AOPA Air Safety Foundation

2000 NALL REPORT

General Aviation Accident Trends and Factors for 1999

Dedication

Joseph T. Nall

The Joseph T. Nall Report 2000 is the AOPA Air Safety Foundation's review of general aviation aircraft accidents that occurred during 1999. This 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.

This is a preliminary report based on accident reports that were available from the NTSB by August 2000. At that time, 80.7 percent of their reports on the general aviation fixed-wing aircraft accidents that occurred during 1999 had been finalized. Why only 80.7 percent? Accident investigation takes a long time—sometimes up to three years. In an effort to provide the most current safety information to the pilot community as soon as possible, the AOPA Air Safety Foundation gathered data from the NTSB throughout the first eight months of 2000 and targeted this publication for the end of 2000. At that time, the NTSB had finalized only 62.5 percent of its reports on fatal accidents, along with 82.7 percent of the accidents with serious injuries, 84.7 percent of the accidents with only minor injuries, and 85.3 percent of those fortunate accidents in which no one was injured. These numbers, added together, give us the above-mentioned overall figure of 80.7 percent of the accident reports being complete. ***The conclusions based on these preliminary reports usually do not change significantly when the final reports are complete, but you should be aware that the numbers might change.***

Only accidents involving fixed-wing general aviation aircraft weighing less than 12,500 pounds are included in this report.

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

National Transportation Safety Board
Federal Aviation Administration
Aircraft Owners and Pilots Association

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Executive Overview

General aviation's safety record continued the gradually improving trend that began several years ago. Overall, accidents were up slightly, fatal accidents were down slightly, and fatalities increased marginally. This was against the backdrop of increased flight hours, resulting in an estimated accident rate that is the lowest since record keeping began in 1938. This trend began in 1994 and although the decreases are small, it shows that the combination of improved technology and education appears to be working.

However, GA pilots continue to have many accidents that defy logic, especially when they fall into the category of "normal flight operations." Everyone understands that certain types of flying, such as aerial application, firefighting, and some types of law enforcement, involve risk that the average pilot does not face. Personal flying, people using airplanes for travel and recreation, still has a disproportionate number of mishaps. Considering the nature of GA, that should not be surprising. The flexibility that is the trademark of this activity, the freedom to travel where and when we please, puts additional burden on pilots to use that freedom wisely.

In general terms, little has changed significantly since last year. Low-level maneuvering flight and weather remain the two largest fatal accident categories, as they have for the last decade. However, there has been a slight improvement in weather-related accidents and while we won't call it a trend yet, the hope is that pilots are heeding the message that VFR flight into instrument conditions is not a life-prolonging activity.

Do we need more study in this area? Perhaps, but what is really needed is for both new, inexperienced pilots and complacent, old graybeards to fully comprehend the risk and decide that no matter what the mission, their lives and those of their passengers are worth more than any schedule. ASF has had a massive education campaign underway for the past five years on weather decision making. We have conducted over 1,000 free seminars and given away thousands of videotapes on the subject. These efforts will continue with the ASF SkySpotter™ program, a campaign to get pilots to submit a pilot report on every flight. This will improve our ability to forecast and nowcast the weather significantly.

Low-level maneuvering fatalities fall into the easily preventable category and this became the leading fatal accident phase of flight for '99. Hitting towers, wires, other objects, and the ground itself in VFR conditions is generally inexcusable with few exceptions. Likewise, stalling an aircraft close to the ground must be considered poor airmanship.

To make the *Nall Report* both timely and accurate, we balance between the need to obtain the greatest number of fully completed accident reports and to publish as quickly as prudent. Traditionally, final accident reports make up the vast majority (over 80 percent) of the data with the balance of preliminary reports included for completeness. We believe that this practice has not significantly changed either numbers or percentages of the overall analysis in any particular area. To verify that assumption, a comparison was made between the projections in the *1999 Nall Report* and the result once all of the final reports were complete, which was late last year.

In almost every case, both the pattern and the relationships between accident categories remained identical. For example, the projection for fatal maneuvering accidents was 18.8 percent. The final tally came in at 19.7 percent. The fatal weather accident prediction, based on pilot-related causes was 21.9 percent and the verification was 19.2 percent. Investigation of fatal mechanical/maintenance accidents frequently takes longer and is an area where we had expected some variability. However, the final numbers did not change greatly and none of the relative positions changed significantly.

This year, due to increasing flight activity, **ASF, in cooperation with the FAA, will focus on collision avoidance.** In flight and on the ground, pilots and instructors will be reminded of the need for vigilance. **A fuel awareness campaign is also underway to reduce fuel exhaustion and starvation mishaps. Weather education programs will continue and a renewed assault on maneuvering flight accidents is contemplated.**

As always, our thanks to the FAA and NTSB staff without whose efforts this report would not be possible. Contributions from AOPA, individual pilot donors, and our corporate sponsors helped to underwrite this annual effort and we are most appreciative of their support.

Let's make this year the best one ever for general aviation safety.

Safe Pilots. Safe Skies.

Bruce Landsberg
Executive Director
AOPA Air Safety Foundation

Background

What Is General Aviation?

Although general aviation (GA) is typically characterized by recreational flying, this important segment of aviation includes much more. Besides providing personal, business, and freight transportation, GA supports diverse activities such as law enforcement, forest firefighting, air ambulance, logging, fish and wildlife spotting, and other vital services. For a breakdown of GA activities and their accident statistics, see "Analysis of Specific Operations" on page 14.

What Does General Aviation Fly?

Aircraft used in GA are as varied as the pilots and the types of operations in which they are involved. The number of aircraft, sorted by category and class, registered in 1998 (the most recent year available from the FAA) to airlines, air taxi operators, and GA is shown below.

This safety report addresses accidents involving most of the types of aircraft listed below. Accidents involving turbojets, aircraft used in Part 121 airline, Part 135 charter, or military operations, aircraft weighing more than 12,500 pounds, helicopters, gliders, and balloons are *NOT* included. (However, midair collisions involving a general aviation fixed-wing aircraft and another aircraft category or commercial/military operation will be included.)

	Airlines	Air Taxi	GA
Piston Single-Engine	167	740	143,494
Piston Multiengine	44	1,797	16,932
Turboprop Single-Engine		53	980
Turboprop Multiengine	1,837	906	4,235
Turbojet	5,108	515	5,551
Helicopter	3	1,030	6,395
Experimental		22	16,480
Total	7,159	5,063	194,067

Analysis

Interpreting Aviation Accident Statistics

Everyone has heard about "the accident rate," but what does that really mean? How do we compare statistics and arrive at conclusions?

To be meaningful, comparisons must be based upon equal exposure to risk. However, this alone does not determine total risk. Reduction factors such as experience, proficiency, equipment, and flight conditions can have significant positive safety impact.

To compare different airplanes, pilots, types of operations, etc., in terms of their accident involvement, we must first level the playing field in terms of exposure to risk. Statisticians call this normalizing. The most common way to normalize factors for aviation safety is to compare accidents per 100,000 flight hours.

This report uses percentages to show which portions of accidents were attributed to particular causes, as well as which portions of accident sequences began in a particular phase of flight. These figures may be used to estimate conditional probabilities. In other words, given an accident that has occurred, what is the probability that it was the result of weather, stall/spin, etc.? This type of analysis makes it easier to identify and concentrate on the accident factors that carry the greatest risk. Caution must be used in interpreting percentages based on small numbers of events. When this is the case a small number warning will be associated with the data.

In some areas, the relative magnitude of data is more important than the absolute number.

Sequence of Events and Accident Causality

In its studies of accidents involving large transport-category aircraft, the Boeing Commercial Airplane Company found that most accidents result from a sequence of events rather than a single catastrophic event. Boeing's research identified as many as 20 events in the course of a single flight that had a direct impact upon the outcome. The National Transportation Safety Board (NTSB) uses a similar method to break down each accident into "occurrences."

In this report, the emphasis is on identifying the phase of flight in which the sequence of events began, often referred to as the "first occurrence," and on the types of problems encountered by the pilots. The objective is to find lessons that can be used to prevent future accidents.

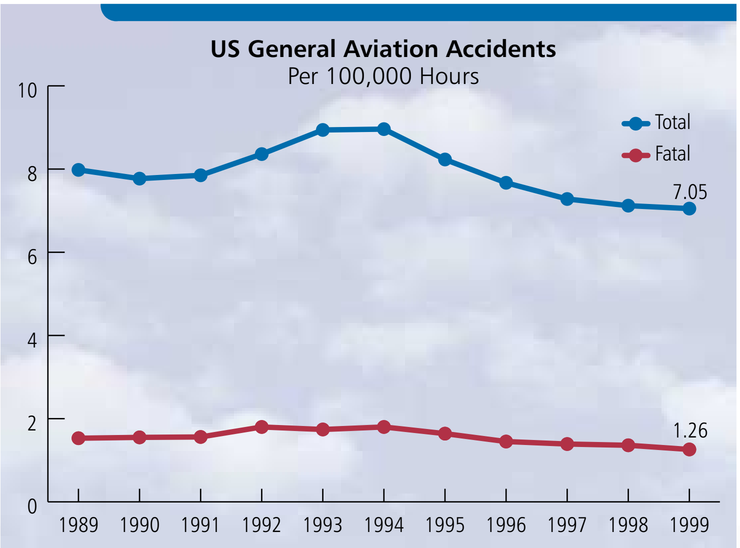
This report uses a simple, single-cause/factor classification scheme. These analyses are based on a combination of fully investigated final and factual reports from the NTSB. If these reports were not available, preliminary reports, describing the accident and providing basic descriptive data, were used.

Overview of Accident Trends and Factors for 1999

1999 Statistics

The FAA's estimate of flight hours increased from 26.8 million in 1998 to 27.1 million in 1999. The GA accident rate per 100,000 flying hours declined slightly in 1999 compared to previous years because the number of accidents remained fairly steady despite a higher number of hours flown that year.

The GA accident statistics below are derived from NTSB accident reports. To make this report more timely, a small number of preliminary reports (19.3 percent) were analyzed and these may cause minor fluctuations in the data once final reports are completed.



Accident Statistics

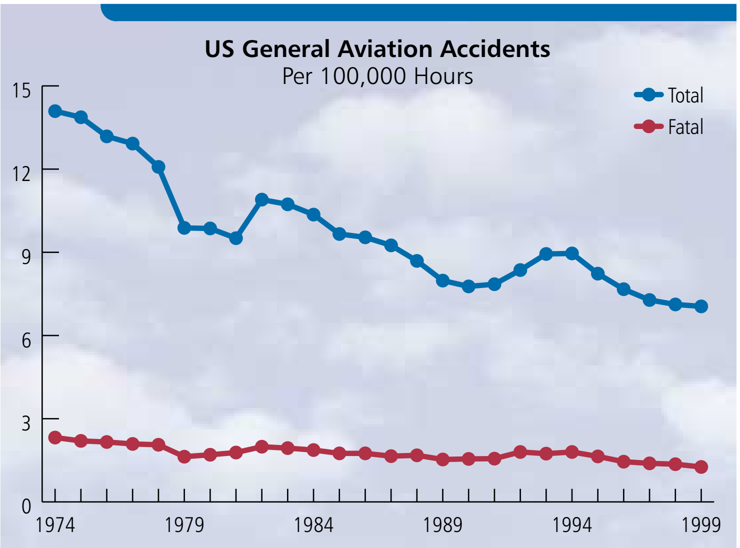
Past Nine Years

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total fixed-wing GA accidents	1,897	1,837	1,808	1,741	1,853	1,781	1,642	1,679	1,701
Fatal fixed-wing GA accidents	394	407	360	354	383	355	331	341	320
Total fixed-wing GA fatalities	724	798	652	641	679	653	667	619	632
Estimated GA flight hours	27.2M	24.8M	22.8M	22.2M	24.9M	24.9M	25.5M	26.8M	27.1M

Overview

Accident Rate

The chart below shows that the overall GA accident rate per 100,000 flying hours has declined significantly over the past 25 years. However, the decline has slowed in the past 10 to 12 years. The fatal accident rate also has declined over those 25 years, with a more gradual decrease over the past 16 to 17 years. Continuing a slight downward trend that began in 1994, 1999 had the lowest total accident rate and the lowest fatal accident rate since 1938, the first year for which such accident statistics were reported. Despite the moderate decrease in fatal GA accidents from 1998, the number of fatal injuries during those accidents actually rose slightly in 1999.



GA accident rates have always been higher than airline accident rates because GA involves risks that airline operations do not share. Listed below are some of the important distinctions of GA:

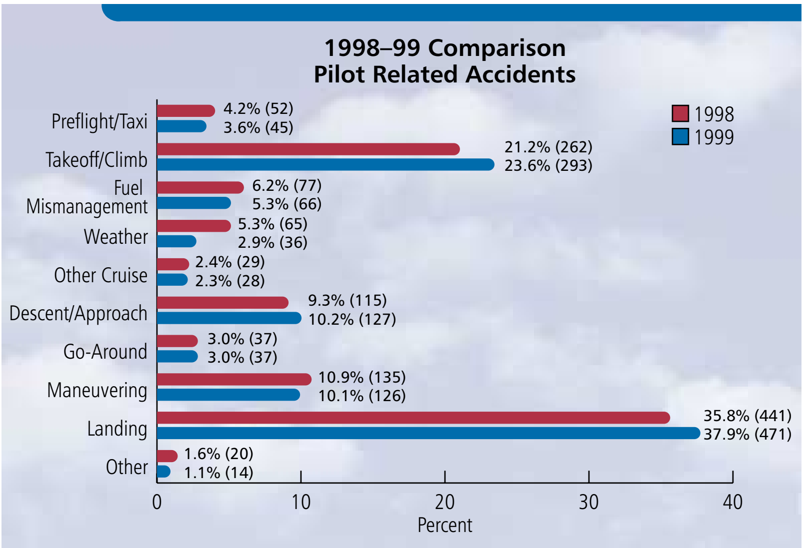
- Less regulation—GA pilots conduct a wider range of operations.
- Wide variances in pilot certificate levels—GA is the training ground for the industry.
- Fewer cockpit resources—Air carrier operations require at least two pilots; GA operations are predominantly single pilot.
- More facilities—GA flies to more than 15,000 landing facilities; the airlines serve only about 700.
- GA facilities may lack the precision approaches, long runways, and advanced services of airline-served airports.
- Many operations, such as aerial application and banner towing, have special mission-related risks.
- More takeoffs and landings—the highest risk phases of any flight (especially during training).
- More individual responsibility—GA aircraft owners and pilots are individually responsible for the safety of flight compared to air carriers and the military that have dispatchers, mechanics, and loadmasters to help share a variety of duties.
- Less weather tolerant aircraft, which generally must fly through the weather instead of over it or may not have systems to avoid/cope with adverse conditions.

Although the freedom and flexibility of GA involve some additional risk, that risk certainly does not guarantee an accident. GA is safe. Pilots who actively manage risk make it even safer.

Comparison With Other Years

Were last year's statistics unique? In a word, no. The most common accident causes continue to be pilot-related. This should come as no surprise. In every form of human activity involving machinery such as automobiles, boats, and aircraft, the hardware is invariably more reliable than the human operator.

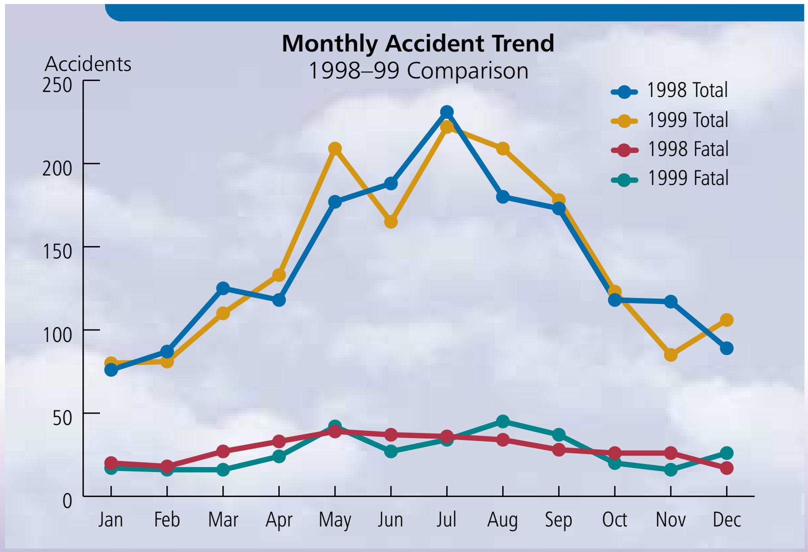
Care must be taken, too, when comparing this year's data with earlier years. Over the past three years, the AOPA Air Safety Foundation has modernized its Aviation Safety Database to incorporate the most complete data available from the NTSB. This has made more final accident reports available for this year's analysis, but it has also changed some of the ways accidents are categorized. Weather-related accidents, for example, used to be listed under the broad category of "cruise-weather" when there was less data available to characterize them. Now, more weather-related accidents can be found in the phase of flight where they occurred, such as takeoff or approach. For this reason, comparisons with earlier reports may show minor differences related to these changes in analytical methods.



Seasonal Trends

Higher accident numbers during the spring and summer months are probably the result of greater flight activity.

The graph to the right compares trends in monthly accidents, including fatal accidents, for 1998 and 1999.



Overview

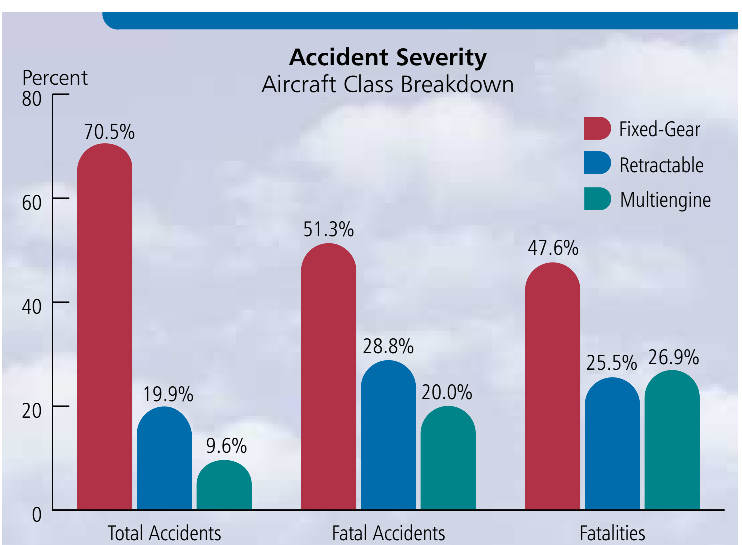
Breakdown by Aircraft Class

In 1999, as in the past, the number of accidents in each class of aircraft reflects the number of hours and types of operations flown in those aircraft. Individual differences in overall accident rates are more likely to be caused by differences in exposure to risk than by characteristics of the airplanes themselves.

Single-engine fixed-gear aircraft have more accidents than complex aircraft, because they are much more common. IFR weather-related and IFR approach accidents are typically more common in single-engine retractable-gear and multiengine airplanes than in single-engine fixed-gear aircraft because they operate more frequently in these weather conditions.

Complexity of aircraft should not be ignored completely. AOPA Air Safety Foundation studies have shown that low time in type is often a contributing factor in accidents. Transitioning to a new aircraft, even one that is simpler than the one the pilot usually flies, can cause problems even for experienced pilots.

Maneuvering flight and takeoff/climb accidents accounted for the highest proportions of fatal accidents in single-engine and multiengine aircraft.



As aircraft increase in size, minimum flight speeds also increase and it is more likely that an accident is going to be fatal. In single-engine fixed-gear airplanes, 11.7 percent of all takeoff/climb accidents were fatal (25 of 214) with 23.1 percent fatal in takeoff/climb accidents in single-engine retractable-gear airplanes (12 of 52) and 40.1 percent of takeoff/climb accidents in multiengine airplanes were fatal (11 of 27).

Maneuvering flight, dominant in single-engine airplanes, also resulted in high total and fatal accident rates, although accounting for a much lower number of total accidents in all classes of airplanes. Maneuvering flight problems in single-engine fixed-gear airplanes resulted in fatalities in 44.3 percent (47 of 106) of these accidents. In single-engine retractable-gear airplanes, the ratio was 82.4 percent (14 of 17) fatal. There were only three maneuvering accidents in twins, but all three were fatal.

While weather-related accidents dropped slightly in 1999, they continue to have the highest probability of fatalities. In single-engine fixed-gear airplanes, 65 percent (13 of 20) of weather-related accidents were fatal. In single-engine retractable-gear airplanes, 88.9 percent (eight of nine) weather-related accidents were fatal and 85.7 percent (six of seven) of weather-related accidents in multiengine airplanes resulted in fatal injuries.

Landings continue to be the highest total accident area, while accounting for some of the lowest numbers of fatal accidents. In single-engine fixed-gear airplanes, 361 accidents were attributed to landing problems but only three of them were fatal. In single-engine retractable-gear airplanes, only one of 68 landing accidents resulted in fatalities. In multiengine airplanes, three of 42 accidents were fatal. The low incidence of fatalities in landing accidents reflects the lower speeds at the time of collision and the fact that the mishap occurred on or close to a runway with few obstacles.

The paragraphs on page 11 outline the key areas of concern and related statistics in each class of airplane.

Single-Engine Fixed-Gear Aircraft — 914 Total/121 Fatal

The areas below constitute the top four areas for fatal accidents in single-engine fixed-gear airplanes in 1999. Together, these areas account for 81.8 percent of all fatal pilot-related accidents in these airplanes.

- Maneuvering flight: 38.8 percent (47)
- Takeoff and initial climb: 20.7 percent (25)
- Approach: 11.6 percent (12 VFR, 2 IFR)
- Weather: 10.7 percent (13)

Single-Engine Retractable-Gear Aircraft — 216 Total/59 Fatal

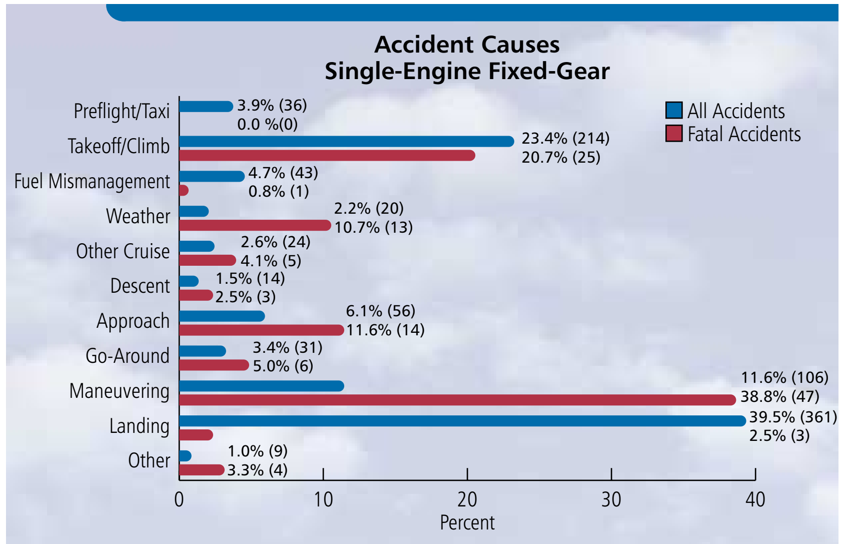
The areas below constitute the top four areas for fatal accidents in single-engine retractable-gear airplanes in 1999. Together, these areas account for approximately 80 percent of all fatal pilot-related accidents in these airplanes.

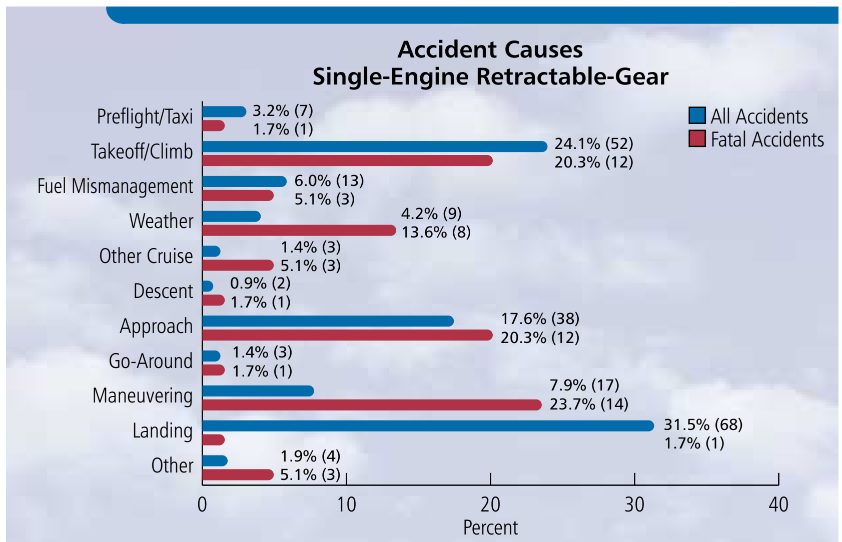
- Maneuvering flight: 23.7 percent (14)
- Takeoff and initial climb: 20.3 percent (12)
- Approach: 20.3 percent (8 VFR, 4 IFR)
- Weather: 13.6 percent (8)

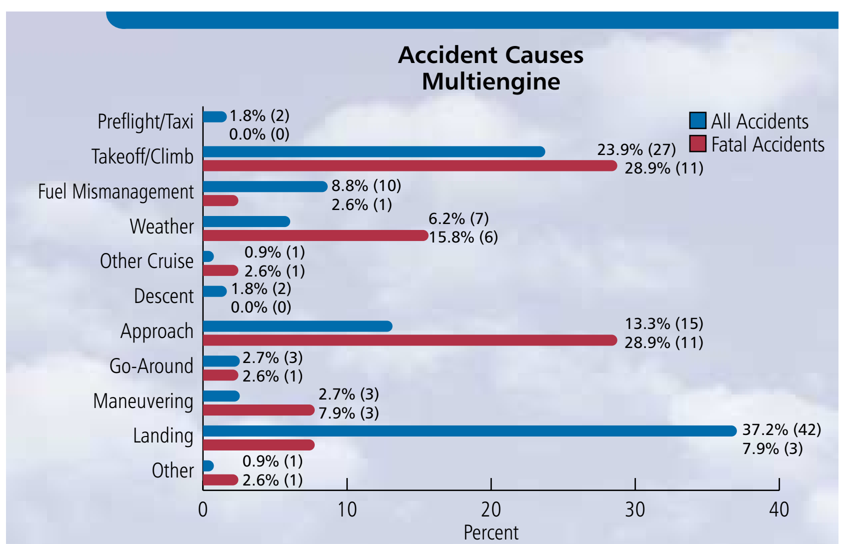
Multiengine Aircraft — 113 Total/38 Fatal

The areas below constitute the top four areas for fatal accidents in multiengine airplanes in 1999. Together, these areas account for 73.7 percent of all fatal pilot-related accidents in these airplanes.

- Takeoff and initial climb: 28.9 percent (11)
- Approach: 28.9 percent (4 VFR, 7 IFR)
- Weather: 15.8 percent (6)







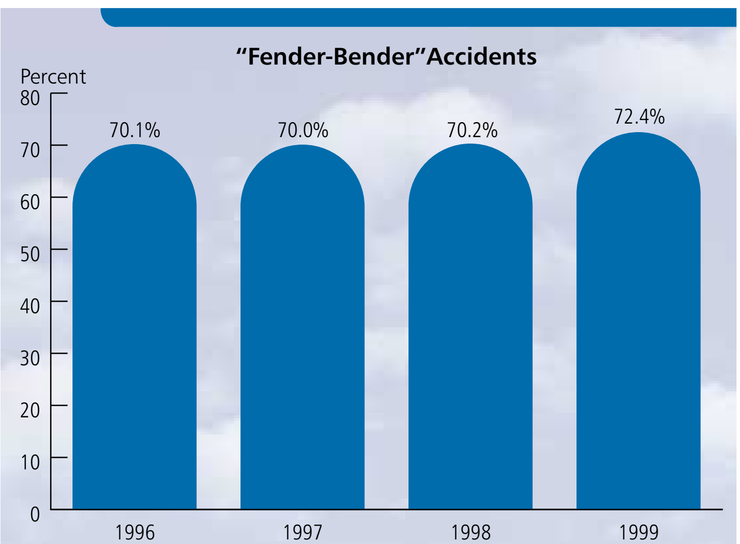
Major Accident Causes and Factors

Summary of Significant Factors

Both total and fatal accident counts dropped slightly during 1999 while the estimated number of hours flown and the number of fatalities increased slightly. At the same time, trends in the causes of accidents showed little change from previous years. The majority of accidents—73.1 percent of all accidents and 68.1 percent of fatal accidents—were the result of pilot-related causes.

The following facts about the causes of accidents are worth remembering:

- Takeoff and landing account for less than five percent of a typical cross-country flight, but 54.1 percent of the accidents for which the emergency phase of flight is known. The majority of these accidents were nonfatal. Only 16.4 percent of fatal accidents occurred during takeoff or landing (12.3 and 4.1 percent respectively). Fatal accidents due to causes related to takeoff have, however, increased significantly, accounting for 22 percent of the fatal pilot-related accidents in 1999, compared to 14.2 percent in 1998. The predominant cause of these accidents was "loss of control/stall on takeoff." Due to the large number of total accidents in the takeoff causal area, however, only 16.4 percent (293 total, 48 fatal) of these accidents were fatal.
- Weather-related accidents accounted for 12.4 percent of all fatal pilot-related accidents. In multiengine airplanes, 15.8 percent of fatal accidents were related to weather. For single-engine retractable-gear airplanes, the figure was 13.6 percent and 10.7 percent for single-engine fixed-gear airplanes. Fatal accidents during instrument approaches added to this total. These figures are comparable to those for the past decade as reported in the AOPA Air Safety Foundation's Safety Review: *General Aviation Weather Accidents.*
- Darkness increased the likelihood of having a weather-related accident. Fully 16.5 percent of the instrument meteorological conditions (IMC) accidents, 21.1 percent of all approach accidents, and 32.4 percent of fatal approach accidents happened at night. In addition, 50 percent of all instrument approach accidents and 61.5 percent of fatal instrument approach accidents happened at night. This is significantly higher than the average of 5.2 percent of all accidents that happened at night.
- Maneuvering flight accidents accounted for 29.4 percent of all fatal pilot-related accidents. Many of these accidents involved buzzing or other low-level flight.
- Although only 45.4 percent of GA flight hours were logged on personal flights, these flights accounted for 68 percent of all accidents and 67.5 percent of all fatal accidents.



Note: Fender-Bender accidents include those accidents where the injuries were *not* classified as serious or fatal according to NTSB Part 830 definitions.

THE ACCIDENT SETTING—PHASE OF FLIGHT

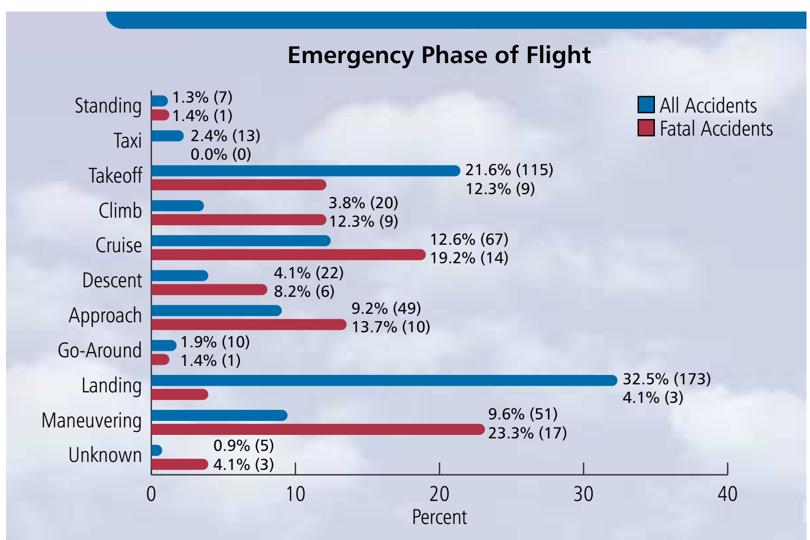
Studies conducted by the Boeing Commercial Aircraft Company on commercial jet aircraft accidents have estimated that takeoff and landing each constitute only one percent of a typical flight. Initial climb adds another one percent and final approach accounts for three percent. Cruising flight was estimated to account for 60 percent of a typical flight, with the remainder being distributed fairly evenly between climb to altitude, descent from altitude, and initial approach.

The majority of accident sequences begin during phases of flight that take up relatively little flight time but contain the highest number of critical tasks and the highest task complexity. Compare the proportions of accidents occurring in the takeoff, cruise, approach, and landing phases, and it is easy to see that there are significant hazards in the phases of flight that account for only a small portion of flight time.

GA operations usually involve many more takeoffs and landings per flight hour than airlines. Instructors and their students sometimes spend entire flight lessons in the traffic pattern. Nevertheless, the critical relationships between phases of flight remain basically the same. For both GA and commercial flights, takeoffs and landings, although the most complex phases of flight, constitute a relatively small portion of the total flight time.

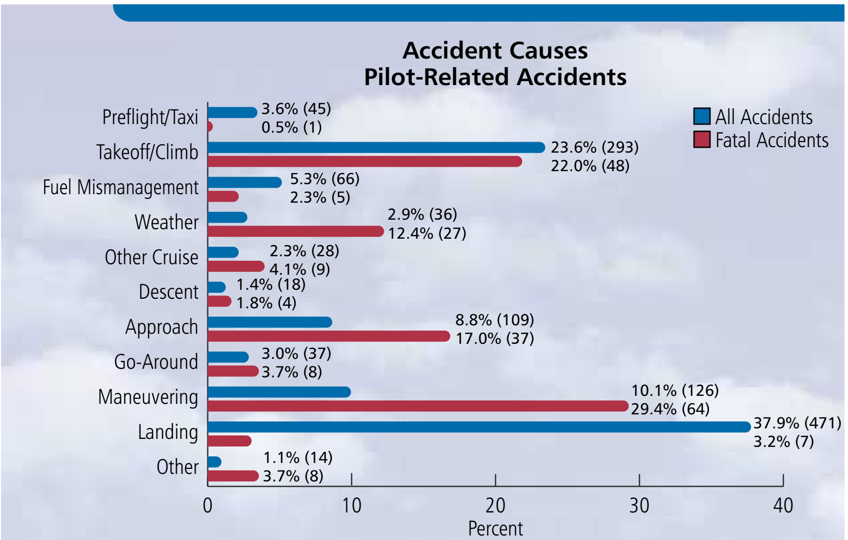
The chart to the right classifies pilot-related accidents according to the phase of flight in which the situation that resulted in the accident began. For example, fuel exhaustion or an encounter with low weather may have caused the pilot to make a precautionary landing. Although the accident actually occurred during this landing, the "emergency phase" of flight would be cruise.

One phase in which accident proportions in GA consistently differ from commercial flying is in cruise. Weather is usually the culprit in these situations where more GA pilots fall victim to VFR flight into IMC. About 58 percent of the GA pilot population is instrument qualified.



Pilot Involvement

Pilot-related problems accounted for 73.1 percent of all accidents and 68.1 percent of the fatal accidents in the 1999 accident records reviewed for this report. Many of the mechanical/maintenance accidents are also attributable to human-related problems.



Type of Operation	Percent of Flying (1998)	Percent of Total Accidents (1999)	Percent of Fatal Accidents (1999)
Personal	45.4	68.0	67.5
Instructional	17.9	13.8	5.3
Aerial Application	5.6	5.8	2.8
Business	15.7	4.2	8.4
Positioning	*	2.1	3.4
Ferry	*	1.1	2.2
Other Work Use	1.1	0.6	1.3
Public Use	2.5	0.6	0.6
Aerial Observation	3.1	0.4	0.0
Executive/Corporate	4.7	0.3	0.9
Other/Unknown	4.0	3.2	7.5

* Included in "Other/Unknown"

Specific Pilot-Related Causes

1243 Total/218 Fatal

The chart to the left compares accidents in which the major cause was attributed to the pilot. Although there is some overlap in the terms used to describe the phase in which the emergency occurred and the cause, the two are not always equivalent. For example, fuel exhaustion may have occurred during cruising flight or during a landing approach, resulting in an accident. The cause of the accidents will then be attributed to fuel mismanagement, and the phase of flight may be listed as approach or cruise. Conversely, problems particular to approach operations, such as descending below the minimum descent altitude, will show approach as both the phase of flight and the cause.

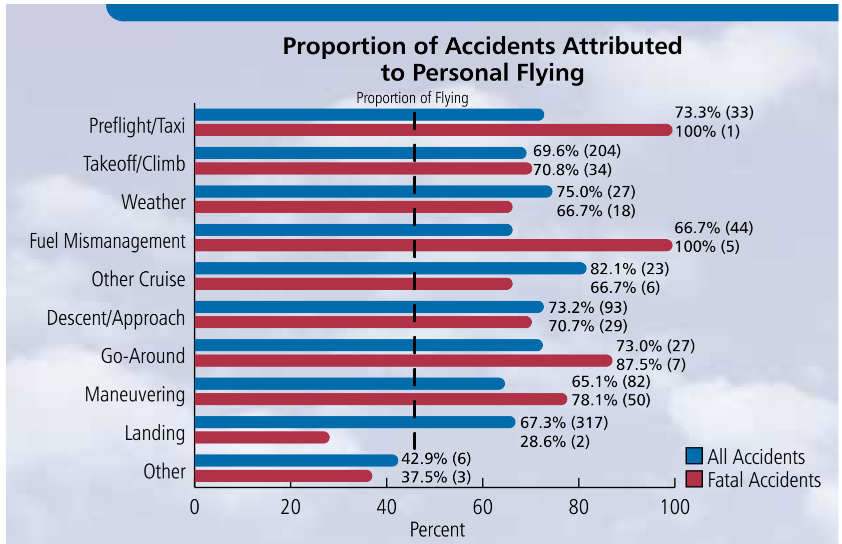
Analysis of Specific Operations

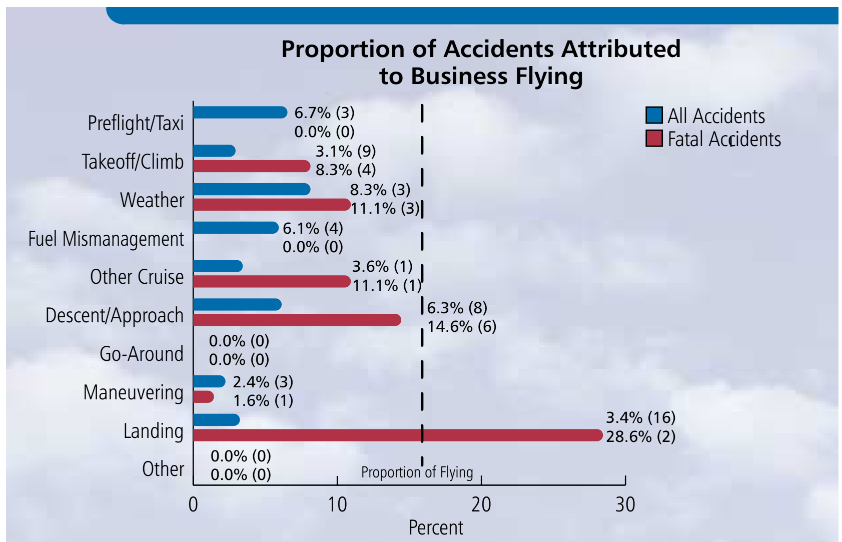
The accident potential of an individual flight can be highly dependent on the length of the flight, time of day, weather conditions, and how important the pilot perceives the flight to be. The purpose of the flight is referred to in the data as type of operation. Because the factors previously cited often vary according to the type of operation, the following sections focus on three of the most common GA operations: personal flying, flight instruction, and business flying. The table to the left shows how those categories compare to other types of operations.

Personal Flying 856 Total/155 Fatal

In a typical year, personal flying comprises approximately 45 percent of all GA flights (45.4 percent in 1998, 43.5 percent in 1997)—by far the largest single type of operation. For 1999, however, accidents during these operations represented an even larger proportion of the total accident picture, accounting for 68 percent of all accidents and 67.5 percent of fatal accidents. This is a continuing trend, with both total and fatal accident proportions associated with personal flying being approximately 65–70 percent.

The chart to the right shows the proportion of accidents due to a particular cause that occurred during personal flights. The reference line shows the 45.4 percent mark—the point at which the percentage of accidents in each category would be equivalent to the percentage of total flight time spent on personal flights. Bars representing individual causes that extend beyond this line indicate that the accidents in that cause category accounted for more than the share of flying done for personal reasons. Personal flights resulted in more than their share of accidents from all causes except for landing. However, only seven fatal landing accidents were recorded in 1999 during all types of flying combined and two of these occurred during personal flights.



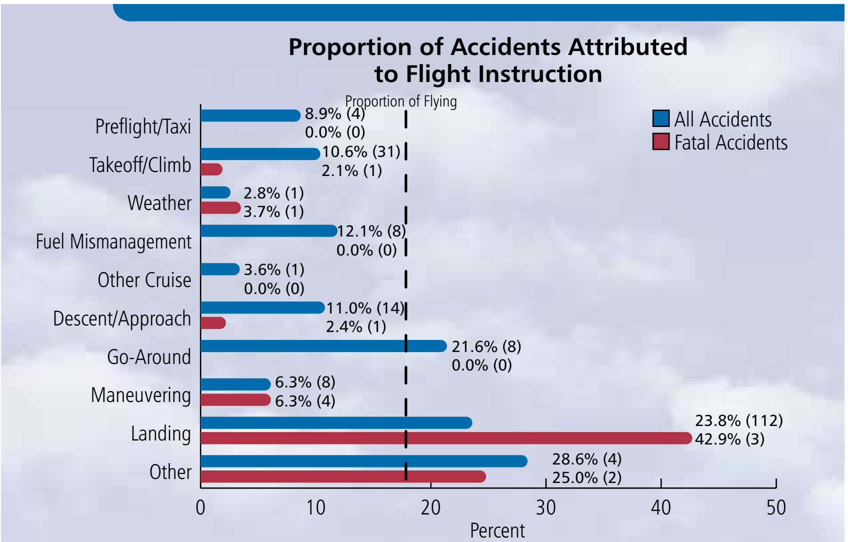


Business Flying 47 Total/17 Fatal

Flying gives many business travelers a flexible, economical way to travel on their own schedules. It also allows them to reach destinations that are difficult or impossible to reach via airlines or other modes of travel. Business flights accounted for only 4.2 percent of the total and 8.4 percent of the fatal accidents in 1999 while accounting for 15.7 percent of all GA flight hours.

The chart to the right shows the causes of business travel accidents. The reference line at 15.7 percent may be used in the same manner as described above under "Personal Flying." As in most recent years, all causal areas of business flight accidents in 1999 were lower than the proportion of business flying hours to total flying hours, except for fatal accidents during landings. This particular statistic should be used with caution, however, because of the extremely small number of fatal accidents that take place during landings. GA saw a total of only seven fatal landing accidents in 1999 (2.2 percent of all fatal accidents), and two of those occurred during business flights. Business flights also accounted for 14.6 percent of fatal descent/approach accidents, still slightly lower than their share of flying hours. Overall, business flying continues to have a very good safety record.

Pilot Involvement



Instructional Flying 191 Total/12 Fatal

The proportion of total accidents attributed to instructional flying was almost unchanged in accidents in 1999 over the previous year. Flight training accounted for 13.8 percent of the accidents in 1999 as compared to 13.4 percent in 1998. The proportion of fatal accidents suffered during instructional flights also remained virtually unchanged with 5.6 percent in 1998 and 5.3 percent in 1999. These figures are still well below the 17.9 percent of the flying done for instructional purposes in 1998 (the most recent estimate available—see table on page 14). While it is difficult to make meaningful generalizations with a small number of accidents, some interesting facts are worth mentioning.

- The total number of accidents attributable to instructional flying increased by 3.8 percent in 1999 compared to the previous year's figures (225 vs. 234).
- Pilot-related instructional accidents increased by 9.8 percent between 1998 and 1999 (174 in 1998 vs. 191 in 1999).
- Landing accidents in instructional flights increased by 27.3 percent in 1999 (88 vs. 112). Three of these accidents resulted in fatal injuries as opposed to only one in 1998.
- Accidents in takeoff and initial climb decreased by 20.5 percent (39 in 1998 vs. 31 in 1999). Only one of these was fatal, compared to two in 1998.

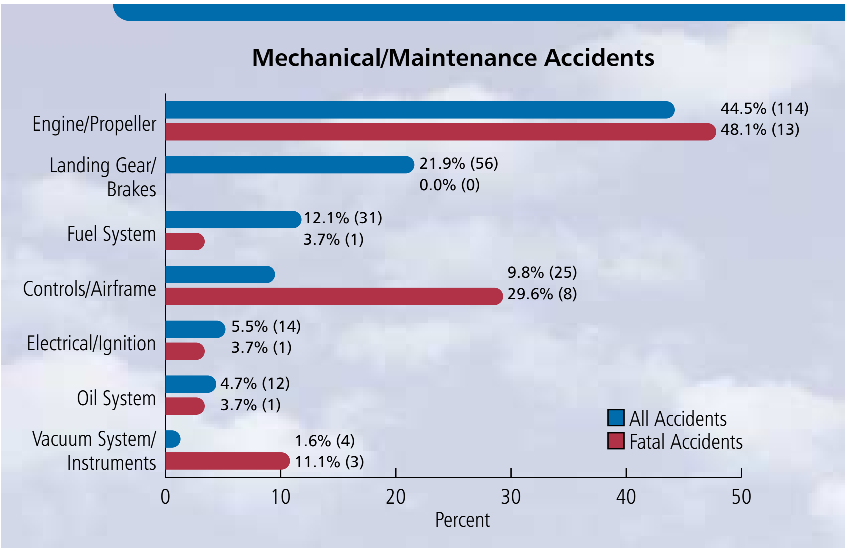
Other common GA accident producers, maneuvering flight, weather, and fuel mismanagement, continued at low levels in instructional flying compared to GA operations as a whole.

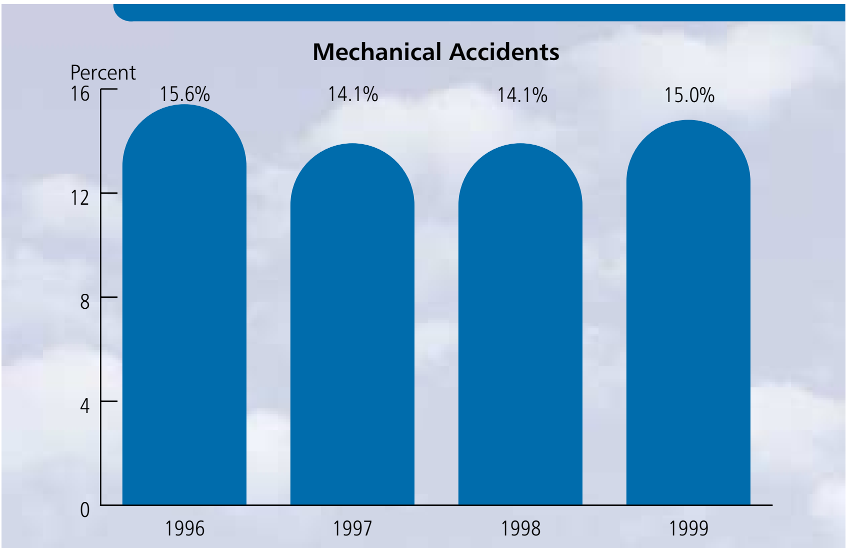
- Maneuvering accidents during instructional flights resulted in eight accidents in both years, with two fatal in 1998 and four in 1999.
- Weather encounters resulted in only one instructional dual flight accident in 1999, which was fatal. In 1998, there were two weather-related instructional accidents, neither of which was fatal.
- Fuel mismanagement accidents doubled in 1999; however, the numbers were still small (four in 1998 vs. eight in 1999). Six of the 1999 accidents were dual flights, while two were solos. None of these accidents were fatal in 1999, while one resulted in fatalities in 1998.

Mechanical/Maintenance — 256 Total/27 Fatal

Mechanical/maintenance accidents accounted for 15 percent of all accidents and 8.4 percent of fatal accidents. By far, the largest percentage of these accidents was the result of powerplant or propeller problems (44.5 percent of all mechanical/maintenance accidents and 48.1 percent of fatal mechanical/maintenance accidents). In addition, another 74 accidents were classified as "power malfunction/loss for unknown reasons." The investigations for 27 of these accidents were still in "preliminary" status when this report was compiled. Thus, the final count of mechanical/maintenance problems may change slightly when the final reports are in.

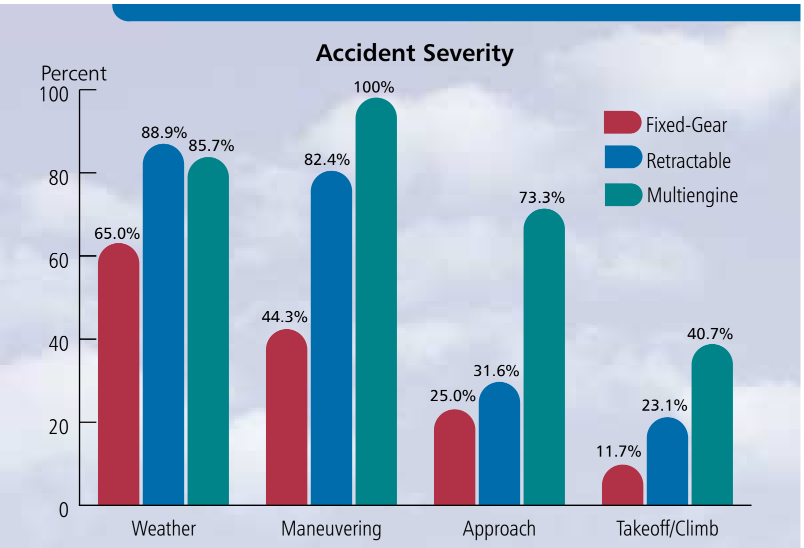
Pilots should note that several of the mechanical failure accidents could have been prevented by a thorough preflight. Other accidents resulted when pilots incorrectly performed procedures after system failures occurred.





General Aviation Accidents

Major Cause	All Accidents	Fatal Accidents
Pilot	73.1%	68.1%
Mechanical/Maintenance	15.0%	8.4%
Other	7.5%	8.8%
Unknown	4.4%	14.7%
Total	1,701	320



Fatal Accident Factors

Based upon the probability of fatalities, the primary causes of fatal accidents across all classes of airplanes for 1999 were:

- Maneuvering Flight
- Weather
- Approaches

As in the past, the causes of fatal accidents were closely linked to the flight profile, including the length of the trip, the time of day, the purpose of the trip, and whether the flight was IFR or VFR.

Severity—Probability of Fatalities

The likelihood that a given accident will result in fatalities can be estimated by comparing the number of total accidents to the number of fatal accidents under the same set of circumstances. Regardless of the cause, however, accidents in single-engine retractable-gear aircraft were more likely to be fatal than those in fixed-gear aircraft. The fatality rate for multiengine airplanes was even higher. This was most likely the result of higher speeds at impact.

- **Maneuvering flight:** Approximately half (50.8 percent) of all accidents involving maneuvering flight (64 of 126 accidents) involved fatalities. Like weather-related accidents, maneuvering accidents frequently involved aircraft crashing out of control or colliding with terrain, wires, or other structures.
- **Weather:** Weather-related accidents were more likely to be fatal than accidents with any other cause. Fully 75 percent of weather-related accidents (27 out of 36) involved fatalities. Most weather-related accidents involved aircraft striking objects or terrain at high airspeed or crashing out of control, sometimes after pilot-induced structural failure.
- **Approach:** Over a third (33.9 percent) of all approach accidents (37 of 109) produced fatalities. Aside from steep turn/stall mishaps, "improper IFR approach" was one of the largest single problems in this area, adding another dimension to the weather-related accident count.

It should also be noted that while only 16.4 percent of accidents attributed to takeoff or initial climbout were fatal, 48 fatal accidents were related to takeoff problems, more than the number of fatal accidents due to approach problems. The low fatality rate was due to the large number of nonfatal takeoff accidents—245 of 293 total takeoff accidents did not involve fatalities. Takeoff accidents involving loss of control at relatively low speeds kept the fatality rate down while accounting for a large number of total accidents.

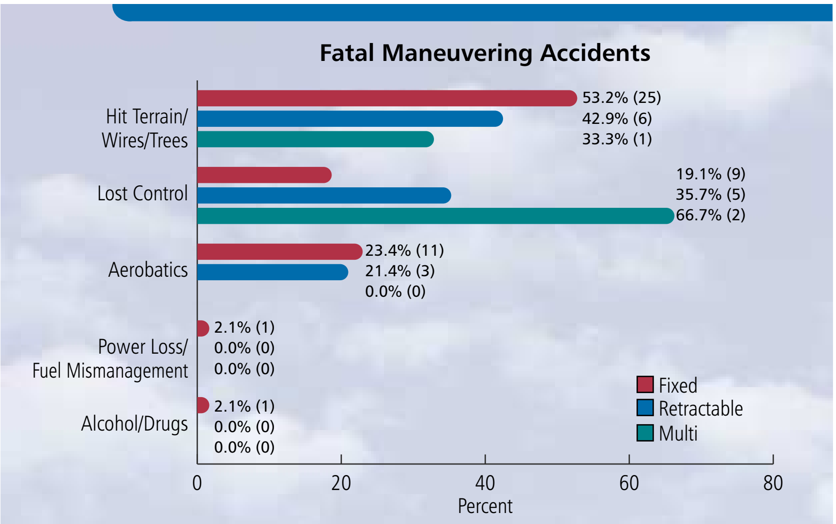
Maneuvering Flight 126 Total/64 Fatal

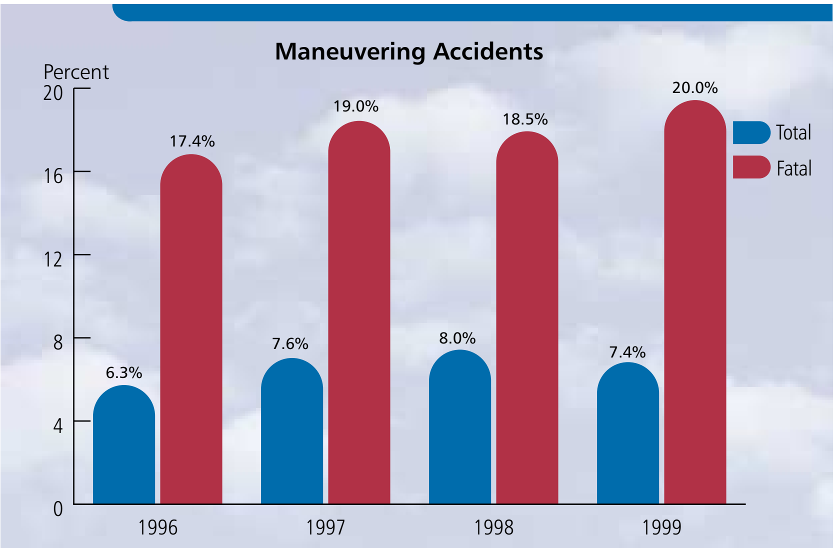
Maneuvering flight continues to be one of the largest producers of fatal accidents. It is also one of the most preventable. Thirty-two of 64, or 50 percent, of fatal maneuvering accidents were the result of "hit terrain, wires, trees, etc." Sixteen of the 64 (25 percent) fatal maneuvering accidents were attributed to "loss of control." Two of the three fatal maneuvering accidents in multiengine airplanes were due to this cause.

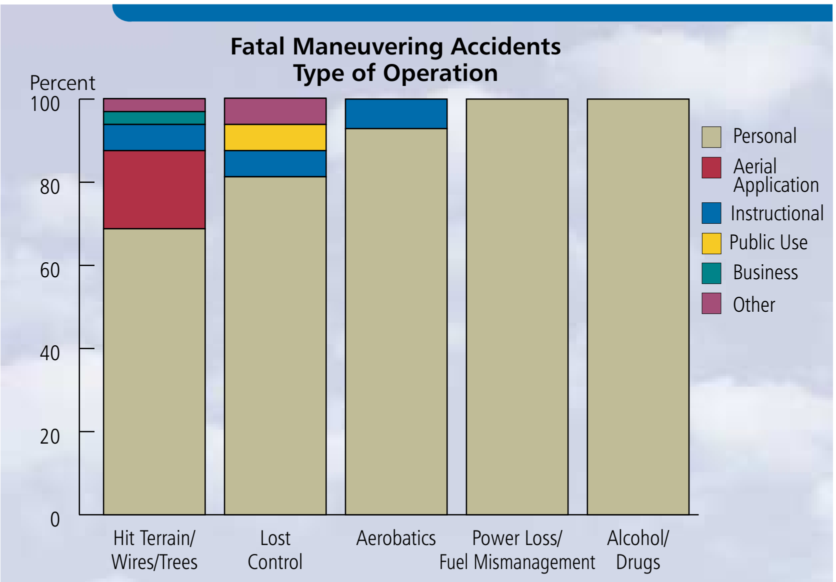
Some of these accidents occurred during legitimate activities such as aerial applications, banner towing, and law enforcement. These operations require low, slow flight and considerable mission-related division of attention. In operations where there is a mission beyond just operating the aircraft, the task demands of the mission and the task demands of flying can reach extremes simultaneously, severely taxing the pilot's capability. These operations carry some inherent risk and demand skill and vigilance from the pilot.

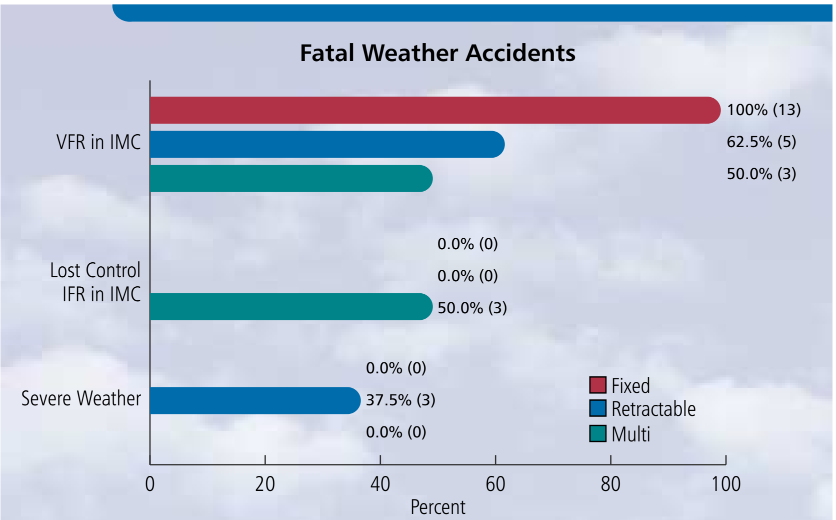
More often than not, maneuvering accidents occurred during personal (65.1 percent), not mission-related, flights.

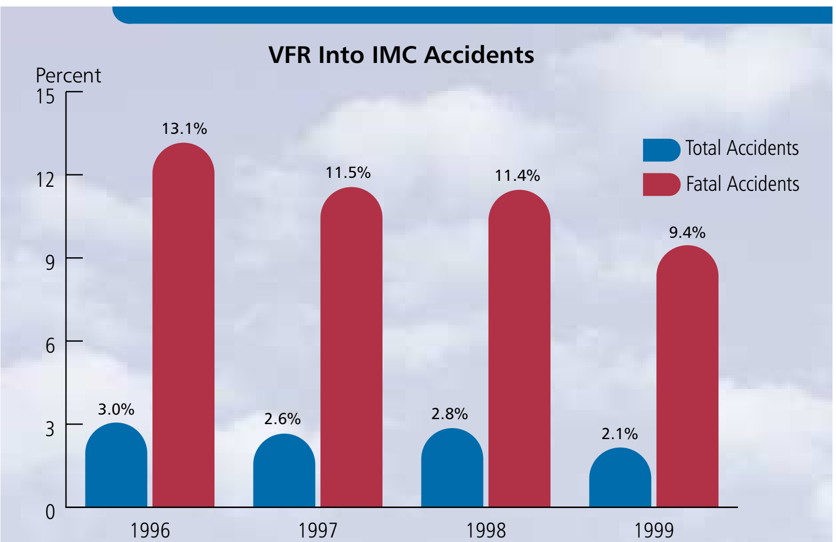
A few of these accidents were the result of inadvertent loss of control by pilots performing common operations. Some, however, occurred during buzzing or low-level aerobatics. Many involved a degree of recklessness that makes it difficult to term them "accidents" in a true sense. No increase in proficiency can prevent such accidents. Pilots must refrain from this type of reckless activity and encourage their peers to do the same.

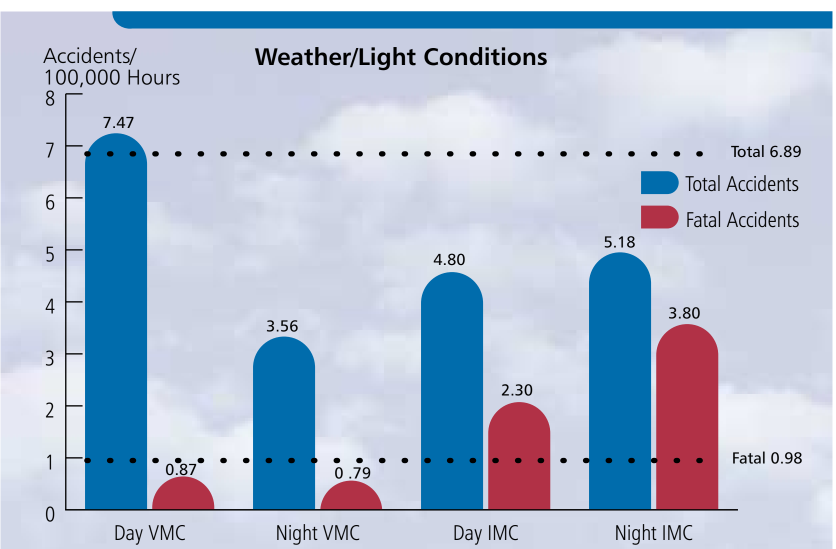












Weather — 36 Total/27 Fatal

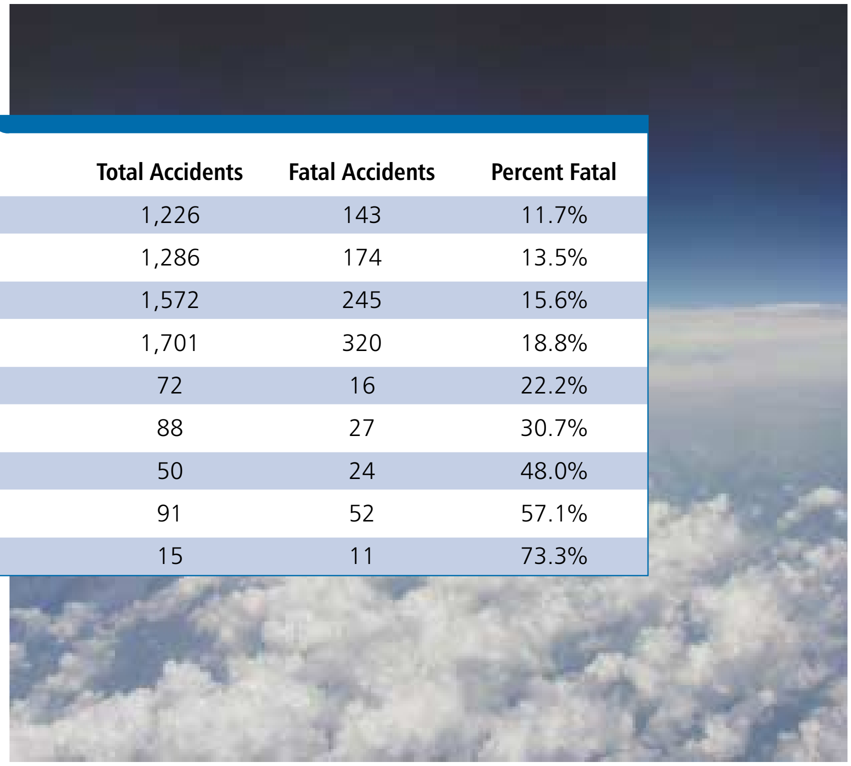
Some accidents attributed to other causes involved weather as a contributing factor, as in the case of improper IFR approach, which was responsible for 13 fatal approach accidents. Wind shear and crosswinds also caused weather-related accidents in VFR conditions.

Twenty-one of the 27 fatal weather-related accidents (77.8 percent) were caused by "attempted VFR flight into IMC." Thirteen of these were in single-engine fixed-gear aircraft, accounting for all of the fatal weather-related accidents in those aircraft. Five of eight (62.5 percent) fatal weather-related accidents in retractable-gear single-engine airplanes were due to this cause. Three of the six fatal accidents in multiengine airplanes were also due to VFR into IMC. While many of these accidents involved inexperienced noninstrument-rated pilots, high-time commercial and airline transport pilots were also included. *At least two flights involved professional pilots attempting VFR operations in weather that included ceilings of less than one hundred feet.* VFR flight into IMC continued to be one of the most frequent single causes of fatal accidents, leading one to the question, "What is it about the fact that they can no longer see the ground that pilots don't understand?" Because so many of these accidents were fatal, there are few surviving pilots to answer the question. The AOPA Air Safety Foundation has published the Safety Review: *General Aviation Weather Accidents*, which offers detail and analysis of weather accidents.

In past years the relative magnitude of day to night fatal accidents doesn't change much. However, night visual meteorological conditions (VMC) tends to be slightly higher than day VMC once the final tallies are complete. The key points are that both IMC and night substantially increase risk, and, when combined, lead to the most challenging flight conditions of all.

INTERACTION OF NIGHT AND WEATHER

The table to the right shows total and fatal accidents in various light and weather conditions. Night increases the probability of fatalities in a given accident. While only 18.8 percent of all accidents result in fatalities, 30.7 percent of night accidents are fatal. IMC, however, nearly doubles the probability of an accident—57.1 percent of IMC accidents result in fatalities. The combination of night and IMC increases the proportion of fatal to total accidents to 73.3 percent, making it the most deadly general aviation flight environment.

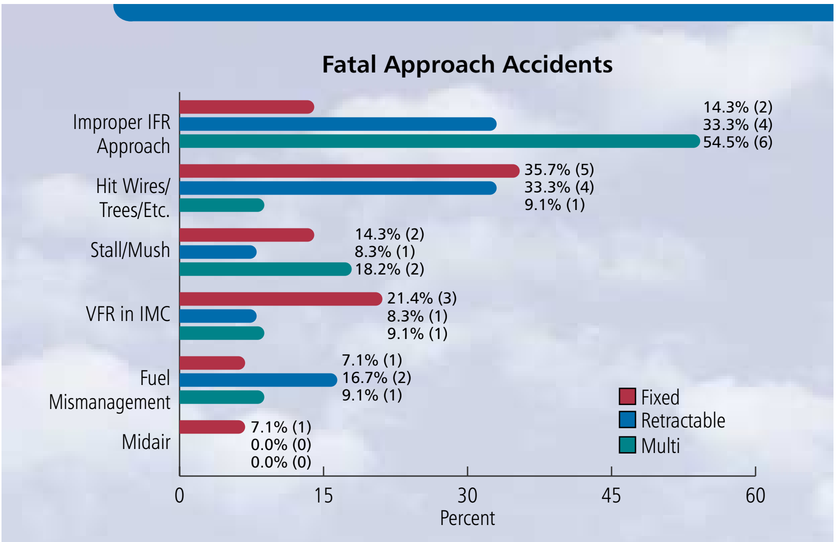


Conditions	Total Accidents	Fatal Accidents	Percent Fatal
Day VMC	1,226	143	11.7%
Day	1,286	174	13.5%
VMC	1,572	245	15.6%
All Conditions	1,701	320	18.8%
Night VMC	72	16	22.2%
Night	88	27	30.7%
Day IMC	50	24	48.0%
IMC	91	52	57.1%
Night IMC	15	11	73.3%

The chart on page 20 shows the interaction between night and IMC. The dashed lines show the total and fatal accidents per 100,000 hours for those accidents where both weather and light conditions were reported. Bars extending above these reference lines indicate a higher than average accident rate under the indicated conditions. The data show that IMC flight produces approximately 20 percent fewer total accidents per 100,000 hours but almost three times the rate of fatal accidents as VMC. Unfortunately, information on light and weather conditions was not available for 19.9 percent of the NTSB accident reports for 1999, and for 39.4 percent of the reports on fatal accidents. The exact conditions under which these accidents occurred is often unknown, particularly where there are no survivors to give firsthand information.

SPATIAL DISORIENTATION

Spatial disorientation is an effect that occurs when a pilot is deprived of visual references to determine an aircraft's orientation in three-dimensional space. The pilot's sensation of balance and orientation, which are also called "kinesthetic senses," are based on information sent from the inner ear to the brain. This information can be quite accurate if the person is motionless, moves slowly, or is supplemented by "visual cues" regarding the person's position in the environment. When the body is not stationary, however, forces produced by motion and acceleration can "fool" the senses. Incorrect impressions of position, movement, and orientation toward the earth will be experienced and can be extremely strong. The pilot quite literally can't tell "which way is up." Because these false impressions are based on physics and a basic aspect of human physiology, they cannot be avoided by training and can, therefore, be experienced by pilots of all skill and experience levels. Any conditions which deprive the pilot of natural, visual references to maintain orientation, such as clouds, fog, haze, darkness, or terrain/sky backgrounds with indistinct contrast (such as arctic whiteout or clear, moonless skies over water) can rapidly bring about spatial disorientation. Without a means of controlling the airplane with reference to the earth's surface, loss of control is imminent. The only preventive measure is to rely on references based on the aircraft's instruments. This, in turn, requires that the aircraft is adequately equipped and maintained, and that the pilot is sufficiently trained and disciplined to fly solely by reference to instruments.



In 1999, six accidents contained specific references to spatial disorientation in the sequence of events or narrative sections of their reports. The conditions surrounding a significant number of other weather-related accidents also suggest that spatial disorientation might have been a factor as well. Typically, these accidents were suffered by noninstrument-rated pilots attempting to complete VFR flights in IMC. At least one accident, however, occurred when an experienced instrument-rated pilot in a well-equipped turbine-powered airplane became disoriented during the visual portion of a circling IFR approach. In this case, conditions of darkness and lack of moonlight exacerbated the weather conditions. As we stated previously, a disciplined approach is essential from preflight to tiedown.

APPROACH

109 TOTAL/37 FATAL, 93 VFR/16 IMC

Accidents resulting from mishandled approaches, although low in number, were fatal 33.9 percent of the time. Most problems were the result of stall/mush or failure to follow instrument approach procedures. All classes of aircraft were represented in both of these problem areas. To prevent these accidents, pilots must build and maintain their skills. Train and stay current!

Fatal instrument approach accidents involved six multiengine, four retractable single-engine, and two fixed-gear single-engine airplanes. Instrument-rated pilots must perform complex tasks, often after flying for long periods in bad weather.

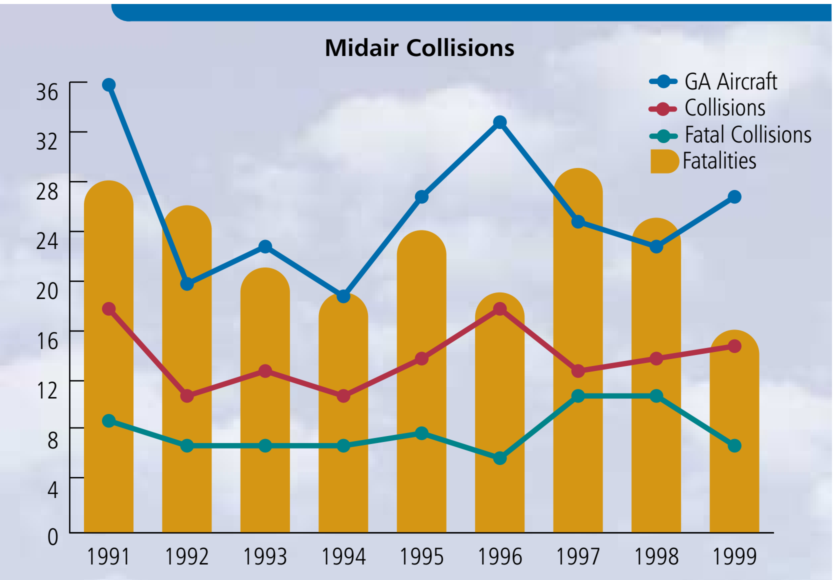
Studies conducted by NASA and the FAA for the airlines have shown that the most demanding tasks, landing and approach, must be performed at a time when the pilot's ability to accomplish complex tasks may be significantly diminished.

Other Accident Factors

Midair Collisions — 15 Total/7 Fatal

During 1999 there were 15 midair collisions involving a total of 27 GA aircraft. Seven of these accidents were fatal, resulting in 16 deaths. The number of midair collisions involving GA airplanes was nearly the same as the 14 in 1998, while the number of fatal midair collisions fell from 11 in 1998. The number of deaths also fell from the 25 suffered in 1998. Midair collisions continued to occur mainly on good VFR days, at low altitude, close to airports. In 1999, all of the midair collisions occurred in VMC and during the hours of daylight.

A recent AOPA Air Safety Foundation study of midair collisions revealed that 49 percent of them occurred in the traffic pattern or on approach to or departure from an airport. Of the other 51 percent, about half occurred during en route climb, cruise, or descent, and the rest resulted from formation flights or other hazardous activities. Eighty percent of the midair collisions that occurred during "normal" flight activities happened within 10 miles of an airport, and 78 percent of the midair collisions that occurred around the traffic pattern happened at nontowered airports. Important strategies for avoiding these mishaps can be found in the Foundation's Safety Advisor: *Operations at Nontowered Airports,* online at www.aopa.org/asf/publications/sa08.pdf.



Alcohol and Drugs — 14 Total/12 Fatal

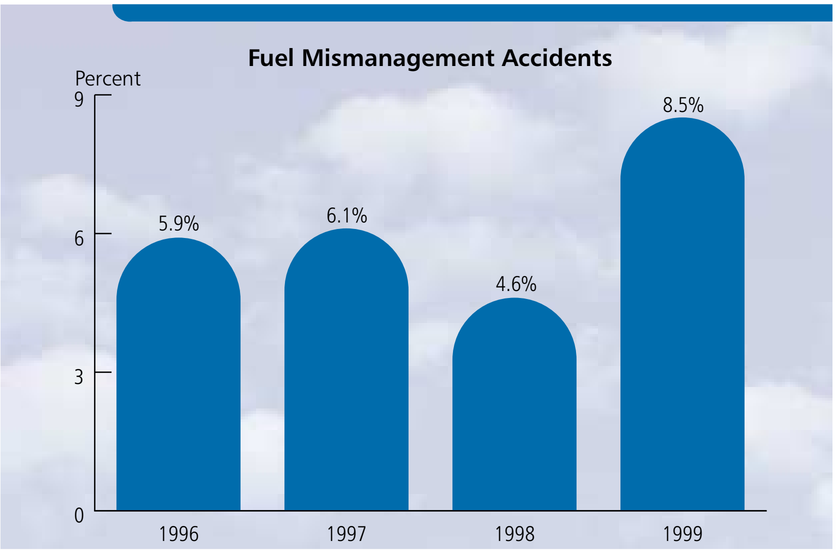
In 1999, 14 accidents showed evidence of the possible involvement of alcohol, illicit drugs, or unapproved prescription or over-the-counter medications. It is clear that other factors were also involved in these accidents. It is also possible that accidents still under investigation will implicate drugs or alcohol as well as the factors already known. From the fact that 85.7 percent (12) of these accidents were fatal, it is evident that drug or alcohol use by pilots is a serious issue. Fortunately, the number of accidents involving drugs and alcohol continues to be relatively low. Over the past five years, the average accident count was 28 per year.

OTHER Accident Factors

FUEL MISMANAGEMENT 66 TOTAL/5 FATAL

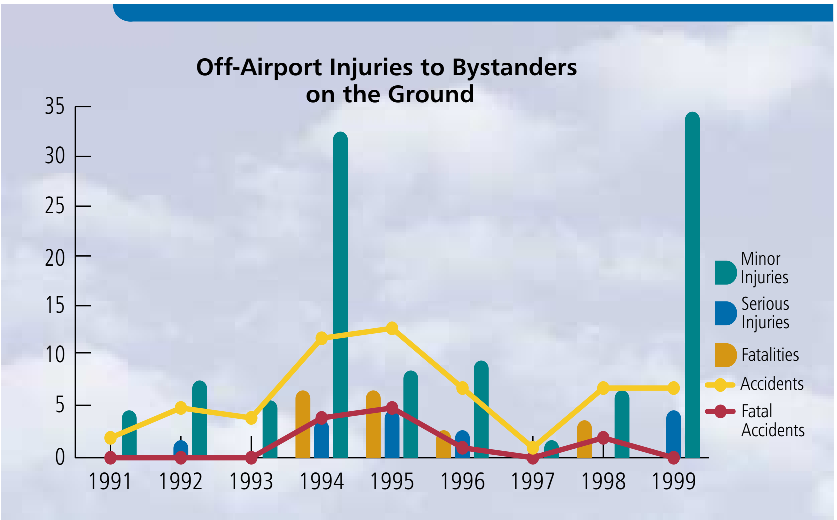
Fuel exhaustion is engine stoppage due to the depletion of all available fuel on board the airplane. Fuel starvation is engine stoppage due to an interruption of the fuel supply to the engine, even though fuel remains available in one or more of the fuel tanks in the aircraft. In 1999, there were 51 accidents caused by fuel exhaustion, of which four were fatal, resulting in seven deaths. Another 13 accidents occurred because of fuel starvation. None of these accidents were fatal. Another two accidents were attributed to fuel contamination, a condition that also contributed to some of the fuel starvation accidents. One of these accidents was fatal, with one fatality. The AOPA Air Safety Foundation recommends a minimum fuel reserve of at least one hour for both VFR and IFR operations.

Knowledge of aircraft performance, realistic preflight fuel planning, and diligent monitoring of fuel consumption would prevent nearly all fuel exhaustion accidents. A thorough knowledge of aircraft systems and a disciplined approach to fuel management are antidotes to most fuel starvation problems.



Off-Airport Injuries — 7 Total/None Fatal, 4 Serious/34 Minor Injuries

One of the myths surrounding GA is the perceived danger of light aircraft falling from the sky. In 1999, there were no fatalities and four serious injuries to off-airport bystanders. There were 34 minor injuries to bystanders throughout the year. This is up from 1998, when six people suffered minor injuries but no bystanders were seriously injured in off-airport GA aircraft accidents. In 1998, however, three bystanders were killed on the ground as a result of GA airplane accidents. In November 1999, a Bonanza crashed shortly after taking off from Linden, New Jersey. The wreckage covered more than a city block and 27 people were injured on the ground. The chart to the right shows trends in this area.



Pilot Incapacitation — 3 Total/3 Fatal

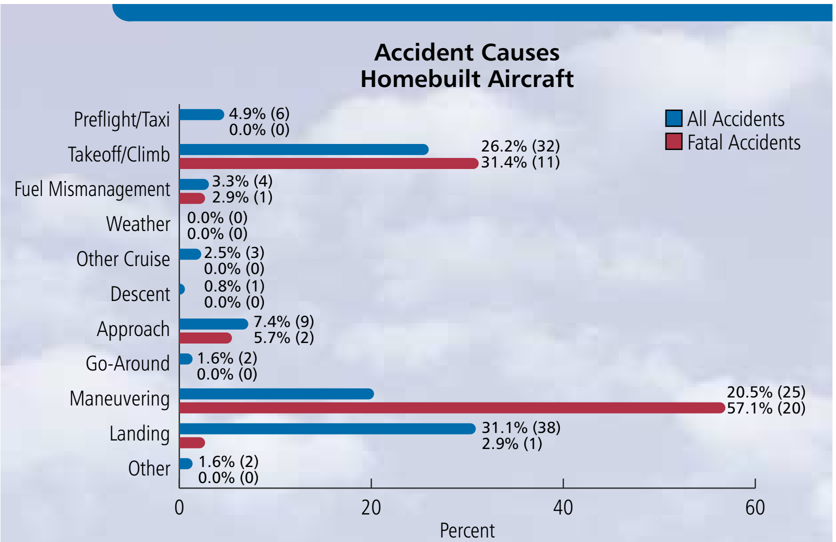
Three accidents have been identified during 1999 in which pilot incapacitation, other than from drugs or alcohol, was listed as a factor at the time of this report. All three pilots suffered heart attacks. In addition, the incapacitation of a front-seat passenger due to motion sickness led to minor injuries in a fourth accident.

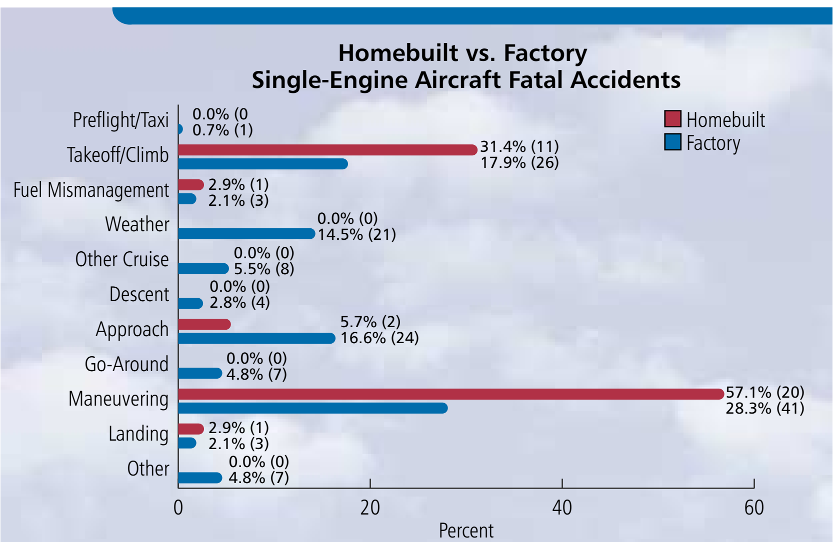
ASF's long running Pinch Hitter® course is recommended for non-flying companions. It is offered live and on video. For more information, visit our web site, www.aopa.org/asf/schedules/pinch.html.

Propeller Strike Injuries — 8 Total/2 Fatal

Three pilots/passengers were struck by turning propellers during 1999. Two of them were killed, and one was seriously injured. These accidents were a combination of pilots attempting to hand prop-start airplanes (other than those designed without starters), and people in the ramp area inadvertently coming into contact with moving propellers. This continues to be an area where a small, but consistent, number of serious injuries and fatalities occur. Pilots, flight schools, and fixed-base operators must ensure that propeller safety is included in their training and safety programs. View the ASF's Safety Advisor, *Propeller Safety,* online at www.aopa.org/asf/publications/sa06.html.

Homebuilt Aircraft





Homebuilt Accidents

Major Cause	All Accidents	Fatal Accidents
Pilot	60.7%	61.4%
Mechanical/Maintenance	23.9%	19.3%
Other	10.9%	10.5%
Unknown	4.5%	8.8%
Total	201	57

Homebuilt Aircraft

201 Total/ 57 Fatal

Accident Causes

The charts on the left show accident causes for homebuilt airplanes and how they compare to those for factory-built airplanes. Some of these accidents were the result of pilots being unprepared for the peculiarities of their aircraft. This is particularly important for initial flight testing and shows up in approach accidents. Unfortunately, however, many of these accidents were the result of poor judgment on the part of the pilots involved and not due to unique features of their aircraft.

Comparision with Factory Aircraft

In 1999, homebuilt airplanes were involved in 201 accidents. Of these, 57 fatal accidents resulted in 74 fatalities. Also in 1999, factory-built airplanes were involved in 1,500 accidents, of which 263 were fatal with 558 fatalities. Using these figures, we can deduce that 28.4 percent of homebuilt aircraft accidents resulted in fatalities, while only 17.5 percent of the accidents in factory-built airplanes were fatal. Possible factors in this disparity may include inherent design and operational risks in homebuilt airplanes, less mature technologies, less performance information available to pilots prior to flying homebuilt airplanes, differences in crashworthiness, and differences in the types of typical operations (e.g., aerobatic vs. cross-country operations). The airplanes' builders and pilots can, however, control these factors to acceptable levels. FAA studies have also shown a disproportional number of accidents to be during the first few hours of operation in the accident airplane, underscoring the need for careful preparation and a disciplined test program for a newly constructed homebuilt aircraft.

Conclusions

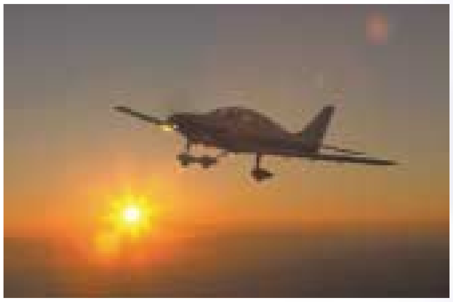
How Safe is General Aviation?

In a 1972 decision, the U.S. Supreme Court said that "safe is not the equivalent of risk free." If safe meant freedom from the possibility of harm, few human activities would meet the standard. In fact, the only way to eliminate risk from any activity is to avoid participating in it. While risk does not guarantee injury or make an activity unsafe, it should not be ignored. By analyzing mishaps, we can learn about potential risks and take proactive steps to control them.

1999—A Final Review

1999 continued the trend of the last several years with declining accident rates—both total and fatal. A slight increase in the number of accidents was offset by an increase in flight hours. A slight decrease in the number of fatal accidents was coupled with a slight increase in the number of fatalities. None of these differences was significant, however, so the fact remains that 1999 was a typical GA accident year.

The human factor continues to predominate the GA accident picture, as it does in commercial aviation. As the aviation environment becomes increasingly complex, its challenges will also increase. As expected, pilot involvement in accident causation in 1999 was high. Approximately 60 to 90 percent of aviation accidents are typically related to human causes and 1999 was no exception.



We continue to suffer the bulk of accidents in takeoff and landing and suffer the majority of fatalities due to maneuvering flight and weather encounters.

In previous years, we have cited studies that compared accidents due to skill and decision types of errors. Faulty decision making tends to result in deaths and serious injuries while skill-related types of problems are implicated in the "fender benders." Many of the less severe accidents that are attributable to skill problems also often have a component of faulty decision making where pilots have placed themselves in situations exceeding their skills.

In 1999, these facts were evident as in previous years. While VFR into IMC accidents declined somewhat, this area still continues to claim too many lives. Few of these accidents were the direct result of insufficient skills, even where noninstrument-rated pilots were involved. Pilot planning and decision making are also evident in problem areas such as fuel management. All pilots are equipped with the knowledge to avoid this problem. It remains the responsibility of all pilots to plan and execute their flights safely and within their training and skill levels.

"Safe is not the equivalent of risk free."

— U.S. Supreme Court, 1972

Pilot reports (pireps) are extremely useful components of aviation weather reporting. These reports submitted by pilots during or immediately after flight are sometimes the best and often the only way of knowing the extent and severity of weather conditions ahead. The problem with pireps is they tend to be scarce when they are most needed.

To improve pirep quality and quantity ASF created the SkySpotter™ program, online at www.aopa.org/asf/skyspotter/. Pilots who wish to participate in the program complete an ASF training program on the Internet and agree to forward pireps on every cross-country flight. This information is collected by Flight Service and ATC as available, to be disseminated to pilots and the National Weather Service to validate forecasts.

A large number of maneuvering accidents reflect another type of decision problem. While weather-related accidents often are related to errors in planning, information gathering, and in-flight decision making, many of these maneuvering accidents are the result of reckless disregard of safe operating practices. The actions that precede these accidents are not usually mistakes in judgment—they are deliberate.

Other causes continue to affect the accident picture to a lesser but still consistent degree. Alcohol and drug use continues to be evident in GA accidents, but to a much lesser degree than on the highways. The fact that it is low is most likely a reflection of the type of people that are involved in aviation.

The pilot-aircraft environment equation is the key to controlling risk. A capable pilot in a well maintained aircraft with proper consideration for flight conditions is one of the safer forms of transportation. Disregard any part of the equation and the risk will rise accordingly, as it does in any other performance activity.

Frequently Asked Questions

NTSB Definitions

Accident/Incident (NTSB Part 830)

The following definitions of terms used in this report have been extracted from Part 830 of the National Transportation Safety Board's Regulation 49CFR:

Aircraft Accident

"Aircraft Accident" means an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage.

- "Fatal Injury" means any injury which results in death within 30 days of the accident.
- "Serious Injury" means any injury which:
  - (1) Requires hospitalization for more than 48 hours, commencing within 7 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) Causes severe hemorrhages, nerve, muscle, or tendon damage;
  - (4) Involves any internal organ; or
  - (5) Involves second- or third-degree burns, or any burns affecting more than 5 percent of the body surface.
- "Minor Injury" means any injury which does not qualify as fatal or serious.
- "Demolished" includes destruction by fire.
- "Substantial Damage" means damage or failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component. NOTE: Engine failure or damage limited to an engine if only one engine fails or is damaged, bent fairings or cowling, dented skin, small punctured holes in the skin or fabric, ground damage to rotor or propeller blades, and damage to landing gear, wheels, tires, flaps, engine accessories, brakes, or wingtips are not considered "substantial damage" for the purpose of this part.
- "Minor Damage" means any damage which does not qualify as "substantial damage."

  (The NTSB definition of damage does not necessarily correlate with financial loss for insurance purposes. Contrary to popular misconception, the NTSB does not use any dollar value to define damage. Because of the high cost of many repairs, large sums of money may be spent to repair damage resulting from incidents which do not meet the NTSB definition of an accident. Because of the variability of insurance limits and other factors, such as airframe condition before the mishap or time on its engines and propellers, an aircraft may be "totaled" even though it may not meet the NTSB criteria for accident reporting.)

Kind 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 14 CFR 135, that are not operated in regular scheduled service, such as charter flights, and all nonrevenue 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 Operation

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 (either 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 airwork, basic airwork, external load operations, etc.

Unknown — The phase of flight could not be determined.

Safe Pilots. Safe Skies.

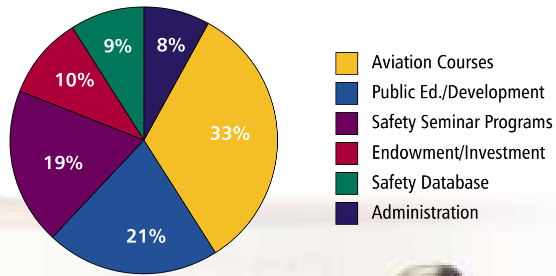
AOPA Air Safety Foundation

Chartered in 1950, the AOPA Air Safety Foundation is the nation's largest non-profit organization providing aviation safety education and programs to the general aviation community.

The mission of the Foundation is to save lives and promote accident prevention through pilot education. To serve the nation's 630,000 general aviation pilots, the Foundation:

- **Conducts hundreds of FREE aviation safety seminars nationwide** on topics such as weather, airspace, GPS, and more.
- **Produces and distributes general aviation education and training** videos, pamphlets, books, and *Safety Advisors* to increase safety awareness.
- **Provides specialized aviation training courses** for students, and renews over 7,000 CFIs each year.
- **Publishes the annual Nall Report,** which examines all general aviation accidents from the previous year and provides guidance on what the FAA, the industry, and pilots can do to lower their risk.
- **Performs accident-trend research** to focus Foundation resources on the principal causes of accidents.
- **Maintains a national aviation safety database** that contains NTSB reports on GA accidents since 1982.

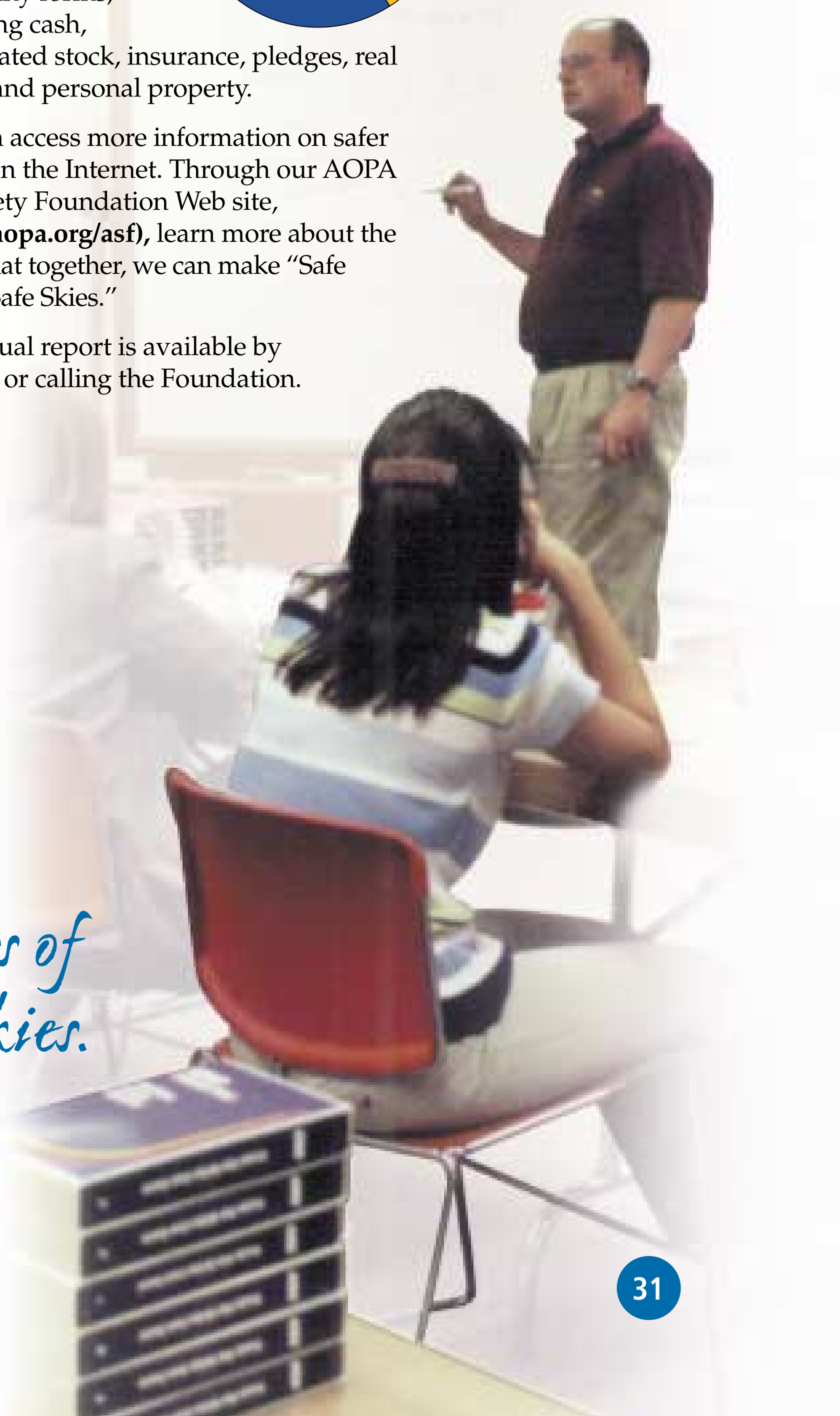
Where The Money Goes



Gifts to the Foundation qualify for the federal charitable deduction and take many forms, including cash, appreciated stock, insurance, pledges, real estate, and personal property.

You can access more information on safer flying on the Internet. Through our AOPA Air Safety Foundation Web site, (**www.aopa.org/asf),** learn more about the ways that together, we can make "Safe Pilots. Safe Skies."

An annual report is available by writing or calling the Foundation.



Celebrating 50 years of Safe Pilots. Safe Skies.

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