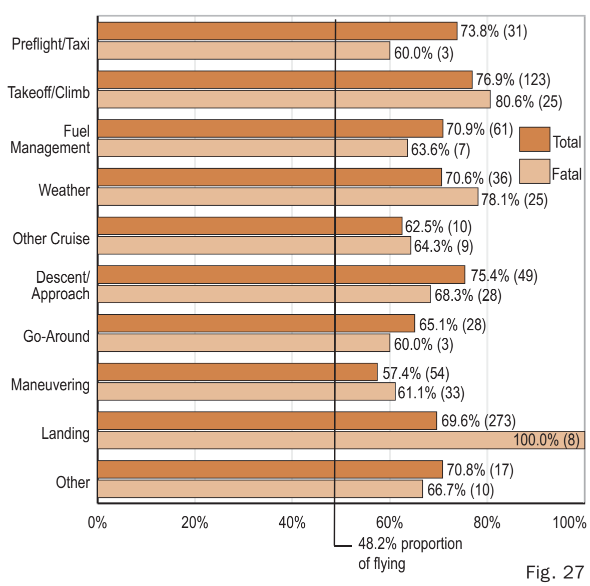


Fig. 27

Business Flying

32 total/14 fatal

General aviation is a key component of the national transportation system, providing service to many cities without adequate airline service. While the airlines serve about 750 airports nationwide, GA has direct access to about 19,000. Many general aviation pilots rely on their airplanes for business transportation, accounting for 15.1 percent of all GA flying in 2006. Figure 28 shows that business flying is proportionately much safer than other types of GA flying. Aircraft used for business flights tend to be properly equipped to handle challenging conditions, and the pilots more experienced and instrument rated.

Business flying accounted for 32 pilot-related accidents in 2006, up two from the year before. Fourteen of those accidents were fatal, however, representing a doubling compared to the previous report. The greatest increases in fatal accidents were in weather (from 6.1 to 15.6 percent), and descent/approach (from 4.0 to 14.6 percent).

Proportion of Accidents — Business Flying

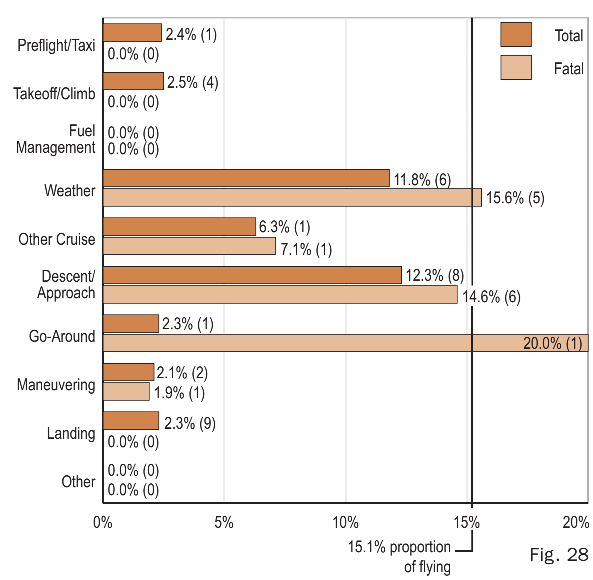


Fig. 28

Instructional Flying

144 total/18 fatal

Instructional flying provides the training and practice that allows pilots to develop and maintain skills, knowledge, and attitudes that directly contribute to safety. In 2006 total pilot-related instructional accidents decreased from 165 to 144, a 12.7 percent improvement over 2005. Fatal instructional accidents increased from 16 to 18 during that period. Figure 29 shows instructional flying accidents by category.

Proportion of Accidents — Instructional Flying

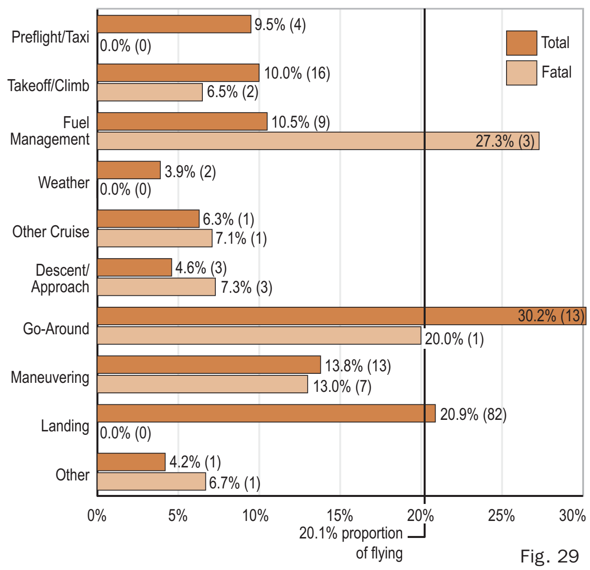


Fig. 29

Accident Case Study

[LAX06FA087]

Cirrus SR20; Lancaster, California

History of Flight

While simulating an engine failure on climbout, the airplane was observed to enter a left teardrop maneuver as it attempted to return to the airport. During the turn, the airplane stalled, entered a spin, and hit level terrain one nautical mile northeast of the departure end of Runway 06. The reported winds were 060 degrees at 15 knots. According to the air traffic controller working the local control position, after completing several touch-and-go landings on Runway 06, the instructor requested a teardrop return to the runway in a simulated engine-out maneuver. During the first one, the airplane made a left teardrop 180-degree turn as it attempted to land on Runway 24. During the turn, the airplane appeared to lose a significant amount of altitude. The controller stated that the airplane recovered prior to landing, and then executed a go-around to reenter the traffic pattern. During the second attempt, the airplane again entered a teardrop turn to the left, and then “spun to the ground.” An examination of the wreckage revealed that the airplane impacted the terrain in a 70-degree nose-down, left-wing low attitude.

Probable Cause

The student pilot’s failure to maintain adequate airspeed while maneuvering, and the flight instructor’s inadequate supervision of the flight. A factor in the accident was the strong tailwind encountered as the airplane turned from upwind to downwind during the teardrop maneuver.

ASF Comments

The return-to-airport maneuver has long been a killer. In this case, the instructor is at fault for trying to develop his student’s proficiency in a high-risk emergency procedure and failing to keep a simulated emergency from becoming real. In nearly all cases, choosing an off-airport landing spot straight ahead is the best option in the event of an engine failure.

Mechanical/Maintenance Accidents

223 total/27 fatal

When properly maintained, general aviation aircraft are very reliable. As a result, systems failures that create safety problems are relatively rare. Mechanical/maintenance accidents are caused by mechanical failures that adversely affect the function or performance of the aircraft. Though pilots are responsible for assuring airworthiness, when an equipment failure leads to an accident, it is considered a mechanical/ maintenance accident. Malfunctions causing accidents in 2006 (Figure 30) were very similar to those the previous year. Engine and propeller malfunctions accounted for 44.4 percent (99) of the total, and 66.7 percent (18) of fatal, mechanical/maintenance accidents.

Over the past eight years, mechanical/maintenance accidents have shown a slight upward trend, but this comes as the fleet continues to age, with the average age of a GA aircraft passing 30 years.

Accident Causes — Mechanical/Maintenance

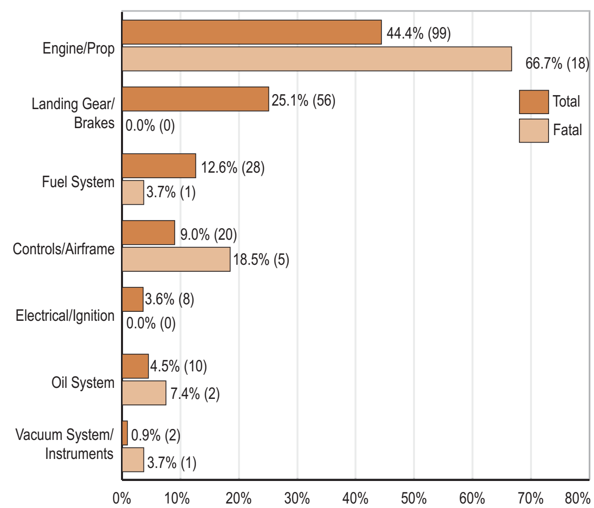


Fig. 30

Accident Trend — Mechanical/Maintenance

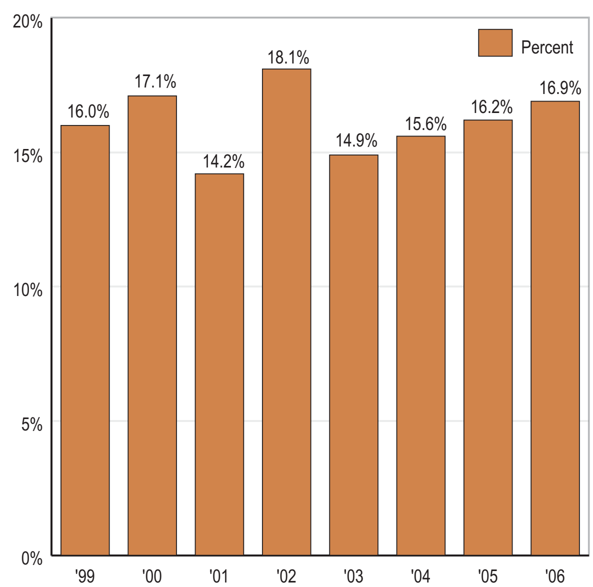


Fig. 31

Night and Weather

Flights conducted at night and/or in adverse weather are more challenging than daytime and/or VMC operations. In spite of this, accidents are more likely to occur during the day than at night (7.1 vs. 6.6 accidents per 100,000 hours), and are also more likely to occur in VMC than IMC (7.2 vs. 5.7 accidents per 100,000 hours). Figure 32 presents 2006 accident data sorted by day vs. night and VMC vs. IMC.

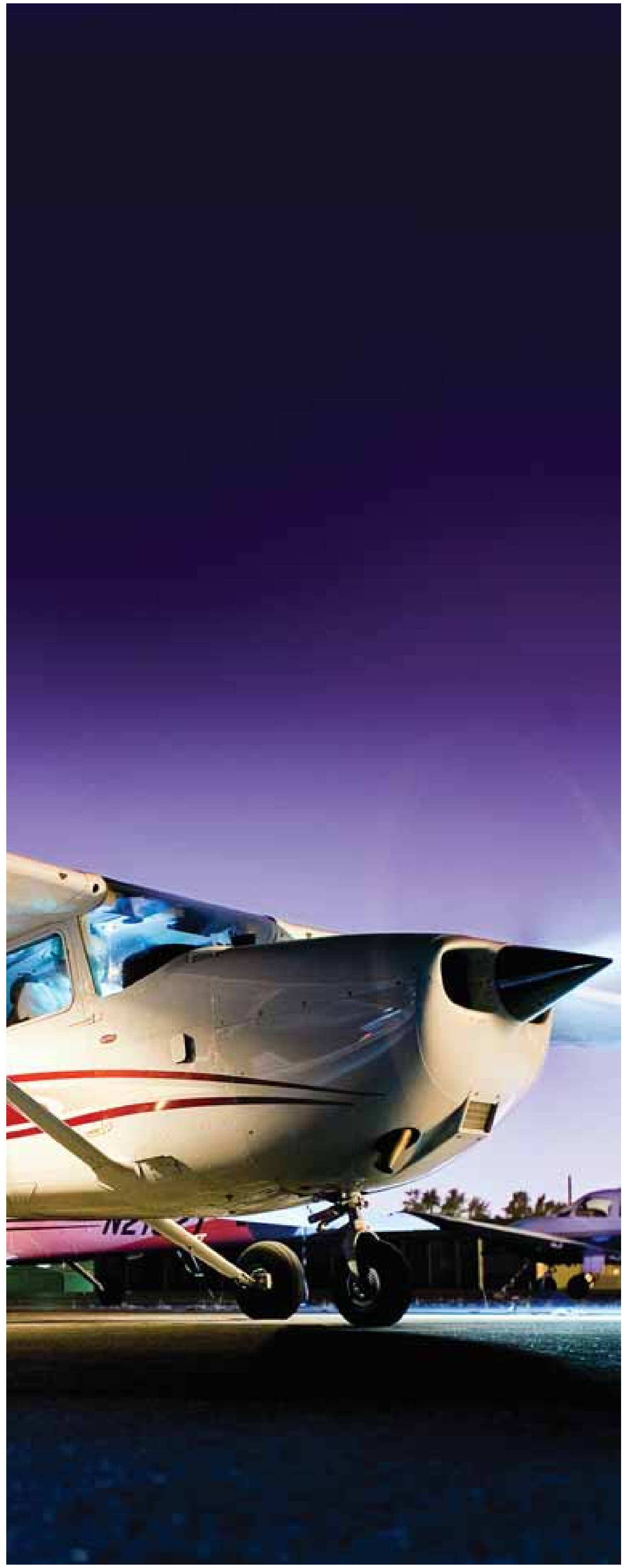
Though the total numbers are lower, accidents at night and in IMC are more likely to be fatal. Only 19.2 percent of daytime accidents resulted in fatalities, but over one-third (34.6 percent) of all night accidents were fatal. Though only 16.9 percent of accidents in VMC were fatal, in IMC nearly three-fourths (73.9 percent) claimed a life.

Accident Causes – Weather and Light

Condition	Accident Total (Fatal)	Percent Fatal	Accident Rate/ 100,000 Hours	Fatal Acc Rate/ 100,000 Hours
Day	1192 (229)	19.2%	7.1	1.4
Night	127 (44)	34.6%	6.6	2.6
VMC	1231 (208)	16.9%	7.2	1.2
IMC	88 (65)	73.9%	5.7	4.2
Day VMC	1131 (184)	16.3%	7.3	1.2
Night VMC	100 (45)	45.0%	6.2	2.8
Day IMC	61 (24)	39.3%	5.0	2.0
Night IMC	27 (20)	74.1%	8.4	6.2

Fig. 32

Looking at the combined factors, day VMC accidents had the lowest fatal accident rate of any light/weather condition, with 16.3 percent resulting in death. Day IMC accidents totaled 39.3 percent. At night, nearly half of the accidents in VMC conditions were fatal (45.0 percent), compared to nearly three-fourths of night IMC accidents (74.1 percent).



Amateur Built Aircraft

126 total/40 fatal

According to data from the FAA Registration database, the amateur built aircraft fleet has grown by over 47 percent in the last 10 years. They include a wide variety of designs and technologies, and cover the full range from simple, low-performance pleasure craft to high-tech, high-performance models. Most are single engine. Pilots of amateur built aircraft represent the entire spectrum of experience and certification.

Pilot-Related Accident Categories — Amateur Built

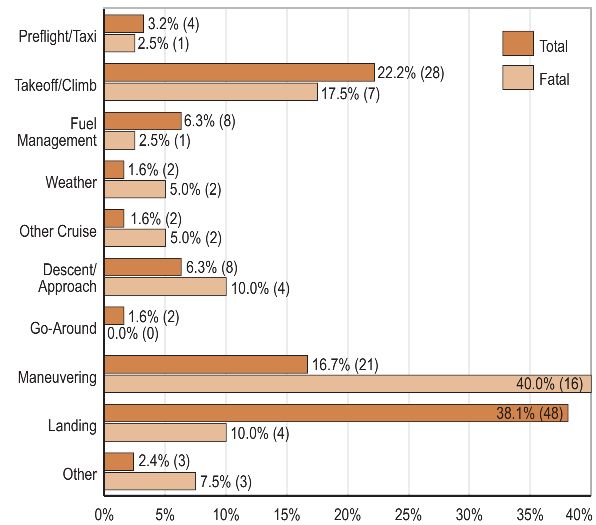


Fig. 33

Pilot-related accidents in amateur built aircraft remained steady in 2006 at 126 while fatal accidents dropped 14.9 percent to 40 from 47 in 2005. Figure 33 depicts the leading categories of pilot-related amateur built aircraft accidents. Four categories accounted for 77.5 percent of fatal amateur built accidents. They were:

- Maneuvering: 40.0 percent (16)
- Takeoff/Climb: 17.5 percent (7)
- Descent/Approach: 10.0 percent (4)
- Landing: 10.0 percent (4)

Figure 34 tracks the proportion of pilot-related accidents in amateur built aircraft to overall GA accidents over the last eight years. Both total and fatal amateur built accidents continue to increase gradually.

Proportion of Accidents — Amateur Built

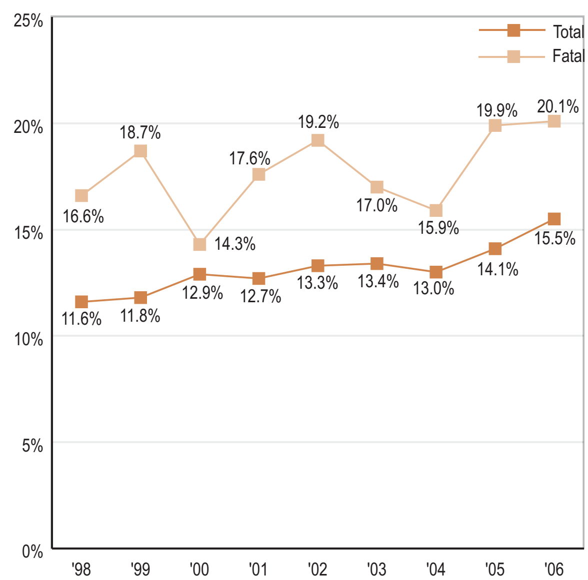


Fig. 34

Other Accident Factors

Fuel Management

86 total/11 fatal

Easily preventable, fuel management accidents include fuel exhaustion (the airplane runs out of gas), fuel starvation (fuel remains on board but is prevented from reaching the engine, e.g., failing to switch tanks at the right time), and fuel contamination. In 2006, 63 (eight fatal) accidents were a result of fuel exhaustion. Fuel starvation caused 17 (three fatal) accidents, and fuel contamination resulted in six (none fatal). These numbers are significantly lower than the 113 total and 20 fatal fuel management accidents in 2005.

Midair Collisions

6 total/4 fatal

Collisions between aircraft in flight are relatively rare. Most happen in day VFR conditions, frequently in or near an airport traffic pattern. Total midair collisions for 2006 dropped to six from the previous year's 10. Fatal midair accidents remained at four, with nine persons killed. As collision avoidance technology becomes more widespread in general aviation, these numbers may improve in coming years.

Alcohol and Drugs

6 total /5 fatal

Alcohol and drug misuse continues to rank low as an accident factor. Historically, these have been cited as a cause or factor in about 1.1 percent of all accidents. As a class, these accidents have a high probability of ending in a fatality. In 2006, six accidents were attributed to alcohol or drugs, with all but one being fatal. Of the total, three pilots were impaired by alcohol and three by illicit drugs.

Pilot Incapacitation

5 total/3 fatal

Pilot incapacitation happens very rarely. Of the five incapacitation accidents that occurred in 2006, two were the result of heart attacks, and one was anoxia/hypoxia. In another accident, the cause of incapacitation had not been determined at press time but was likely a heart attack. The remaining crash involved an unknown cause of incapacitation.

Ground Injuries: Off-Airport

6 total/2 fatal, 11 injured/ 2 fatalities

The thought of airplanes falling out of the sky, causing death or injury on the ground, is a common worry for non-pilots. This concern is often cited as a reason to restrict or close GA airports, even though statistics show it is far more fiction than fact. In 2006 there were a total of six GA accidents that resulted in off-airport ground injuries. One accident in Alaska involved an L-39, which crashed and caused five minor injuries on the ground. The two fatal accidents involved a flight that crashed while maneuvering, and one where a mobile home was struck during landing.

Propeller Strike Injuries

4 total/3 fatal

Propeller strike injuries usually result from either an attempt to hand-prop an airplane or inadvertent contact with a moving propeller by an individual in the ramp area. The number of fatalities from propeller strikes is very low, averaging two per year. Four propeller strike accidents occurred in 2006, two of which were hand-prop accidents. One of these was fatal. The other two fatalities were the result of individuals coming into contact with spinning propellers on the ramp.

Accident Case Study

[SEA06FA038]

Mooney MK-20TC;
North Plains, Oregon

History of Flight

The pilot was flying a VFR practice ILS approach. Approximately 4 nm from the runway, he reported a loss of engine power to air traffic control (ATC). In his last transmission, the pilot said he had a turf airstrip beneath him. A witness, who was a certificated pilot, said the airplane went into a steep right turn with a 30 to 40 degree nose-low attitude. He said that it looked like a spin entry. Several residents at the private residential airpark heard a loud noise and found the downed aircraft. They reported not smelling any fuel fumes at the accident scene, and there was no post-impact fire. The aircraft had been airborne for approximately 45 minutes. Aerial photographs indicated that the private airstrip was bordered on two sides by two 180-acre plots of open crop land, with no obstacles.

Probable cause

The pilot's failure to maintain airspeed while maneuvering for a forced landing, resulting in a stall-spin and uncontrolled descent. A contributing factor was the loss of engine power due to fuel exhaustion, resulting from the pilot's inadequate preflight planning.

ASF Comments

Although the stall-spin was the final link in the chain of events, the pilot's failure to make sure there was enough fuel onboard was the error that started this fatal sequence.

Summary

Overall, the GA accident rate per 100,000 flight hours continues its decade-long decline, having dropped from 7.19 per 100,000 hours in 1997 to 6.32 per 100,000 hours in 2006. In the period between 2002 and 2006, the number of GA accidents has declined by almost 11 percent, while annual estimated GA flight hours have decreased by 1.5 million or about 6 percent. This means that while the overall GA flight hours have dropped, the decline in accidents in that same timeframe is outpacing the decline in flight hours — proof that GA continues to focus on and improve its safety record.

While this is encouraging news, there is still work to be done. The AOPA Air Safety Foundation continues to work for additional improvements in GA safety and in 2006 reached more pilots than ever before with its safety message (see graph below).

2006 Safety Education Programs	Outreach
Safety Seminar Attendance	34,256
Live Seminars Presented	203
ASF Seminar Kits	744
In-Person FIRCs	5,080
Online FIRCS	5,702
Instructor Reports	384,800
Online Safety Courses	77,160
Sporty's Safety Quizzes	127,218
Database Queries	396,473
Publication Downloads	313,536
DVD Mailings	46,956

Here are the highlights of GA accident trends for 2006:

- The accident rates per 100,000 hours for GA aircraft were 6.32 total and 1.26 fatal.

- Pilot-related accidents in 2006 decreased from 1076 to 973 for total and 242 to 216 for fatal accidents. This represents a drop of 9.6 and 10.7 percent respectively, compared to 2005.

- Maneuvering accidents, which accounted for 54 (25.0 percent) of fatal GA accidents, showed an improvement from 80 (33.1 percent) the previous year. Fatal descent and approach accidents, on the other hand, increased from 25 (10.3 percent) of the fatal crashes in 2005 to 41 (19.0 percent) in 2006.

- Pilot-related weather crashes were comparable to the previous year, registering 51 (5.2 percent) of the total and 32 (14.8 percent) of fatal pilot-related accidents. The majority of fatal weather accidents in single-engine aircraft resulted from VFR flight into IMC. The long-term trend for weather accidents continues to increase.

- Personal flights accounted for nearly half (48.2 percent) of general aviation flying, but a disproportionate 71.5 percent of total accidents and 71.8 percent of fatal accidents.

- There was a noticeable improvement in fatal accidents for pilots with 1,000 hours of total experience or less (from 49.7 percent to 41.8 percent), and a similar reduction for pilots with 100 hours of time-in-type or less (from 43.0 percent to 41.3 percent). The percentage of accidents involving holders of commercial certificates increased in 2006 from 32.7 percent to 35.4 percent.

- Accidents are more likely to occur during the day than at night (7.1 vs. 6.6 accidents per 100,000 hours), and are also more likely to occur in VMC than IMC (7.2 vs. 5.7 accidents per 100,000 hours).

Those who cannot remember the past are condemned to repeat it.

—George Santayana

Appendix

GA Safety vs. Airlines

GA accident rates have always been higher than airline accident rates. People often ask about the reasons for this disparity. There are several:

• **Variety of missions –** GA pilots conduct a wider range of operations. Some operations, such as aerial application (crop-dusting, in common parlance) and banner towing, have inherent mission-related risks.

• **Variability of pilot certificate and experience levels –** All airline flights are crewed by at least one ATP (airline transport pilot), the most demanding rating. GA is the training ground for most pilots, and while the GA community has its share of ATPs, the community also includes many new and low-time pilots and a great variety of experience in between.

• **Limited cockpit resources and flight support –** Usually, a single pilot conducts GA operations, and the pilot typically handles all aspects of the flight, from flight planning to piloting. Air carrier operations require at least two pilots. Likewise, airlines have dispatchers, mechanics, loadmasters, and others to assist with operations and consult with before and during a flight.

• **Greater variety of facilities –** GA operations are conducted at about 5,000 public-use and 8,000 private-use airports, while airlines are confined to only about 750 of the larger public-use airports. Many GA-only airports lack the precision approaches, long runways, approach lighting systems, and the advanced services of airline-served airports. (There are also another 6,000 GA-only landing areas that are not technically airports, such as heliports and seaplane bases.)

• **More takeoffs and landings –** During takeoffs and landings aircraft are close to the ground and in a more vulnerable configuration than in other phases of flight. On a per hour basis, GA conducts many more takeoffs and landings than either air carriers or the military.

• **Less weather-tolerant aircraft –** Most GA aircraft cannot fly over or around weather the way airliners can, and they often do not have the systems to avoid or cope with hazardous weather conditions, such as ice.

What Is General Aviation?

Although GA is typically characterized by recreational flying, it encompasses much more. Besides providing personal, business, and freight transportation, GA supports diverse activities such as law enforcement, forest fire fighting, air ambulance, logging, fish and wildlife spotting, and other vital services. For a breakdown of GA activities and their accident statistics, see "Type of Operation" on page 6.

What Does General Aviation Fly?

General aviation aircraft are as varied as their pilots and the types of operations flown. The following aircraft categories and classes are included in each year's Nall Report:

- Piston single-engine
- Piston multiengine
- Turboprop single-engine
- Turboprop multiengine
- Experimental
- Homebuilt
- Turbojet

What Does General Aviation Fly?

	Air Taxi	General Aviation
Piston Single Engine	1,452	143,584
Piston Multiengine	1,562	17,146
Turboprop Single Engine	469	2,107
Turboprop Multiengine	954	4,533
Turbojet	2,489	7,890
Helicopter	2,036	7,123
Experimental	75	22,972
Light Sport	0	1,273
TOTAL	**9,037**	**206,628**

Fig. 35

The following aircraft categories, classes, and operations are not included in each year's Nall Report:

- FAR Part 121 airline operations
- FAR Part 135 charter operations
- Military operations
- Aircraft weighing more than 12,500 pounds
- Helicopters
- Gliders
- Balloons

The number of GA aircraft, sorted by category and class, registered in 2005 to air taxi operators and GA is shown in Figure 35 on the previous page.

Figure 35 displays the composition of the powered GA fleet, divided by aircraft class and by the type of operation. The aircraft covered in this report comprise 90.6 percent of the GA fleet, if one totals homebuilt aircraft, all singles, and all piston aircraft.

Interpreting Aviation Accident Statistics: What is the accident rate?

Meaningful comparisons are based on equal exposure to risk. However, this alone does not determine total risk. Experience, proficiency, equipment, and flight conditions all have a safety impact. To compare different airplanes, pilots, types of operations, etc., we must first "level the playing field" in terms of exposure to risk. The most common way to do this is to compare accidents per 100,000 flight hours. GA flight hours are estimated using data from an annual aircraft activity survey conducted by the FAA. In the last few years, the FAA has made a considerable investment to improve both the accuracy and sample size of the activity survey. Whether this survey accurately reports the total hours has been debated for years, but even with likely inaccuracies, the relationships between accident categories will remain constant. For instance, landing accidents will still account for the majority of minor injury mishaps, while weather and maneuvering flight will still claim the most lives.

Accident investigators and safety researchers determine the probability that a given accident was the result of a particular cause or sequence of events. This report shows the percentage of accidents attributed to a particular accident category and the percentage of accident sequences that began in a particular phase of flight. Thus we can identify and concentrate on accidents that carry the greatest risk.

NTSB Definitions

Accident/Incident (NTSB Part 830)

The following definitions of terms used in this report have been extracted from NTSB Part 830 of the Federal Aviation Regulations. It is included in most commercially available FAR/AIM digests and should be referenced for detailed information.

Aircraft Accident

An occurrence incidental to flight in which, "as a result of the operation of an aircraft, any person (occupant or nonoccupant) receives fatal or serious injury or any aircraft receives substantial damage."

- **A fatal injury** is one that results in death within 30 days of the accident.

- **A serious injury** is one that:

(1) Requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received.

(2) Results in a fracture of any bone (except simple fractures of fingers, toes, or nose).

(3) Involves lacerations that cause severe hemorrhages, nerve, muscle, or tendon damage.

(4) Involves injury to any internal organ. Or

(5) Involves second- or third-degree burns, or any burns affecting more than five percent of body surface.

- **A minor injury** is one that does not qualify as fatal or serious.

- **Destroyed** means that an aircraft was demolished beyond economical repair, i.e., substantially damaged to the extent that it would be impracticable to rebuild it and return it to an airworthy condition. (This may not coincide with the definition of "total loss" for insurance purposes. Because of the variability of insurance limits carried and such additional factors as time on engines and propellers, and aircraft condition before an accident, an aircraft may be "totaled" even though it is not considered "destroyed" for NTSB accident-reporting purposes.)

- **Substantial damage** – As with "destroyed," the definition of substantial for accident reporting purposes does not necessarily correlate with "substantial" in terms of financial loss. Contrary to popular misconception, there is no dollar value that defines "substantial" damage. Because of the high cost of many repairs, large sums may be spent to repair damage resulting from incidents that do not meet the NTSB definition of substantial damage.

(1) Except as provided below, substantial damage means damage or structural failure that adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected part.

(2) Engine failure, damage limited to an engine, bent fairings or cowling, dented skin, small puncture holes in the skin or fabric, ground damage to rotor or propeller

blades, damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wing tips are not considered "substantial damage."

- **Minor damage** is any damage that does not qualify as substantial, such as that in item (2) under substantial damage.

Type of Flying

The purpose for which an aircraft is being operated at the time of an accident:

- **On-Demand Air Taxi –** Revenue flights, conducted by commercial air carriers operating under FAR Part 135 that are not operated in regular scheduled service, such as charter flights and all non-revenue flights incident to such flights.

- **Personal –** Flying by individuals in their own or rented aircraft for pleasure or personal transportation not in furtherance of their occupation or company business. This category includes practice flying (for the purpose of increasing or maintaining proficiency) not performed under supervision of an accredited instructor and not part of an approved flight training program.

- **Business –** The use of aircraft by pilots (not receiving direct salary or compensation for piloting) in connection with their occupation or in the furtherance of a private business.

- **Instruction –** Flying accomplished in supervised training under the direction of an accredited instructor.

- **Executive/Corporate –** The use of aircraft owned or leased, and operated by a corporate or business firm for the transportation of personnel or cargo in furtherance of the corporation's or firm's business, and which are flown by professional pilots receiving a direct salary or compensation for piloting.

- **Aerial Application –** The operation of aircraft for the purpose of dispensing any substance for plant nourishment, soil treatment, propagation of plant life, pest control, or fire control, including flying to and from the application site.

- **Aerial Observation –** The operation of an aircraft for the purpose of pipeline/power line patrol, land and animal surveys, etc. This does not include traffic observation (electronic newsgathering) or sightseeing.

- **Other Work Use –** The operation of an aircraft for the purpose of aerial photography, banner/glider towing, parachuting, demonstration or test flying, racing, aerobatics, etc.

- **Public Use –** Any operation of an aircraft by any federal, state, or local entity.

- **Ferry –** A non-revenue flight for the purpose of (1) returning an aircraft to base, (2) delivering an aircraft from one location to another, or (3) moving an aircraft to and from a maintenance base. Ferry flights, under certain terms, may be conducted under terms of a special flight permit.

- **Positioning –** Positioning of the aircraft without the purpose of revenue.

- **Other –** Any flight that does not meet the criteria of any of the above.

- **Unknown –** A flight whose purpose is not known.

Phase of Flight

The phase of the flight or operation is the particular phase of flight in which the first occurrence or circumstance occurred:

- **Standing –** From the time the first person boards the aircraft for the purpose of flight until the aircraft taxies under its own power. Also, from the time the aircraft comes to its final deplaning location until all persons deplane. Includes preflight, starting engine, parked-engine operating, parked-engine not operating, and idling rotors.

- **Taxi –** From the time the aircraft first taxies under its own power until power is applied for takeoff. Also, when the aircraft completes its landing ground run until it parks at the spot of engine shutoff. Includes rotorcraft aerial taxi. Includes taxi to takeoff and taxi from landing.

- **Takeoff –** From the time the power is applied for takeoff up to and including the first airborne power reduction, or until reaching VFR traffic pattern altitude, whichever occurs first. Includes ground run, initial climb, and rejected takeoff.

- **Climb –** From the time of initial power reduction (or reaching VFR traffic pattern altitude) until the aircraft levels off at its cruise altitude. Also includes en route climbs.

- **Cruise –** From the time of level off at cruise altitude to the beginning of the descent.

- **Descent –** From the beginning of the descent from cruise altitude to the IAF, FAF, outer marker, or VFR pattern entry, whichever occurs first. Also includes en route descents, emergency descent, auto-rotation descent, and uncontrolled descent.

- **Approach –** From the time the descent ends (IAF, FAF, outer marker, or VFR pattern entry) until the aircraft reaches the MAP (IMC) or the runway threshold (VMC). Includes missed approach (IMC) and go-around (VMC).

- **Landing –** From either the MAP (IMC) or the runway threshold (VMC) through touchdown or after touchdown off an airport, until the aircraft completes its ground run. Includes rotorcraft run-on, power-on, and auto-rotation landings. Also includes aborted landing where touchdown has occurred and landing is rejected.

- **Maneuvering –** Includes the following: aerobatics, low pass, buzzing, pull-up, aerial application maneuver, turn to reverse direction (box-canyon-type maneuver), or engine failure after takeoff and pilot tries to return to runway.

- **Other –** Any phase that does not meet the criteria of any of the above. Examples are practice single-engine air work, basic air work, external load operations, etc.

- **Unknown –** The phase of flight could not be determined.

Additional Resources

If you would like additional information about the topics covered in this report, as well as many other topics not covered, visit ASF's Web site: www.asf.org.

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