AOPA Air Safety Foundation

2001 Nall Report

General Aviation Accident Trends and Factors for 2000

DEDICATION

Dedicated to the memory of Joseph Nall, an NTSB Board member who died as a passenger in an airplane accident in Caracas, Venezuela, in 1989.

PREFACE

Final vs. preliminary statistics

This report is based on NTSB reports of accidents involving fixed-wing general aviation aircraft weighing less than 12,500 pounds. In order to provide the most current safety information to the pilot community as quickly as possible, we gathered NTSB data throughout the first nine months of 2001 and targeted this publication for early 2002. By August 2001, 83.7 percent of the year 2000 reports had been finalized. The remaining 16.3 percent contained preliminary data. Why only 83.7 percent? Accident investigation takes a long time – sometimes up to three years. Prior year comparisons between this mix of preliminary and final data suggest that the conclusions presented here will not change significantly when the final reports are analyzed, but you should be aware that some numbers may change slightly.

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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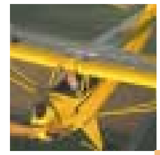
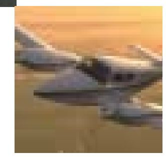

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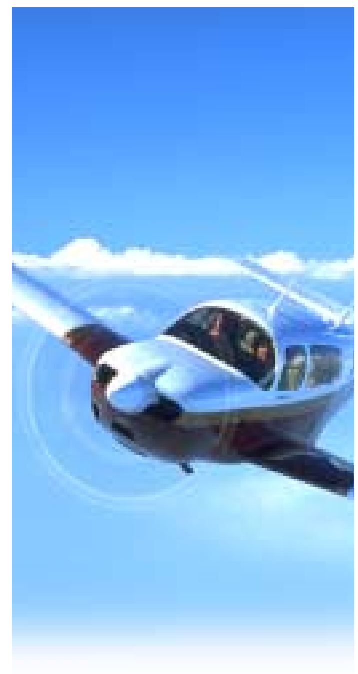


EXECUTIVE OVERVIEW

Bruce Landsberg
Executive Director,
AOPA Air Safety Foundation

Although this report deals with the year 2000, before the attacks on September 11, 2001, much recent attention has been focused on security. However, for individual general aviation pilots and their passengers, the primary emphasis must remain on the same problem areas that have been causing accidents in light aircraft for the past decade. From the time of the attacks until the end of the year, there were 309 accidents – none of which had anything to do with national security. While such accidents are always expensive in terms of lives lost/disrupted and property damage, they take on new significance this year as insurance becomes significantly more expensive or more difficult to obtain. Your attention to safety, while the nation's eyes are upon general aviation, is paramount.

The gradual improvement that the industry enjoyed over the last six years has flattened somewhat. Overall, accidents were down significantly, but fatal accidents were up slightly, and fatalities increased. This occurred against a backdrop of increased flight hours, again resulting in an estimated accident rate that is the lowest since record keeping began in 1938.

Personal flying, people using airplanes for travel and recreation, still has a disproportionate number of mishaps. Considering the nature of general aviation, 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 producers.

FAA's Joint Safety Analysis Team, of which the Air Safety Foundation (ASF) was a part, noted last year that the warning "VFR not recommended" was perhaps overused, thus diminishing its effectiveness. In 2001, ASF, working in coordination with FAA Flight Service and the National Weather Service's Aviation Weather Center, created SkySpotter™. This program is designed to significantly increase low altitude pireps to improve preflight and in-flight decision making, as well as aviation forecasts. Visit www.asf.org to learn more about this program.

Low-level maneuvering fatalities fall into the easily preventable category and this was the leading fatal accident phase of flight for 2000 for the second consecutive year. Stalls in the traffic pattern is an issue of basic airmanship but no amount of training will help the pilot who buzzes objects or people and then either loses control or collides with the ground. Good judgment is the only consistently effective preventive measure.

Last year ASF placed emphasis on collision avoidance with a dedicated seminar and a new Safety Advisor. With a special funding package and FAA participation, we were able to mail the advisor to all pilots in the state of Illinois, where radio personality Bob Collins collided in the traffic pattern of a towered airport with a student pilot. It is a reminder that regardless of experience level or environment, one must remain vigilant. Additional resources were provided in Florida and California where high-density traffic increases the potential for collision. The intent was to start an awareness campaign that will have long-lasting results. You can read the Safety Advisor online at www.aopa.org/asf/publications/sa15.pdf.

In 2002 the focus shifts to spatial disorientation. After the high profile accidents of John F. Kennedy Jr. and Governor Mel Carnahan of Missouri (still in preliminary investigation), ASF decided to revisit spatial disorientation. In 2000, there were 13 spatial disorientation accidents with the majority caused by VFR flight into instrument conditions. At this point in the analysis, no vacuum system malfunction or instrument failure has been identified.

As always, Federal Aviation Administration (FAA) and National Transportation Safety Board (NTSB) staff provide invaluable assistance to make this report 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 the coming year the best one ever for general aviation safety.

Safe Pilots. Safe Skies.

Bruce Landsberg
Executive Director

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 fire fighting, 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 7.

What Does General Aviation Fly?

General aviation aircraft are as varied as their pilots and the types of operations flown. The number of aircraft, sorted by category and class, registered in 1999 (the most recent year available from the FAA) to air taxi operators and GA is shown below:

	Air Taxi	**General Aviation**
Piston single-engine	652	150,081
Piston multiengine	1,607	19,469
Turboprop single-engine	75	943
Turboprop multiengine	860	3,802
Turbojet	496	6,625
Helicopter	746	6,701
Experimental	30	20,493
Total	**4,466**	**208,114**

The following aircraft categories and classes are included in this report:

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

The following are not included in this report:*

- Turbojets
- Part 121 airline operations
- Part 135 charter operations
- Military operations
- Aircraft weighing more than 12,500 pounds
- Helicopters
- Gliders
- Lighter than air

**Note: Midair collisions involving a general aviation fixed-wing aircraft and another aircraft category or commercial/military operation are included.*

Analysis

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 activity survey conducted by the FAA. Whether this accurately reports the total hours has been debated for years, but, even though the rate may not be accurate, the relationships between accident categories will probably not change significantly with more accurate exposure data. Landing accidents will still account for the lion's share 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 particular causes 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. Percentages based on small numbers of events can be misleading so we provide the warning-Caution: Small Numbers-when that is the case.

Sequence of Events and Accident Causality

The Boeing Commercial Airplane Company, studying accidents of transport-category aircraft, found that most result from a sequence of events rather than a single catastrophic event. Their research identified as many as 20 events in a single flight that directly influenced the accident. The NTSB uses a similar method to break down each accident into "occurrences."

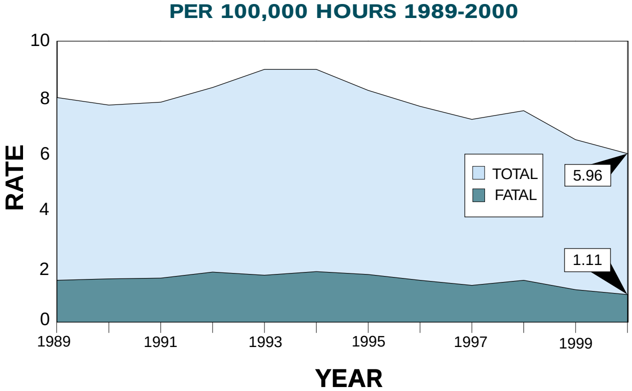
Our objective is to prevent future accidents by learning from the past. This report identifies the phase of flight in which the sequence of events began, often referred to as the "first occurrence." Compensating for hazards associated with the "first occurrence" or breaking a subsequent link in the chain of events should prevent the accident.

Overview of Accident Trends and Factors for 2000

2000 Statistics

The FAA's estimate of flight hours increased from 29.5 million in 1999 to 30.8 million in 2000. The GA accident rate per 100,000 flying hours declined slightly in 2000 compared to previous years because the number of accidents declined despite a higher number of hours flown that year.

U.S. GENERAL AVIATION ACCIDENTS
PER 100,000 HOURS 1989-2000



GA accident statistics derived from NTSB accident reports are presented below.

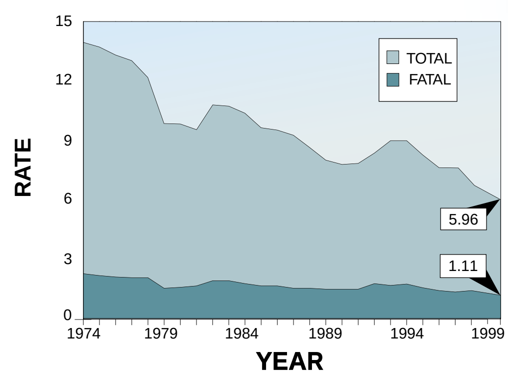
ACCIDENT STATISTICS
PAST EIGHT YEARS

	1993	1994	1995	1996	1997	1998	1999	2000
Total Fixed-Wing GA Accidents	1,856	1,770	1,861	1,706	1,646	1,688	1,704	1,654
Fatal Fixed-Wing GA Accidents	377	364	393	335	333	351	326	342
Total Fixed-Wing GA Fatalities	687	653	695	608	634	649	644	672
Estimated GA Flight Hours	22.8M	22.2M	24.9M	24.9M	25.5M	25.4M	29.5M	30.8M

Accident Rate

The chart below shows the overall GA accident rate per 100,000 flying hours. Continuing a slight downward trend that began in 1994, 2000 had the lowest total accident rate and the lowest fatal accident rate since 1938, the first year for which such accident statistics were reported. The decline has slowed in the past 10 to 12 years. The fatal accident rate has experienced a more gradual decrease over the past 16 to 17 years. This is to be expected, as easily addressed accident causes and factors are mitigated through education, training, and technology. The remaining causes and factors will pose more difficult problems that require more effort and resources to solve.

U.S. GENERAL AVIATION ACCIDENTS
PER 100,000 HOURS 1974-2000



GA accident rates have always been higher than airline accident rates because GA operations involve risks that airline operations do not share. Some of the important distinctions of GA are:

- **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.

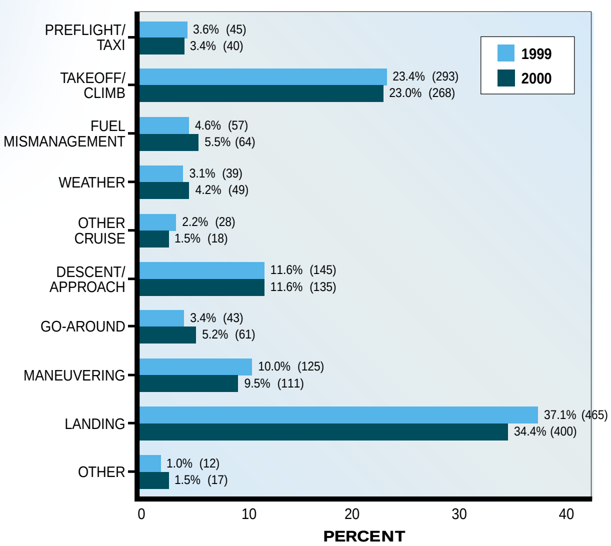
- GA airports may lack the precision approaches, long runways, and advanced services of airline-served airports.
- Many operations, such as aerial application and banner towing, have special mission-related risks.
- More takeoffs and landings — the highest risk phases of any flight.
- More individual responsibility — GA aircraft owners and pilots are individually responsible for the safety of flight. Air carriers and the military have dispatchers, mechanics, and loadmasters to help share a variety of duties.
- GA operates aircraft that generally must fly though the weather instead of over it or that may not have systems to avoid/cope with adverse weather conditions.

Although GA operations involve some additional risk, that certainly does not guarantee an accident. Most GA operations are safe, and pilots who actively manage risk make those operations even safer.

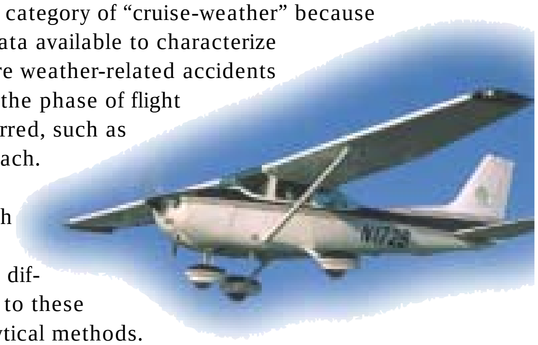
Comparison with Other Years

The GA accident picture for 2000 was typical and 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 simply because a bad design can be improved to "engineer out" the problem. This does not mean that accidents are inevitable nor does it mean that just by trying harder, or by adding multiple layers of regulation, the safety record will improve significantly.

1999-2000 COMPARISON
PILOT-RELATED ACCIDENTS



Care must be taken when comparing this year's data with earlier years. Over the past three years, we have modernized our Aviation Safety Database to incorporate the most complete data available from the NTSB. This made more final accident reports available for analysis, but it 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" because 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

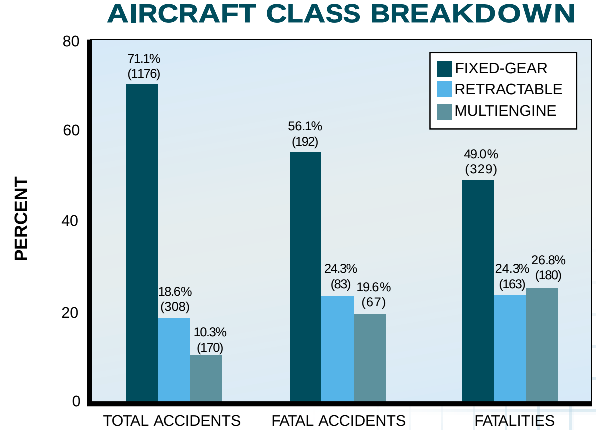
Higher accident numbers during the spring and summer months are the result of greater flight activity. Certain types of accidents tend to be season-specific due to changes of weather patterns, shorter days during winter months, and increases in certain types of flying such as recreational flying, aerobatic flying, and vacation trips during the spring, summer, and early fall.

In 2000, the highest number of accidents occurred during the summer months of June, July, and August. The total accident counts for those months were 172, 221, and 208, respectively. The lowest number of accidents occurred during January (76) and December (81).

Breakdown by Aircraft Class

In 2000, as in the past, the number of accidents in each class of aircraft reflects the number of hours and types of operations flown. 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. For example, training aircraft are more likely to be involved in takeoff and landing accidents since they spend much of their time in pattern operations with inexperienced pilots.

ACCIDENT SEVERITY
AIRCRAFT CLASS BREAKDOWN



Note that increased complexity increases the amount of risk that must be managed. Higher speeds and more complex systems place higher demands on pilots' attention and systems management skills. This includes not only features such as retractable landing gear and constant-speed propellers, but also the inclusion of sophisticated navigation and autopilot systems on otherwise simple airplanes.

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

Our studies have shown that low time in type is often a significant contributing factor in accidents. Transitioning to a new aircraft, even one that is less complex than the one the pilot usually flies, can cause problems for experienced pilots as well as novices.

Maneuvering flight and weather accidents accounted for the highest proportions of fatal accidents in both single-engine and multiengine aircraft (see graph on page 9).

As aircraft increase in size, minimum flight speeds also increase and that increases the probability of fatalities. In single-engine fixed-gear airplanes, 15.5 percent (30 of 193) of all takeoff/climb accidents were fatal, 31.4 percent (16 of 51) were fatal in single-engine retractable-gear airplanes, and 31.8 percent (7 of 22) were fatal in multiengine airplanes.

Maneuvering flight, the dominant accident factor 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 45.8 percent (44 of 96) of these accidents. In single-engine retractable-gear airplanes, 80 percent (eight of 10) were fatal. There were only four maneuvering accidents in multi-engine airplanes, but three of them were fatal.

Weather-related accidents continue to have the highest probability of fatalities. In single-engine fixed-gear airplanes, 85.7 percent (24 of 28) of weather-related accidents were fatal. In single-engine retractable-gear airplanes 94.1 percent (16 of 17) of weather-related accidents were fatal and 100 percent (four of four) of weather-related accidents in multiengine airplanes resulted in fatal injuries.

Landings continue to account for the highest number of total accidents, while accounting for some of the lowest numbers of fatal accidents. In 2001, there were 400 total landing accidents – four resulted in fatalities. 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.

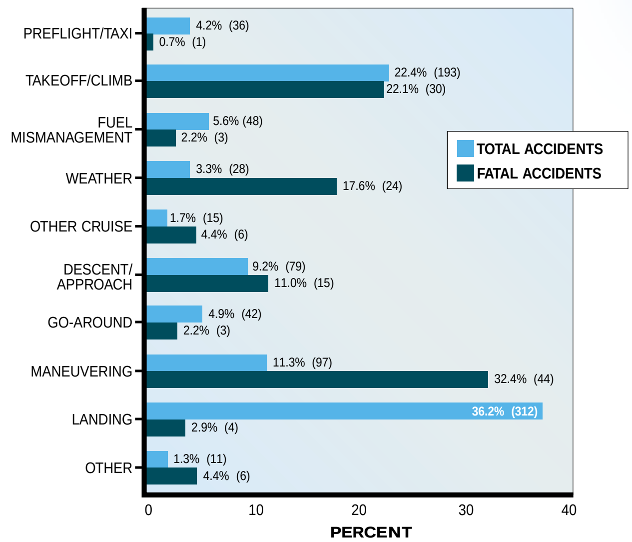
The paragraphs below outline the key areas of concern and related statistics in each class of airplane.

Single-Engine Fixed-Gear Aircraft
861 Total/136 Fatal

The following constitute the top four areas for fatal accidents in single-engine fixed-gear aircraft in 2000. Together, these areas account for 83.1 percent of all fatal pilot-related accidents in these airplanes.

- Maneuvering flight: 32.4 percent (44)
- Takeoff and initial climb: 22.1 percent (30)
- Weather: 17.6 percent (24)
- Descent/Approach: 11 percent (11 VFR, 4 IFR)

ACCIDENT CAUSES SINGLE-ENGINE FIXED-GEAR

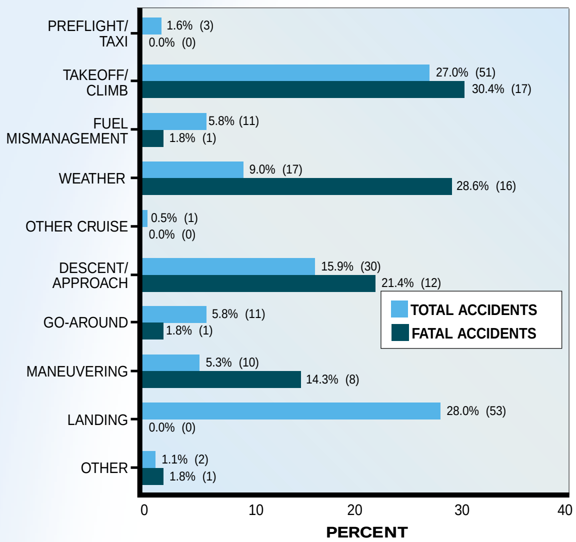


Single-Engine Retractable-Gear Aircraft
189 Total/56 Fatal

The following constitute the top four areas for fatal accidents in single-engine retractable-gear aircraft in 2000. Together, these areas account for 94.7 percent of all fatal pilot-related accidents in these airplanes.

- Takeoff and initial climb: 30.4 percent (17)
- Weather: 28.6 percent (16)
- Descent/Approach: 21.4 percent (4 VFR, 8 IFR)
- Maneuvering flight: 14.3 percent (8)

ACCIDENT CAUSES SINGLE-ENGINE RETRACTABLE-GEAR

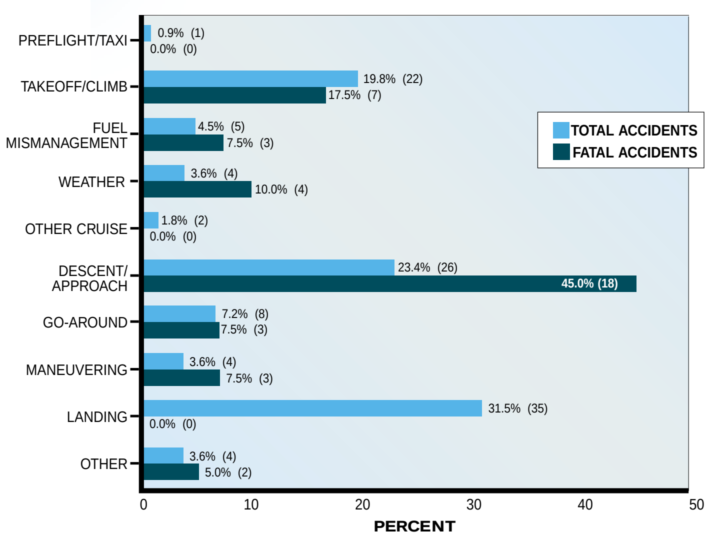


Multiengine Aircraft
111 Total/40 Fatal

The following constitute the top three areas for fatal accidents in multiengine aircraft in 2000. Together, these areas account for 72.5 percent of all fatal pilot-related accidents in these airplanes.

- Descent/Approach: 45 percent (8 VFR, 8 IFR, 2 Unknown)
- Takeoff and initial climb: 17.5 percent (7)
- Weather: 10 percent (4)

ACCIDENT CAUSES - MULTIENGINE

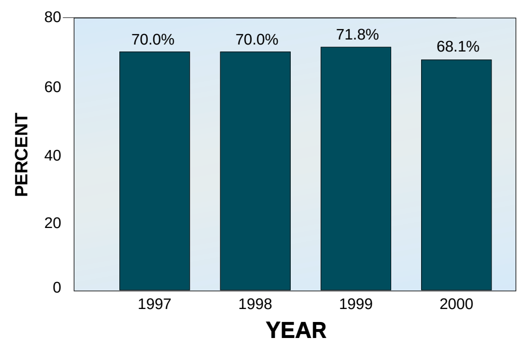


Accident Causes and Factors

Summary of Significant Factors

Total accident counts dropped significantly, but fatal accidents increased during 2000 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 — 70.2 percent of all accidents and 67.8 percent of fatal accidents — were the result of pilot-related causes. This will likely increase several percentage points as the last reports of 2000 are finalized. Typically, the final numbers attribute 75 percent of all accidents to pilot-related causes.

"FENDER-BENDER" ACCIDENTS 1997-2000



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

The following are some of the most significant factors influencing GA accidents.

- Takeoff and landing account for less than five percent of a typical cross-country flight, but they constitute an impressive 55 percent of accidents for which the emergency phase of flight is known. 17.1 percent of fatal accidents occurred during takeoff or landing (14.4 and 2.7 percent, respectively). Takeoff is the far more dangerous environment. The predominant cause of takeoff accidents was "loss of control/stall on takeoff." These accidents were fatal 19.8 percent (53 of 268) of the time.

The category with the largest number of landing accidents (79 of 400) was "loss of control on landing in crosswind/gust/tailwind conditions."

• Weather-related accidents accounted for 19 percent of all fatal pilot-related accidents. In multiengine airplanes, 10.0 percent of fatal accidents were related to weather. For single-engine retractable-gear airplanes, the figure was 29.1 percent and 17.6 percent for single-engine fixed-gear airplanes. 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 25.0 percent of the IMC accidents, 23.7 percent of all approach accidents, and 24.4 percent of fatal approach accidents happened at night. In addition, 36.6 percent of all instrument approach accidents and 30 percent of fatal instrument approach accidents happened at night. This is significantly higher than the average of 6.2 percent of all accidents that happened at night. Night complicates all flight operations – particularly instrument operations – and if an accident occurs at night, it's much more likely to be fatal. This doesn't mean that pilots should avoid night flight. It means they should be aware of, and compensate for, the additional risk.

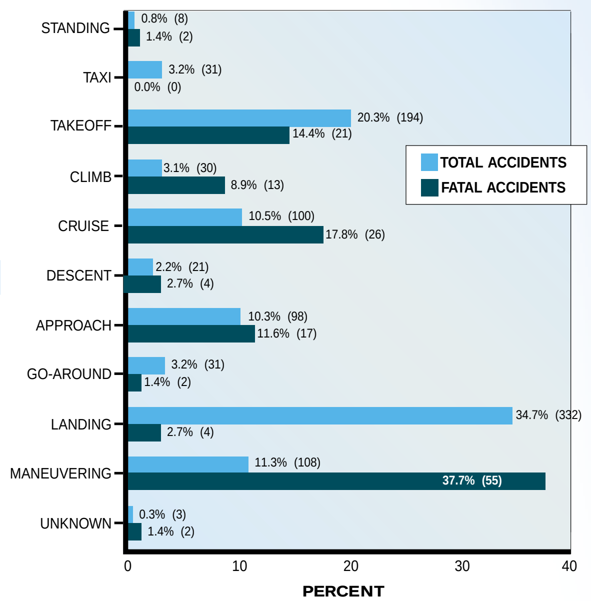
• Maneuvering flight accidents accounted for 23.7 percent of all fatal pilot-related accidents. Many of these accidents involved buzzing or other low-level flight.

• Personal flight comprises only 44.3 percent of GA activity but these flights accounted for 67.3 percent of all accidents and 64.4 percent of all fatal accidents.

The Accident Setting – Phase of Flight

Most 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.

EMERGENCY PHASE OF FLIGHT



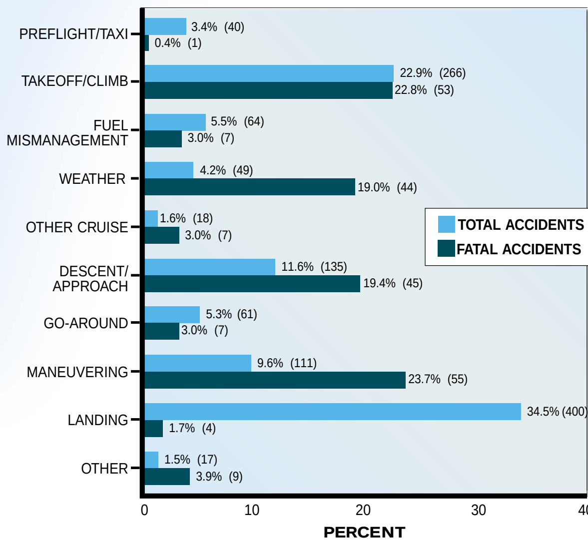
The chart above classifies pilot-related accidents according to the phase of flight in which the situation that resulted in the accident began. For example, fuel exhaustion or an encounter with low weather may have caused the pilot to make a precautionary landing. Although the accident actually occurred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

Cruise is one phase in which GA accident proportions consistently differ from commercial flying. Weather is usually the culprit in cruise accidents – especially when GA pilots attempt VFR flight into IMC. Approximately half of the pilot population is instrument qualified. While IFR flying presents new risk areas that pilots must manage, earning an instrument rating can equip the pilot with vital life-saving skills. Studies have shown that attainment of an instrument rating can reduce pilots' accident potential, even in areas unrelated to weather.

Pilot Involvement

Pilot-related problems accounted for 70.2 percent of all accidents and 67.8 percent of the fatal accidents in the accident records reviewed for this report. After all reports are finalized this typically climbs to 75 percent. Many of the mechanical/maintenance accidents are also attributable to human-related problems.

ACCIDENT CAUSES PILOT-RELATED ACCIDENTS



Specific Pilot-Related Causes
1161 Total/232 Fatal

The chart above compares accidents in which the major cause was attributed to the pilot. There is some overlap in the terms used to describe the phase in which the emergency occurred and the accident cause, but the two are not always the same. For example, fuel exhaustion resulting in an accident may have occurred during cruising flight or during a landing approach. The accident cause will be attributed to fuel mismanagement, and the phase of flight may be listed as approach or cruise. Conversely, problems associated with 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 is 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 as type of operation. The following sections focus on three of the most common GA operations: personal flying, business flying, and instructional flying. The table at right shows how those categories compare to other types of operations.

TYPE OF OPERATION

TYPE OF OPERATION	Percent of Flying (1999)	Percent of Total Accidents (2000)	Percent of Fatal Accidents (2000)
Personal	44.3	67.3	64.4
Instructional	22.1	13.1	8.2
Aerial Application	4.8	6.0	5.0
Business	13.6	4.0	6.1
Positioning	*	1.7	2.3
Ferry	*	1.0	0.3
Other Work Use	2.2	1.0	1.2
Public Use	2.2	0.7	0.9
Aerial Observation	4.1	0.4	0.3
Exec./Corporate	5.5	0.4	0.9
Other/Unknown	1.1	4.4	10.2

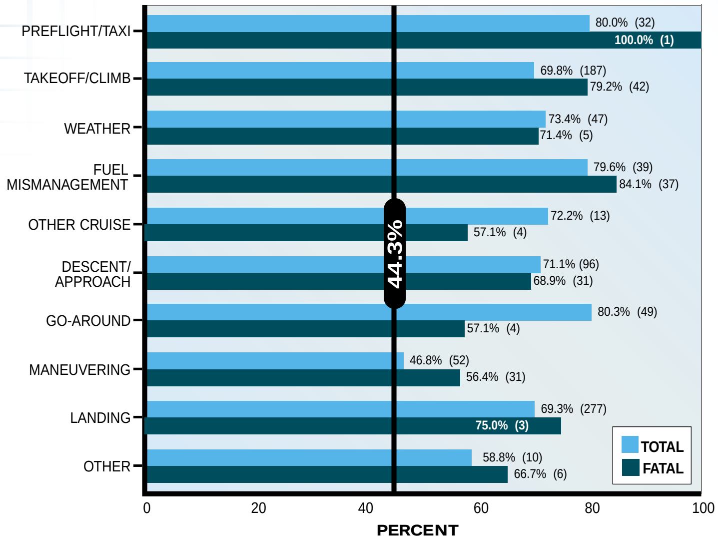
*Included in Other/Unknown

Personal Flying
802 Total/164 Fatal

In a typical year, personal flying comprises approximately 45 percent of all GA flights (44.3 percent in 1999, 45.4 percent in 1998) – by far the largest single type of operation. For 2000, however, accidents during these operations represented an even larger proportion of the total accident picture, accounting for 67.3 percent of all accidents and 64.4 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.

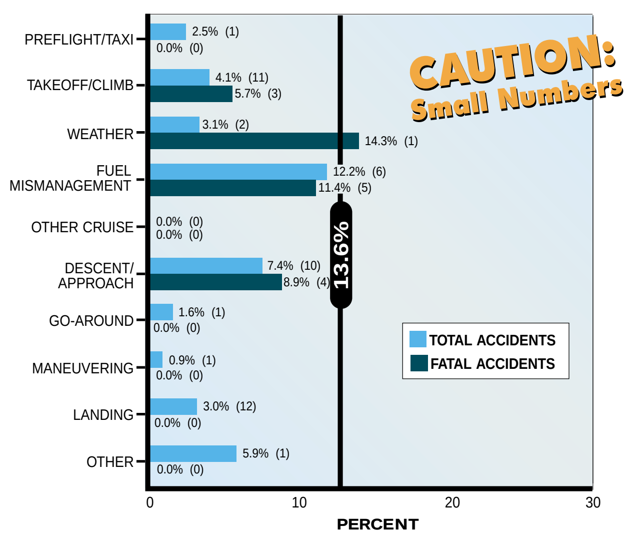
The chart on page 8 shows the proportion of accidents due to a particular cause that occurred during personal flights. The solid reference line shows the 44.3 percent

PROPORTION OF ACCIDENTS ATTRIBUTED TO PERSONAL FLYING



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. Only four fatal landing accidents were recorded in 2000 during all types of flying combined and three of these occurred during personal flights.

PROPORTION OF ACCIDENTS ATTRIBUTED TO BUSINESS FLYING

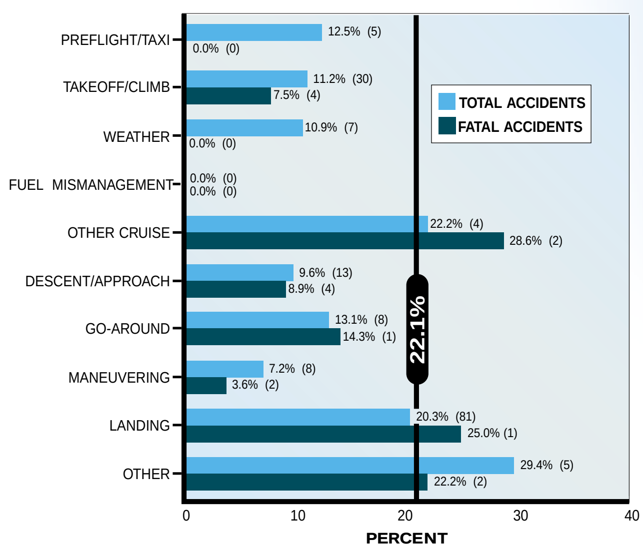


Business Flying
45 Total/13 Fatal

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 4.0 percent of the total accidents and 6.1 percent of the fatal accidents in 2000, while accounting for 13.6 percent of all GA flight hours. Note: There is a distinction between business and corporate flying. Many corporations that operate turbojet aircraft or airplanes that weigh more than 12,500 pounds are not considered in this report. Conversely, smaller propeller airplanes operated by individuals or corporations are included.

The chart below, left, shows the causes of business travel accidents. The reference line at 13.6 percent may be used in the same manner as described under "Personal Flying." As in most recent years, all causal areas of business flight accidents in 2000 were lower than the proportion of business flying hours to total flying hours, except for fatal accidents during bad weather. This particular statistic should be used with caution, however, because of the extremely small number of fatal accidents that take place during bad weather. In 2000, there were two business accidents that occurred during bad weather, and one involved fatalities. Business flights also accounted for 8.9 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.

PROPORTION OF ACCIDENTS ATTRIBUTED TO FLIGHT INSTRUCTION



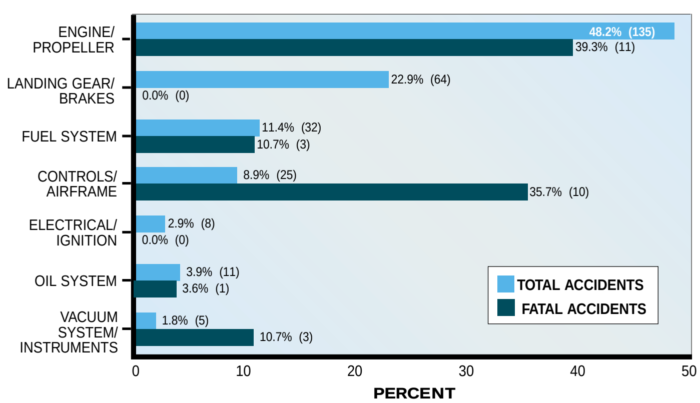
Instructional Flying
161 Total/16 Fatal

The proportion of total accidents attributed to instructional flying was almost identical to the previous year. Flight training, which includes dual instruction and solo flight for instructional purposes, accounted for 13.8 percent of the accidents in both 2000 and 1999. The proportion of fatal accidents suffered during instructional flights rose from 5.3 percent in 1999 to 6.9 percent in 2000. These figures are still well below the 22.1 percent of instructional flying in 1999 (the most recent estimate available – see table on page 7). 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 decreased by six percent in 2000 compared to the previous year's figures (231 vs. 217).
• Pilot-related instructional accidents declined by 15.7 percent between 1999 and 2000 (191 in 1999 vs. 161 in 2000).
• Landing accidents in instructional flights decreased by 27.7 percent in 2000 (112 vs. 81). Only one of these accidents resulted in fatal injuries compared to three in 1999.
• Accidents in takeoff and initial climb remained virtually unchanged (31 in 1999 vs. 30 in 2000).

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.

MECHANICAL/MAINTENANCE ACCIDENTS



Mechanical/Maintenance
280 Total/28 Fatal

Mechanical/maintenance accidents accounted for 16.9 percent of all accidents and 8.2 percent of fatal accidents. This is up slightly from 1999, when 15.8 percent of all accidents were attributed to mechanical/maintenance issues. By far, the largest percentage of these accidents resulted from powerplant or propeller problems (48.2 percent of all mechanical/maintenance accidents and 39.3 percent of fatal mechanical/maintenance accidents). In addition, another 82 accidents were classified as "power malfunction/loss for unknown reasons." For instance, carburetor icing could cause an engine to stop but by the time investigators look at the carburetor, the ice may have melted. The investigations for 12 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.

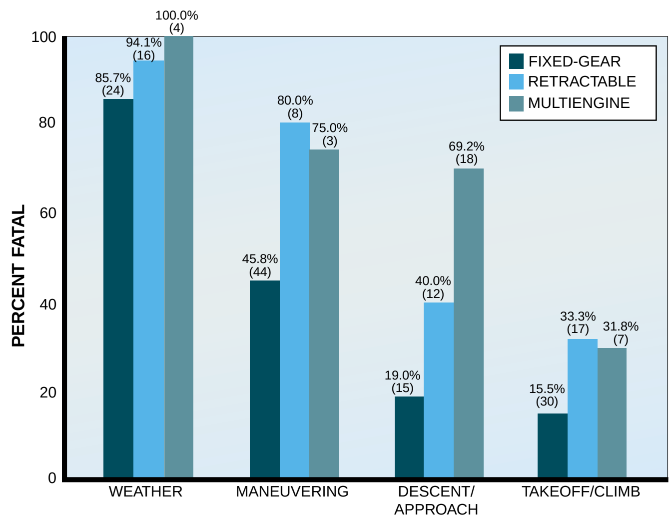
Pilots should note that several of the mechanical failure accidents could have been prevented by a thorough preflight. Other accidents resulted when pilots incorrectly performed procedures after system failures occurred.

Fatal Accident Factors

Based upon the probability of fatalities, the primary causes of fatal accidents across all classes of airplanes for 2000 were weather, maneuvering, and descent/approach.

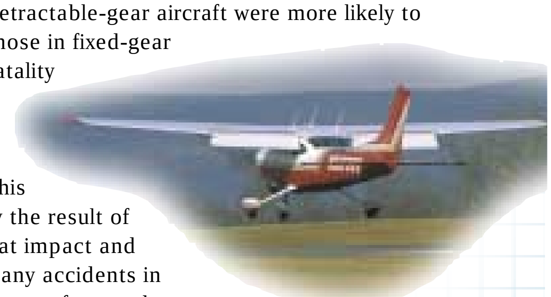
As in the past, the causes of fatal accidents were closely linked to the flight profile, including the length of the trip, the time of day, the purpose of the trip, and whether the flight was IFR or VFR.

ACCIDENT SEVERITY



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, accidents in single-engine retractable-gear aircraft were more likely to be fatal than those in fixed-gear aircraft. The fatality rate for multi-engine airplanes was even higher. This was most likely the result of higher speeds at impact and the fact that many accidents in these airplanes are of types that are inherently more likely to result in fatalities (e.g., loss of control or collision with terrain in weather).



• **Weather:** Weather-related accidents were more likely to be fatal than accidents with any other cause. Fully 90 percent of weather-related accidents (44 of 49) 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.

- **Maneuvering flight:** Approximately half (49.5 percent) of all accidents involving maneuvering flight (55 of 111 accidents) involved fatalities. Like weather-related accidents, maneuvering accidents frequently involved aircraft crashing out of control or colliding with terrain, wires, or other structures.
- **Descent/Approach:** Approximately a third (33.3 percent) of all approach accidents (45 of 135) 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.

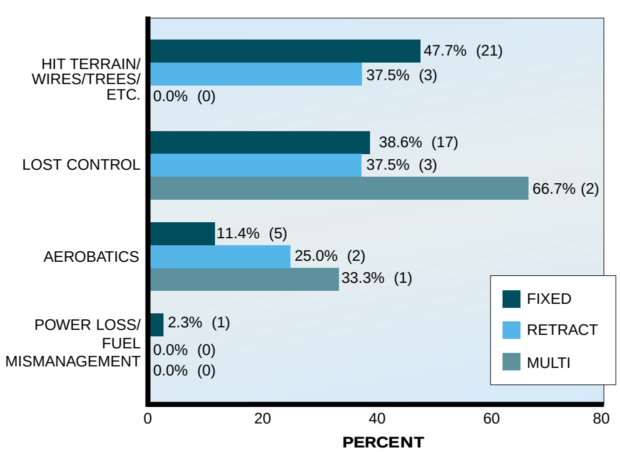
It should also be noted that while only 19.8 percent of accidents attributed to takeoff or initial climb-out were fatal, 53 fatal accidents were related to takeoff problems, eight more than the 45 fatal accidents due to approach problems. The low fatality rate was due to the large number of nonfatal takeoff accidents – 215 of 268 (80.2 percent) 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

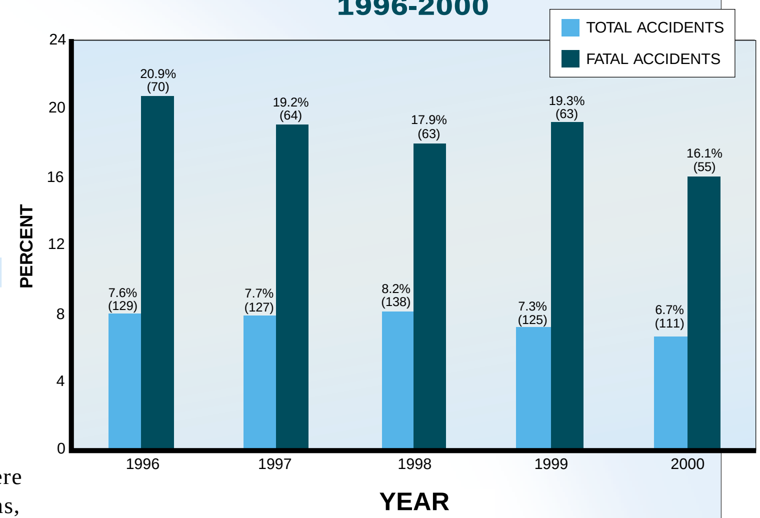
111Total/55 Fatal

Maneuvering flight continues to be one of the largest producers of fatal accidents. It is also one of the most preventable. Twenty-four of 55, or 43.6 percent, of fatal maneuvering accidents were the result of "hit terrain, wires, trees, etc." Twenty-two of the 55 (40 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.

FATAL MANEUVERING ACCIDENTS

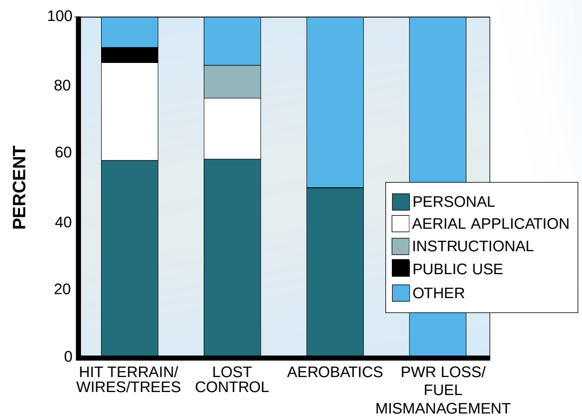


MANEUVERING ACCIDENTS 1996-2000



Some maneuvering 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,

FATAL MANEUVERING ACCIDENTS TYPE OF OPERATION



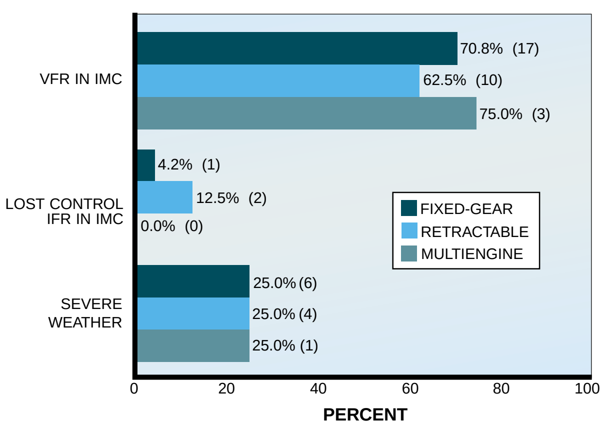
severely taxing the pilot's capability. These operations carry some inherent risk and demand skill and vigilance from the pilot.

More often than not, maneuvering accidents occurred during personal (56.4 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.

FATAL WEATHER ACCIDENTS



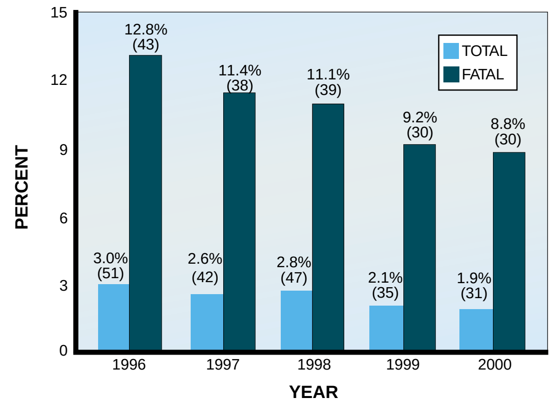
Weather

49 Total/44 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 11 fatal approach accidents. Wind shear and crosswinds also caused weather-related accidents in VFR conditions.

Thirty of the 44 fatal weather-related accidents (68.2 percent) were caused by "attempted VFR flight into IMC." Seventeen of these were in single-engine fixed-gear aircraft.

"VFR INTO IMC" ACCIDENTS 1996-2000

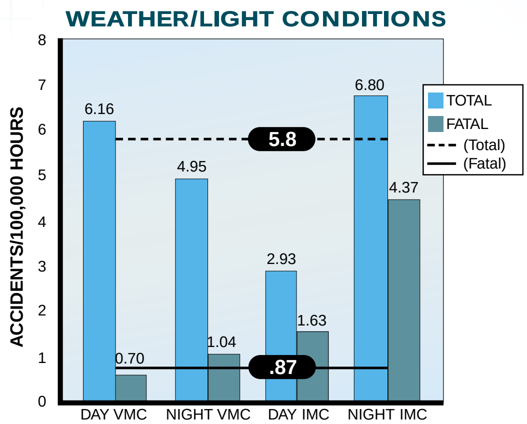


Ten of 16 (62.5 percent) fatal weather-related accidents in retractable-gear single-engine airplanes were due to this cause. Three of the four fatal accidents in multiengine airplanes were also due to VFR into IMC. While many of these accidents involved inexperienced noninstrument-rated pilots, high-time commercial and airline transport pilots were also included. VFR flight into IMC continued to be one of the most frequent single causes of fatal accidents, leading one to the question, "What part of cloud don't pilots understand?" Because so many of these accidents were fatal, there are few surviving pilots to answer the question. The AOPA Air Safety Foundation's Safety Review: *General Aviation Weather Accidents* offers detail and analysis of weather accidents.

Interaction of Night and Weather

The table below shows total and fatal accidents in various light and weather conditions. Night increases the probability of fatalities in a given accident. Only 20.7 percent of all accidents resulted in fatalities, but 29.6 percent of night accidents were fatal. Day IMC, however, nearly doubles the probability of an accident – 55.6 percent of day IMC accidents resulted in fatalities. The combination of night and IMC increased the proportion of fatal to total accidents to 64.3 percent, making it the most deadly general aviation flight environment.

CONDITIONS	Total Accidents	Fatal Accidents	Percent Fatal
Day VMC	1,171	133	11.4%
Day	1,231	165	13.4%
VMC	1,513	248	16.4%
All Conditions	1,654	342	20.7%
Night VMC	114	24	21.1%
Night	142	42	29.6%
Day IMC	54	30	55.6%
IMC	112	75	67.0%
Night IMC	28	18	64.3%



The chart above shows the interaction between weather and light conditions. The horizontal lines indicate the total and fatal accidents per 100,000 hours 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 visual meteorological conditions (VMC). Unfortunately, information on light and weather conditions was not available for 17.3 percent of the NTSB accident reports for 2000, or for 40.1 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. However, even with imperfect information available, bad weather and night increase the risk level significantly.

Special Emphasis Topic for 2002

Spatial Disorientation

On October 16, 2000, Missouri Governor Mel Carnahan died in an airplane crash that resulted from a loss of control in instrument conditions. The governor's son, an instrument-rated commercial pilot, was at the controls of the Cessna 335. He contacted ATC to report problems with the airplane's primary attitude gyro and said he was attempting to control the airplane by reference to the copilot's attitude indicator. Shortly afterward the airplane crashed, killing all aboard. At the time of this printing, the NTSB has not yet released a final report for this accident. However, preliminary NTSB documents have not identified any equipment malfunction.

Spatial disorientation occurs when a pilot is deprived of visual references to determine an aircraft's orientation in three-dimensional space. The pilot's sensations of balance and orientation, called "kinesthetic senses," are based on information sent from the inner ear to the brain. This information is accurate if the person is motionless, moves slowly, or is supplemented by "visual cues." When the body is not stationary, 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. Because these false impressions are based on physics and a basic aspect of human physiology, they cannot be avoided by training and can, therefore, affect pilots of all experience levels. Any conditions that deprive the pilot of natural, visual references to maintain orientation, such as clouds, fog, haze, darkness, or terrain/sky backgrounds with indistinct contrast, can rapidly induce spatial disorientation.

Sixty-five percent of these accidents occur when VFR pilots fly into instrument weather (IMC). Once in the soup, pilots must fly by reference to the aircraft instruments until they can regain visual reference. This 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.

Each year, a few pilots are killed after losing either the primary attitude indicator or the gyro's power source, usually a vacuum pump or dual pumps. ASF conducted a review of accidents occurring between 1991 and 2000 in which the vacuum system, electrical system, or gyros were implicated. A number of accidents occurred in which pilots reported gyro problems and disorientation in airplanes, but upon post crash investigation, no faults could be found. Several of these accidents occurred in airplanes equipped with backup systems that should have been capable of powering at least part of the airplane's gyros. In some of the accidents reviewed, the pilots apparently did not understand the limitations of the remaining systems when the backup systems were in use. In at least two cases, apparent effects of one failure (e.g., debris from the failed pump) interfered with operation of the remaining system.

Some pilots fail to recognize the seriousness of a vacuum failure, and decide to continue on their flight. In one such case, a pilot and his wife, also a pilot, took off in marginal VFR weather to return home after their vacuum pump failed on their trip's outbound leg. Trapped between layers in deteriorating weather, the pilot obtained an IFR clearance but lost control and crashed while attempting an instrument approach. Both pilots perished in the crash. Another pilot in a complex single, after losing his vacuum pump, continued toward his destination, an hour's flight time away, in IFR conditions rather than diverting. That decision proved to be fatal.

In 2000, 13 accident reports cited "spatial disorientation" as the accident cause or a contributing factor. None involved vacuum or instrument failures, although there have been 25 such accidents since 1990. The conditions surrounding a significant number of other weather-related accidents also suggest that spatial disorientation may have been contributory as well. A discussion of all accidents in which weather was implicated is contained on page 11.

Since John F. Kennedy Jr.'s tragic accident in 1998, much has been written about the use of autopilots by pilots inadvertently entering instrument conditions. While this can be a valuable lifesaving technique, the autopilot is not a substitute for instrument skills and good judgment. The same caution goes for the use of GPS and other advanced navigation equipment. These devices are excellent situational awareness and navigation aids, but they offer no assistance in maintaining airplane control.

Between 1990 and 1999 there was an average of more than 27 accidents per year, of which 24 annually were fatal. At this rate, there is one spatial disorientation accident every 13 days or a fatal one every 15 days. Pilots must be familiar with the systems of the aircraft they fly, receive regular recurrent training, and use sound judgment.

Perhaps the key point to remember in spatial disorientation discussions is that roughly 90 percent of these accidents are fatal. Equipment failure is identified in only about 10 percent of the crashes. Remain VFR unless rated, current, and equipped.

The Air Safety Foundation's Safety Advisor, *Spatial Disorientation: Confusion that Kills*, available online at www.aopa.org/asf/publications/sa17.pdf, contains additional information about spatial disorientation.

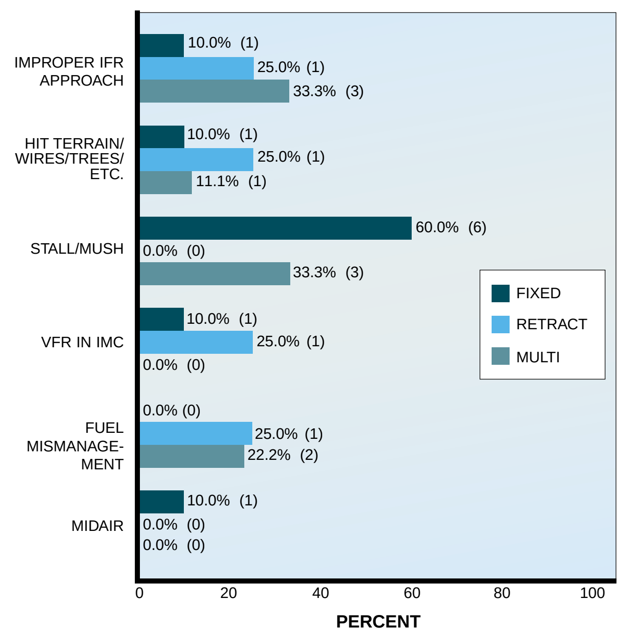
Approach

135 Total/45 Fatal

103 VMC/30 IMC/2 UNKNOWN

Accidents resulting from mishandled approaches, although low in number, were fatal 33.3 percent of the time. Most problems in this category 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.

FATAL APPROACH ACCIDENTS



Fatal instrument approach accidents involved three multiengine, one retractable single-engine, and one fixed-gear single-engine airplane. To prevent these accidents, pilots must build and maintain their skills. Training and currency are essential but pilots must also deal with fatigue. Instrument-rated pilots must perform complex tasks, often after flying for long periods in bad weather.

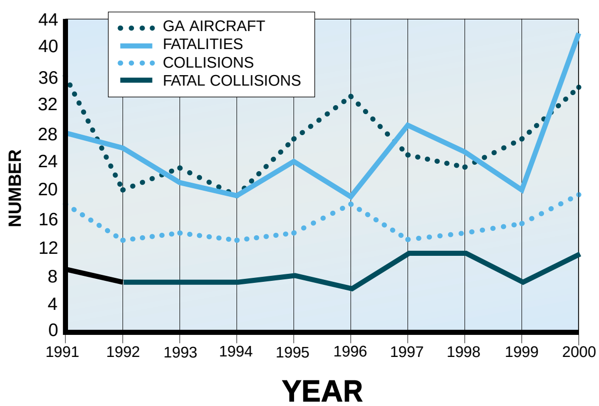
Airline studies conducted by NASA and FAA have shown that the most demanding tasks, landing and approach, must be performed at a time when the pilot's ability to accomplish complex tasks may be significantly diminished.

Other Accident Factors

Midair Collisions
19 Total/11 Fatal

During 2000 there were 19 midair collisions involving a total of 34 GA aircraft. The other aircraft involved do not meet the criteria for this report. They were: a Piper Navajo and Cessna 208 operating under Part 135, a Lear 55, and an F-16. Eleven of these accidents were fatal, resulting in 42 deaths. There were four more midairs in 2000 than in 1999. Midair collisions occur mainly on good VFR days, at low altitude, close to airports. In 2000, all of the midair collisions occurred in VMC and during the hours of daylight.

MIDAIR COLLISIONS
1991-2000



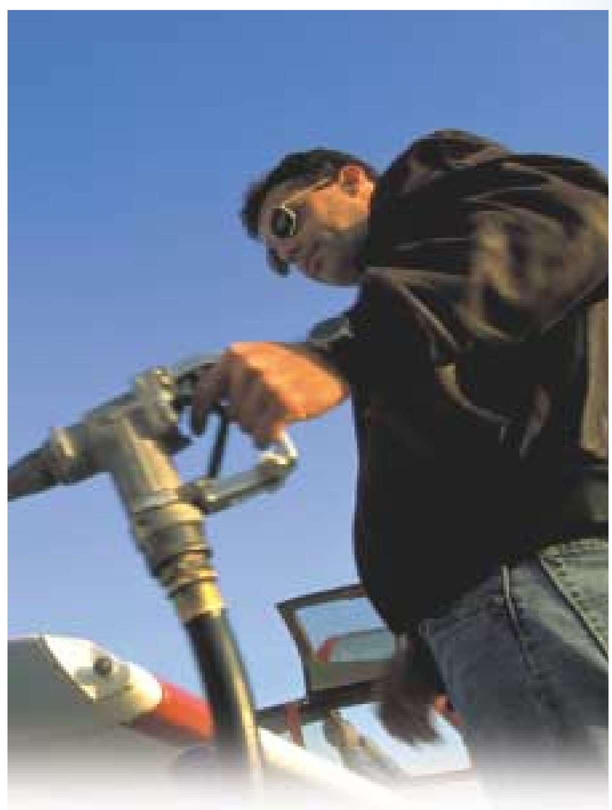
A recent AOPA Air Safety Foundation study of midair collisions revealed that 49 percent of them occurred in the traffic pattern or on approach to or departure from an airport. Of the other 51 percent, about half occurred during en route climb, cruise, or descent, and the rest resulted from formation flights or other hazardous activities. Eighty percent of the midair collisions that occurred during "normal" flight activities happened within ten 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 two of the Foundation's Safety Advisors, *Operations at Nontowered Airports*, online at www.aopa.org/asf/publications/sa08.pdf, and *Collision Avoidance: Strategies and Tactics*, online at www.aopa.org/asf/publications/sa15.pdf.

Alcohol and Drugs
14 Total/12 Fatal

In 2000, 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 probable that accidents still under investigation will implicate drugs or alcohol as well as the factors already known. Twelve (85.7 percent) of these accidents were fatal, showing 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 alcohol/drug accident count was 24 per year.

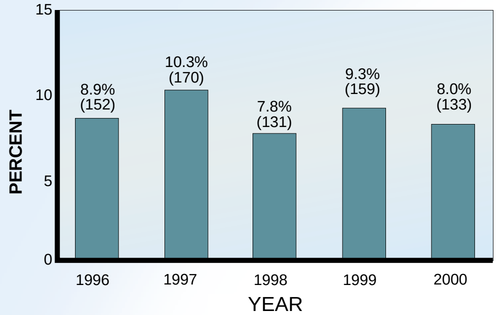
Fuel Mismanagement
133 Total/12 Fatal

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 2000, there were 85 accidents caused by fuel exhaustion, of which 10 were fatal, resulting in 15 deaths. Another 42 accidents occurred because of fuel starvation. One of these accidents was fatal resulting in two fatalities. Another six 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.



As with many accident causes, fuel mismanagement is not the sole domain of the inexperienced pilot.

FUEL MISMANAGEMENT ACCIDENTS 1996-2000



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. Although fuel mismanagement accidents were down from 159 in 1999 to 133 in 2000, it is still an area in which accidents can be easily avoided. For more information see the Foundation's Safety Advisor, *Fuel Awareness*, online at www.aopa.org/asf/publications/sa16.pdf.

Off-Airport Injuries

3 Total/0 Fatal

0 Serious/5 Minor Injuries

One of the myths surrounding GA is the perceived danger of light aircraft falling from the sky. In 2000, there were no fatalities and no serious injuries to off-airport bystanders. There were five minor injuries to bystanders throughout the year. This is down from 1999, when 42 people suffered minor injuries, including 38 in two accidents, and four bystanders were seriously injured in off-airport GA aircraft accidents.

Pilot Incapacitation

1 Total/0 Fatal

Thankfully, only one accident in 2000 was the result of the pilot becoming incapacitated from a cause other than drugs or alcohol. The pilot sustained serious injuries. This number is down from 1999 when three accidents resulted from incapacitation of the pilot. All three of those accidents were fatal. ASF's Pinch-Hitter® course is recommended for all nonflying 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

2 Total/1 Fatal

A pilot and a passenger were struck by turning propellers during 2000. One of them was killed, and the other 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

202 Total/42 Fatal

Accident Causes

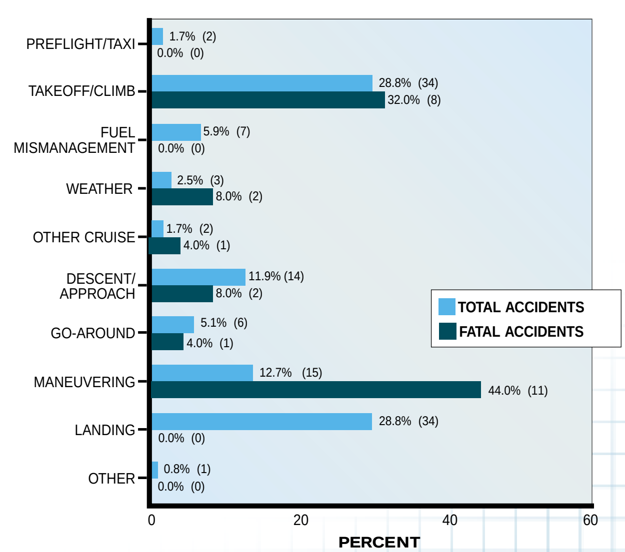
The charts below show major accident causes for homebuilt airplanes. Some of these accidents were the result of pilots being unprepared for the peculiarities of their aircraft. This is particularly important for initial flight testing and shows up in approach accidents. Unfortunately, however, many of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

HOMEBUILT ACCIDENTS

MAJOR CAUSE	ALL ACCIDENTS	FATAL ACCIDENTS
Pilot	58.4%	59.5%
Mechanical/Maintenance	27.7%	16.7%
Other	11.9%	14.3%
Unknown	2.0%	9.5%

MAJOR CAUSE	ALL ACCIDENTS	FATAL ACCIDENTS
Pilot	118	25
Mechanical/Maintenance	56	7
Other	24	6
Unknown	4	4
TOTAL	202	42

ACCIDENT CAUSES - HOMEBUILT AIRCRAFT



Comparison with Factory Aircraft

In 2000, homebuilt airplanes were involved in 202 accidents. Of these, 42 fatal accidents resulted in 64 fatalities. Factory-built airplanes in 2000 were involved in 1,452 accidents, of which 300 were fatal with 608 fatalities. Using these figures, we can deduce that 20.8 percent of homebuilt aircraft accidents resulted in fatalities, and 20.7 percent of the accidents in factory-built airplanes were fatal. The fatal accident percentage of both homebuilt and factory-built aircraft was the same – just over 20 percent each. Homebuilt aircraft, which in previous years have shown a higher fatality rate than factory aircraft, have seen an 8.3 percent decrease in fatalities between 1999 and 2000.

As in previous years, human causes, principally those of pilots, are dominant in aircraft accident causes. As general aviation becomes increasingly complex, new capabilities will translate into new challenges. Researchers in commercial aviation safety have found that, while new technology has brought many advances in safety and efficiency, it has also brought new sources of human error and, therefore, potential causes of accidents. As more and more of these advances are making their way into general aviation cockpits, pilots must be extremely careful to avoid these pitfalls.

On the other hand, many of the accident causes that have plagued aviation for decades are still occurring. Even as the number and rates of accidents, injuries, and fatalities have remained relatively stable over the last decade, the causes of most of these accidents and the scenarios in which they occur have been repetitive as well. The year 2000 was no exception.

Conclusions

How Safe Is General Aviation?

> "Safe is not the equivalent of risk free."
>
> *- U. S. Supreme Court, 1972*

As general aviation pilots, we are often asked if our activity is safe. Webster defines "safe" as free from damage or danger. Certainly, as these pages have shown, there is potential for both in aviation. Does this mean flying is "unsafe"? We would be deceiving ourselves to deny that many hazards still exist. However, a cavalier attitude toward risk should not be taken, nor is it true that accidents are inevitable. Quite the contrary, risk management is an active skill that can and should be learned and continuously practiced by all pilots. Accidents are inevitable for those who fail to do so. For pilots who study the sources of risk and who conscientiously seek and employ good risk management techniques, general aviation can be a safe and rewarding occupation, means of recreation, or business tool.

2000 – A Final Review

While total accidents were down in 2000, fatal accidents and fatalities went up slightly. However, trends in both of these numbers are almost level throughout the last five years and down only slightly during the past 10 years. In the meantime, estimated flight hours continue to climb, after hitting a low point in 1994.

The human factor continues to contribute the largest proportion of accident causes. Proportions of accidents attributable to specific causes change slightly from year to year, but these also tend to follow predictable patterns. The bulk of accidents occur during takeoff and landing, and the majority of fatalities are due to weather encounters and maneuvering flight.

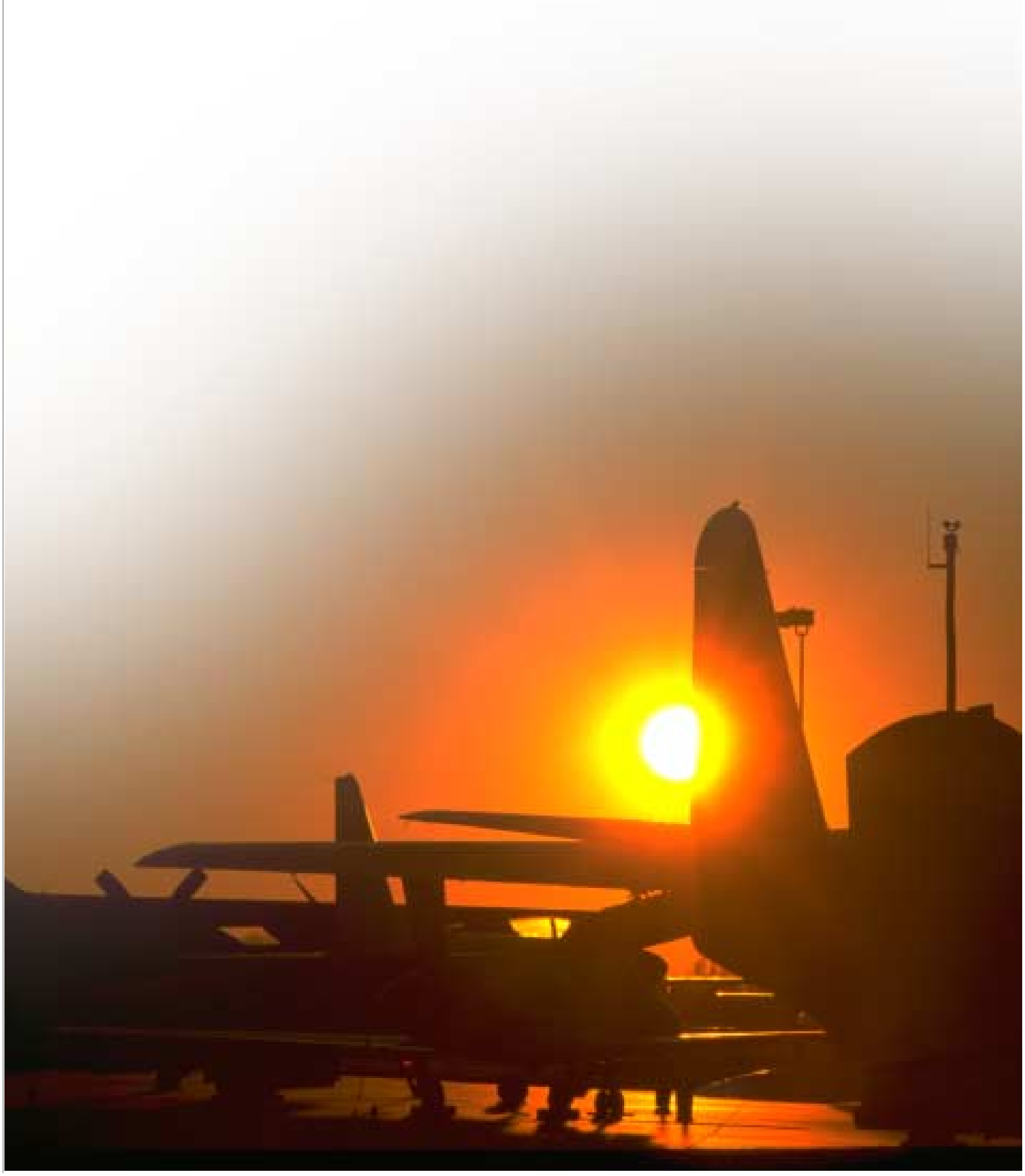
Faulty decision making tends to be more strongly implicated in accidents resulting in deaths and serious injuries, while skill-related types of problems are implicated in the "fender benders." Many of the less severe accidents attributable to skill problems often have a component of faulty decision making where pilots have placed themselves in situations exceeding their skills.

Our special emphasis area for this year, spatial disorientation, is an example of the effects of both decision and skill problems. The ability to control and maneuver an airplane by reference to instruments may be one of the most complex skills learned by a pilot. The ability to recover control of an airplane while transitioning from visual references to instrument references, as in an inadvertent entry into instrument meteorological conditions, is even more challenging. However, decision processes are likely to have been involved in shaping the events that placed the pilot in this situation. The good news is that decision making and risk management can be trained and practiced. In fact, decision making can be thought of as a skill area in itself.

CONCLUSIONS

Unfortunately, the other prime problem area in terms of GA fatalities, maneuvering flight, is also usually related to combinations of skill and decision-making problems. The problem is normally a case of pilots deliberately exceeding their skill level or airplane capabilities. The decision-making problem is more often related to lack of flight discipline, rather than lack of skill or training.

Accident prevention, therefore, must build on both acquisition and maintenance of good flying skills, as well as sound decision making and application of personal self-discipline, a formula as old as aviation itself.



Frequently Asked Questions

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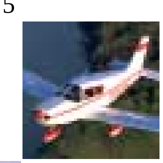
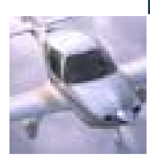




NTSB Definitions

Accident/Incident (NTSB Part 830)

The following definitions of terms used in this report have been extracted from NTSB Part 830 of the National Transportation Safety Board's Regulation 49CFR. It is included in most commercially available FAR/AIM digests and should be referenced for detailed information.

Aircraft Accident

Aircraft accident — An occurrence incidental to flight in which, "as a result of the operation of an aircraft, any person (occupant or non-occupant) 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" above, 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 in item (2), 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.

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 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 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).

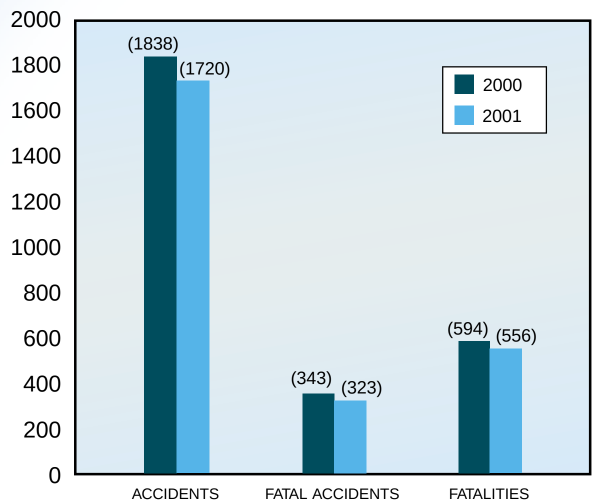
Landing — From either the MAP (IMC) or the runway threshold (VMC) through touchdown or after touchdown off an airport, until the aircraft completes its ground run. Includes rotorcraft run-on, power-on, and auto-rotation landings. Also includes aborted landing where touchdown has occurred and landing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

PRELIMINARY 2001 DATA



A look to the future:

In January, NTSB released preliminary accident figures for 2001. Once again we've posted the safest year since 1938, when accident record keeping started. That's something GA should be proud of, but we can't take all the credit for the good news. The terrorist attacks of September caused an unprecedented shutdown of the airspace system; a shutdown from which some segments of GA have yet to recover. Drastically reduced GA flying in the last quarter of 2001 resulted in fewer accidents. We must do what we can to keep the record improving, but also be prepared for more accidents in 2002 than we had in 2001.

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