Annual Review of Aircraft Accident Data
U.S. General Aviation, Calendar Year 2004

ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA

NTSB/ARG-08/01
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National
Transportation
Safety Board

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Abstract: The National Transportation Safety Board's *2004 Annual Review of Aircraft Accident Data for U.S. General Aviation* is a statistical compilation and review of general aviation accidents that occurred in 2004 involving U.S.-registered aircraft. As a summary of all U.S. general aviation accidents for 2004, the review is designed to inform general aviation pilots and their passengers and to provide detailed information to support future government, industry, and private research efforts and safety improvement initiatives.

The National Transportation Safety Board is an independent Federal agency dedicated to promoting aviation, railroad, highway, marine, pipeline, and hazardous materials safety. Established in 1967, the agency is mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The Safety Board makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

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2004 General Aviation Accident Summary

A total of 1,619 general aviation accidents occurred during calendar year 2004, involving 1,635 aircraft.[1] The total number of general aviation accidents in 2004 was slightly lower than in 2003, with a 7% decrease of 121 accidents. Of the total number of accidents, 314 were fatal, resulting in a total of 559 fatalities. The number of fatal general aviation accidents in 2004 decreased 11% from calendar year 2003, and the total number of fatalities decreased by 12%. The circumstances of these accidents and details related to the aircraft, pilots, and locations are presented throughout this review.

2004 General Aviation Accident Statistics

General Aviation Accidents	
Total accidents	1,619
Fatal accidents	314
Accident aircraft	1,635
General Aviation Accident Injuries	
Fatal	559
Serious	266
Minor	425
Persons involved in accidents with no injuries	1,972
General Aviation Accident Rate	
General aviation hours flown[a]	24,888,000
All accidents[b]	6.49/100,000 hours
Fatal accidents[b]	1.26/100,000 hours
Accidents per active pilots	2.62/1,000 active pilots
Fatal accidents per active pilots	0.51/1,000 active pilots

[a] Federal Aviation Administration, *General Aviation and Air Taxi Survey, 2004.*
[b] Excludes events involving suicide, sabotage, and stolen/unauthorized use

[1] In this review, a collision between two aircraft is counted as a single accident. The 11 midair collisions that occurred in 2004 involved 22 general aviation aircraft. In addition, 5 ground collisions involved 10 general aviation aircraft.

Introduction

Purpose of the Review

The National Transportation Safety Board's *2004 Annual Review of Aircraft Accident Data for U.S. General Aviation* is a statistical compilation and review of general aviation accidents that occurred in 2004 involving U.S.-registered aircraft. As a summary of all U.S. general aviation accidents for 2004, the review is designed to inform general aviation pilots and their passengers about trends in general aviation safety and to provide detailed information to support future government, industry, and private research efforts and safety improvement initiatives.

For this review, the Safety Board extracted accident data from the Board's Aviation Accident/Incident Database.[2] Activity data were extracted from the *General Aviation and Air Taxi Activity and Avionics Survey* (*GAATAA Survey*)[3] and from *U.S. Civil Airmen Statistics*,[4] which are published by the Federal Aviation Administration (FAA), Statistics and Forecast Branch, Planning and Analysis Division, Office of Aviation Policy and Plans. Additional information was extracted from the *General Aviation Statistical Databook*, published by the General Aviation Manufacturers Association (GAMA).

What Is General Aviation?

General aviation can be described as any civil aircraft operation that is *not* covered under 14 *Code of Federal Regulations* (CFR) Parts 121, 129, and 135, commonly referred to as commercial air carrier operations.[5]

Which Operations Are Included in this Review?

This review includes accidents involving U.S.-registered aircraft operating under 14 CFR Part 91, as well as public aircraft[6] flights that do not involve military or intelligence agencies. Aircraft operating under Part 91 include aircraft that are flown for recreation and personal transportation and certain aircraft operations that are flown with the intention of generating revenue,[7] including business flights, flight instruction, corporate/executive flights, positioning or ferry flights, aerial application, pipeline/powerline patrols, and news and traffic reporting.

[2] See appendix A for more details.

[3] FAA: <http://www.faa.gov/data_statistics/aviation_data_statistics/general_aviation/CY2004/>. Although they are included in the *GAATAA Survey*, data associated with air taxi and air tour operations are not included in this review.

[4] FAA: <http://www.faa.gov/data_statistics/aviation_data_statistics/civil_airmen_statistics/>

[5] For a review of accident statistics related to air carrier operations, see National Transportation Safety Board, *Annual Review of Aircraft Accident Data, U.S. Air Carrier Operations, Calendar Year 2004* (Washington, DC: 2007), available at <http://www.ntsb.gov>.

[6] Although the precise statutory definition has changed over the years, public aircraft operations for Safety Board purposes are qualified government missions that may include law enforcement, low-level observation, aerial application, firefighting, search and rescue, biological or geological resource management, and aeronautical research.

[7] See 14 CFR 119.1.

Which Aircraft Are Included in this Review?

General aviation operations employ a wide range of aircraft, including airplanes, rotorcraft, gliders, balloons and blimps, and registered experimental or amateur-built aircraft. The diverse set of operations and aircraft types included within the scope of general aviation must be considered when interpreting the data in this review. The type of aircraft being flown is usually closely related to the type of flight operation being conducted. Jet and turboprop aircraft are commonly used for corporate/executive transportation, smaller single-engine piston aircraft are commonly used for instructional flights, and a variety of aircraft types are used for personal and business flights.

Not included in this review are any accident data associated with aircraft operating under 14 CFR Parts 121, 129, or 135 inside and outside the United States. Also not included are data for military or intelligence agencies, non-U.S.-registered aircraft, unregistered ultralights, and commercial space launches, unless the accident also involved aircraft conducting general aviation operations. Crashes involving illegal operations, stolen aircraft, suicide, or sabotage are included in the accident total, but not in accident rates.[8]

Organization of the Review

The *2004 Annual Review* is organized into four parts:

1. A summary of general aviation accident statistics for 2004, industry markers related to general aviation activity in 2004, and contextual statistics from previous years.
2. An investigation of trends over the past 10 years, providing the context for such accident information as operation types, levels of aircraft damage, and injuries.
3. A discussion of specific accident circumstances, a description of accident occurrences, and a summary of the Safety Board's findings of probable cause and contributing factors.
4. In-depth coverage of a special topic important to general aviation safety. The *2004 Annual Review* focuses on sport pilot and light sport aircraft.

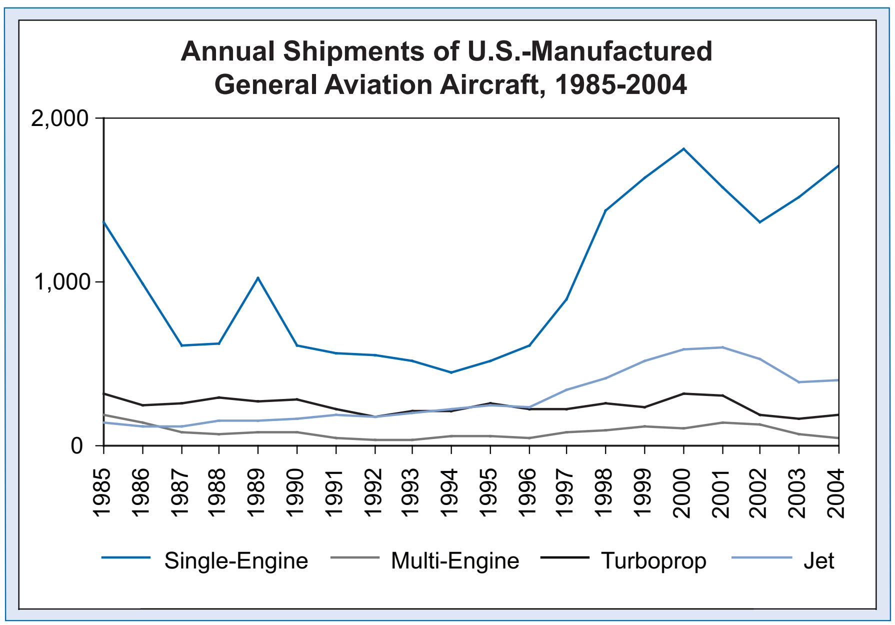
Graphics are used to present much of the information in this review. For readers who wish to view tabular data or to manipulate the data used in this review, the data set is available online at < http://www.ntsb.gov/aviation/Stats.htm>.

[8] In 2004, three crashes involved stolen/unauthorized use of aircraft.

The General Aviation Environment in 2004

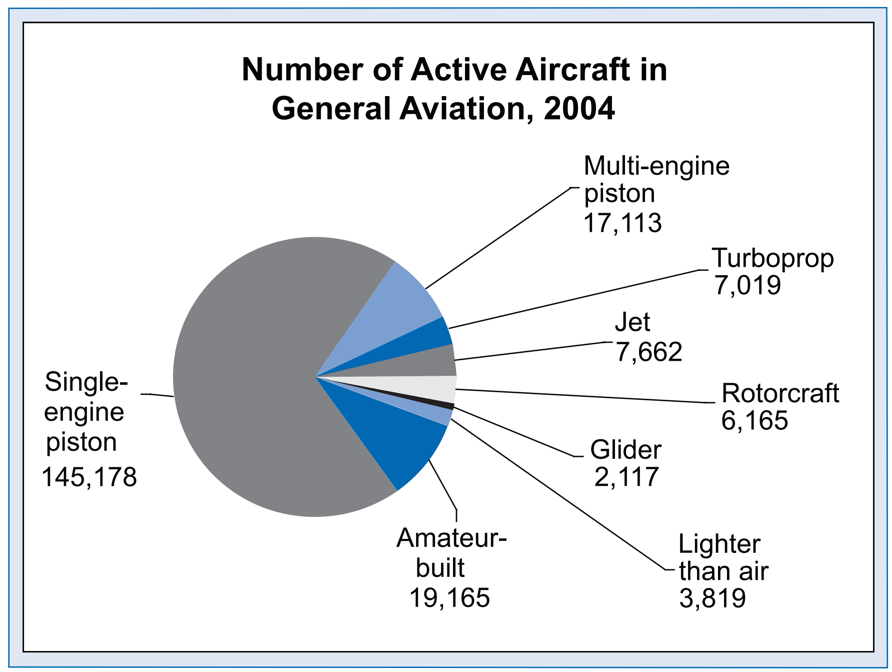
General Aviation Industry Indicators

A theme repeated throughout the annual reviews is that general aviation accident numbers should be interpreted in light of related information, such as aircraft type, type of operation, and operating environment. Because personal and business operations account for the largest percentage of general aviation flying, prevailing economic conditions and/or trends may noticeably affect both the general aviation industry and flight operations. In 2004, the general aviation climate was influenced by generally favorable economic conditions and an increase in general aviation aircraft production.



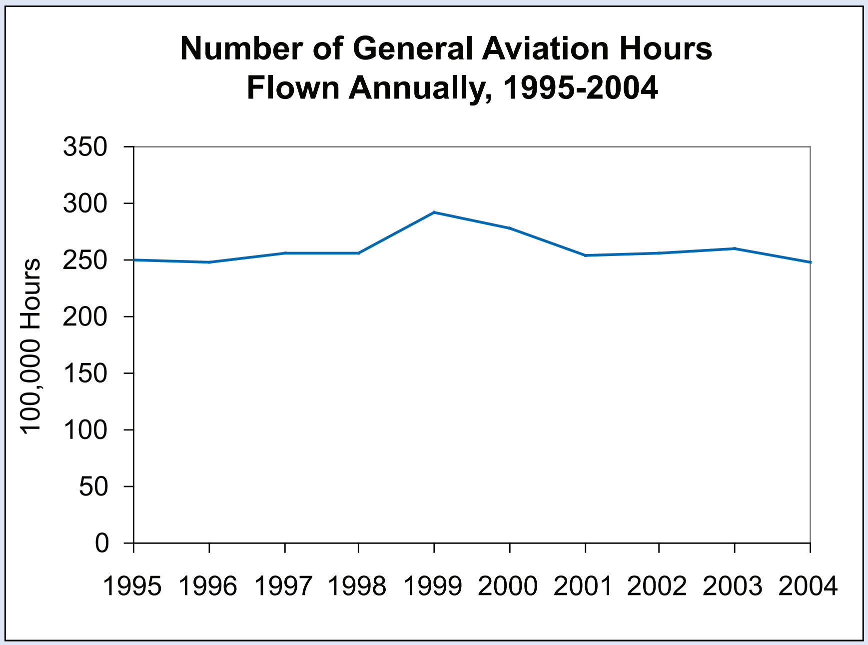
Fleet Makeup

Although sales of new general aviation aircraft increased noticeably after the mid-1990s, FAA registry data indicate that general aviation aircraft in use during 2004 were on average more than 31 years old. U.S. manufacturers delivered 2,355 new general aviation aircraft in 2004, compared to an estimated 211,821 in service. Single-engine piston aircraft currently have the highest average age of all general aviation aircraft types and account for the largest percentage of the general aviation fleet. As a consequence, any structural or design improvements incorporated into newly manufactured aircraft may not be reflected in the accident record for several years. The safety benefits of improved equipment, such as avionics, are also difficult to track because most new equipment is also available for installation in older aircraft.



General Aviation Activity

Because general aviation includes such a diverse group of aircraft types and operations, some measure of exposure must be considered to make meaningful comparisons of accident numbers. Flight activity is typically used to normalize accident numbers across different groups, with the level of activity corresponding to the level of exposure to potential accident risk. Total flight hours, departures, and miles flown are common indicators used to measure activity. As the following figure shows, annual general aviation flight hour estimates from 1995 through 2004 peaked in 1999, but were lower after that. In 2004, the estimated number of general aviation flight hours was 24.8 million, slightly lower from 2003.



Activity data for general aviation are far less reliable than data available for commercial air carriers. Unlike Part 121 and scheduled Part 135 air carriers, which are required to report total flight hours, departures, and miles flown to the Department of Transportation (DOT),[9] operators of general aviation aircraft are not required to report actual flight activity data. As a result, activity for this group of aircraft must be estimated using data from the *GAATAA Survey*,[10] which was established in 1978 to gather information about aircraft use, flight hours, and avionics equipment installations from owners of general aviation and on-demand Part 135 aircraft. General aviation activity data are considered less reliable because a sample of aircraft is selected from the registry of aircraft owners for use in the *GAATAA Survey*, and reporting is not required.

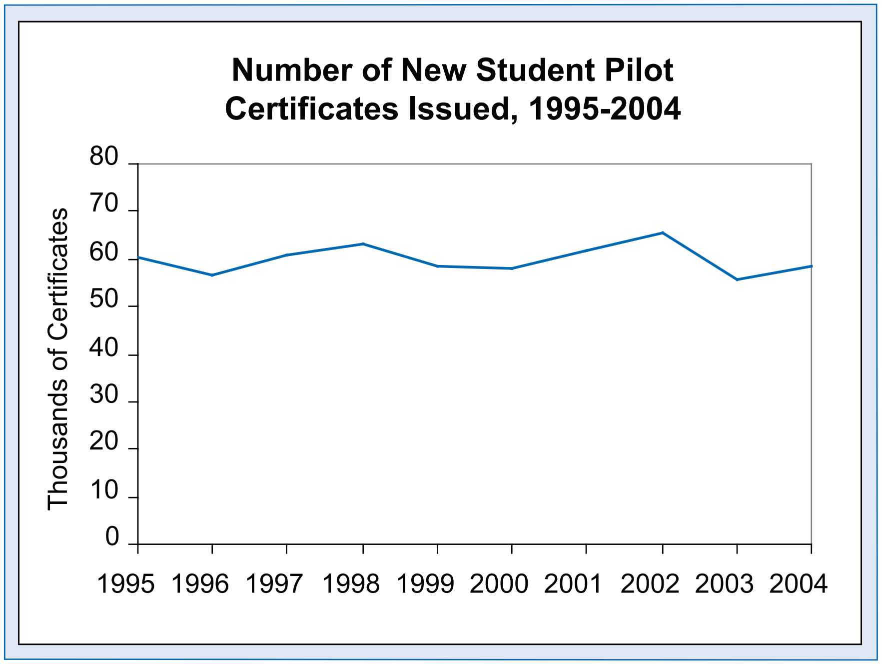
In addition to flight-hour estimates, the number of pilots can be used to establish the level of exposure to risk for the various types of general aviation operations. Available measures of the pilot population include both the number of certificates issued to new pilots, which represents positive growth in the pilot population, and the number of medical certificates issued, which represents an informal census of all active pilots.

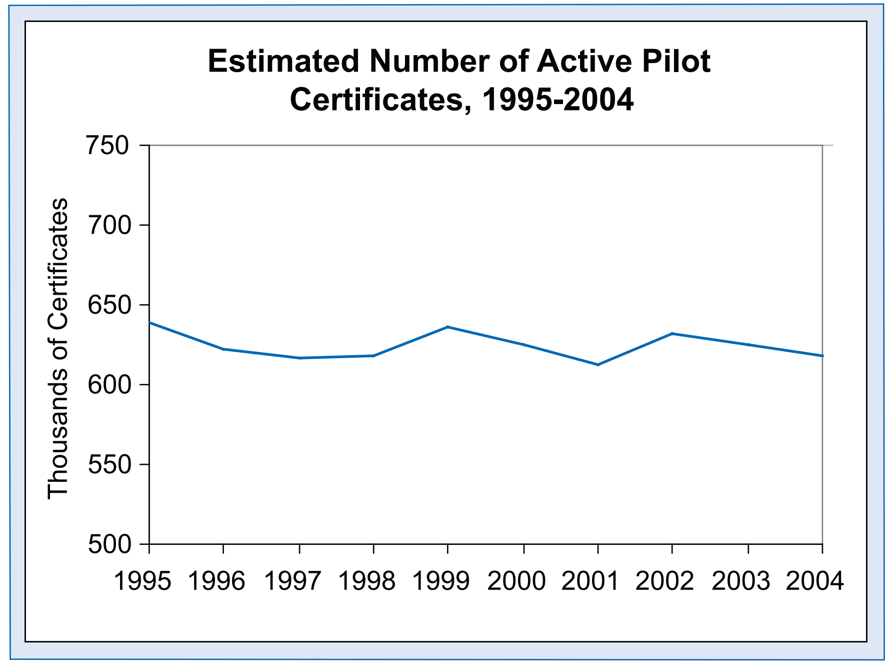
The number of new student pilot certificates fluctuated annually between 1995 and 2004.[11] The total number of new student certificates issued in 2004 came to 58,362, an increase from the 55,446 issued in 2003.

[9] Part 121 operators report activity monthly, and scheduled Part 135 operators report quarterly.

[10] Available at <http://www.faa.gov/data_statistics/aviation_data_statistics/general_aviation/CY2004/>.

[11] Available at <http://www.faa.gov/data_statistics/aviation_data_statistics/civil_airmen_statistics/>.





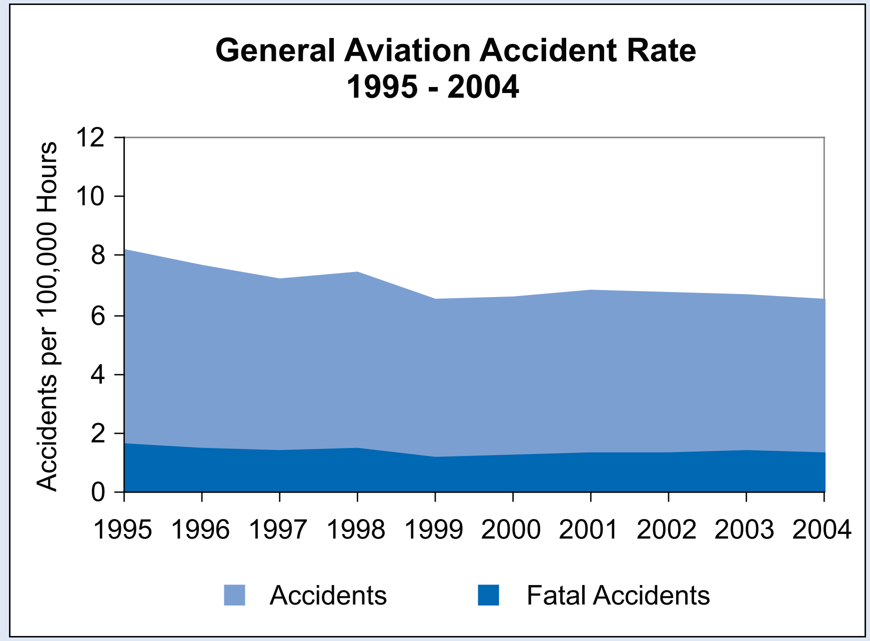
As shown by the number of medical certificates issued, the total number of active pilots in the U.S., including general aviation pilots, decreased steadily throughout the early and mid-1990s, from 692,095 in 1990 to 622,261 in 1996. Between 1996 and 2004, the number of active pilots fluctuated, with an estimated total of 618,633 active U.S. pilots in 2004.

In summary, general aviation indicators—flight hours and the total number of active and newly issued pilot certificates—have fluctuated annually, with little overall change, between 1995 and 2004.

Historical Trends In Accident Data

Accident Rates

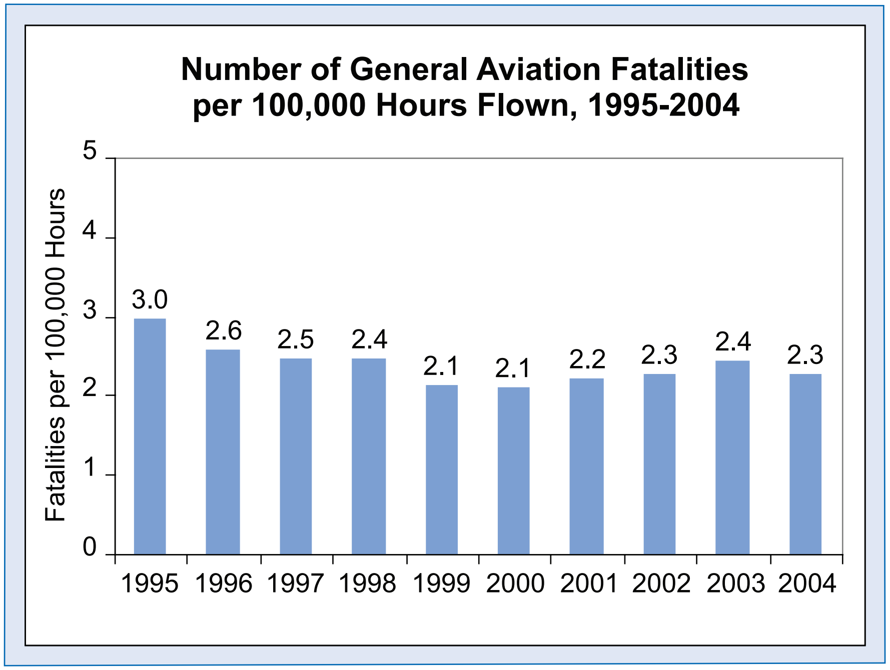
In the last decade, the calculated general aviation accident rate declined overall as annual estimates of general aviation activity increased noticeably[12] without a corresponding increase in the number of accidents. The rate of 6.49 accidents per 100,000 hours flown in 2004 was substantially lower than the 8.21 accidents per 100,000 hours recorded in 1995. In fact, the 2004 rate was only slightly higher than that of 1999, which had the lowest rate since the Safety Board began reporting general aviation-only annual accident rates in 1975.[13] The relative percentage of fatal accidents remained fairly constant from 1995 through 2004, at 18 to 21% of the total rate. The 2004 rate of 1.26 fatal accidents per 100,000 flight hours was only slightly lower than the 2003 fatal accident rate of 1.34.

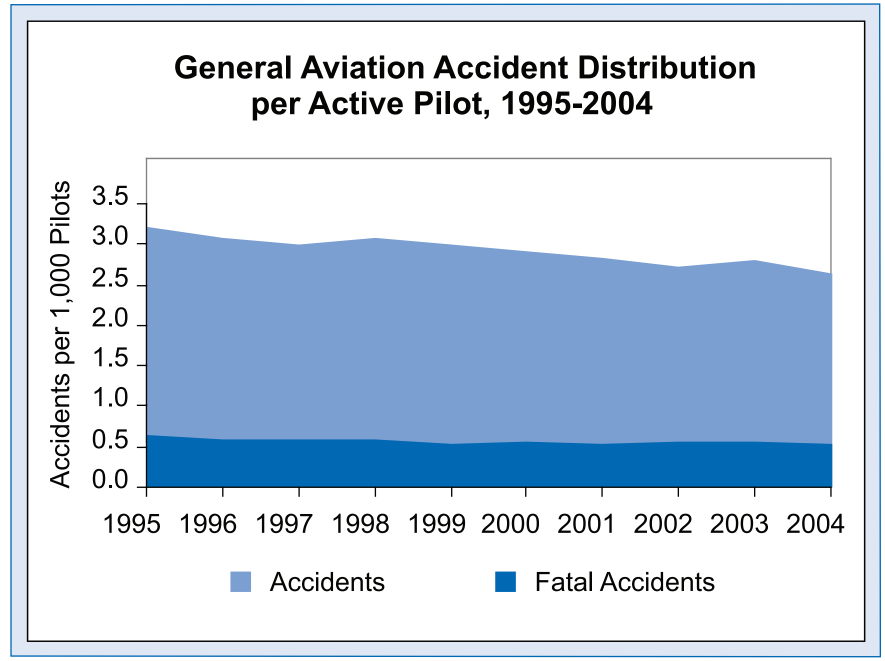


In 2004, accident-related deaths per flight hour were 2.3 fatalities per 100,000 hours flown. The highest annual fatality-per-hour rate occurred in 1995 with 3.0 deaths per 100,000 hours flown.

[12] FAA estimates of annual general aviation activity increased noticeably after 1998 due to a change of *GAATAA Survey* methodology that increased the estimated general aviation aircraft population by about 10%. See appendix A of the *GAATAA Survey, Calendar Year 2004,* for an explanation of the changes in survey methodology.

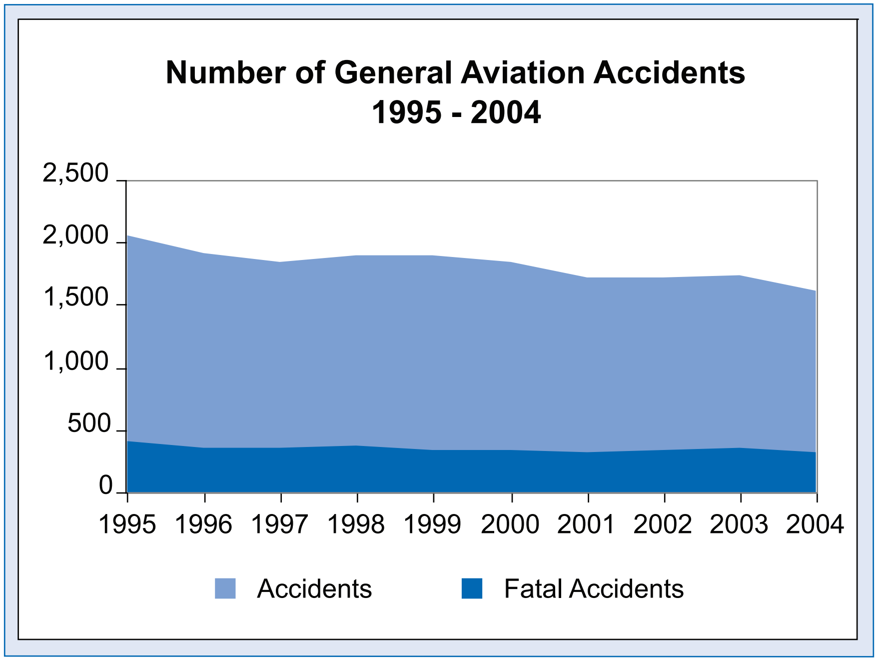
[13] Prior to 1975, scheduled 14 CFR 135 commuter and non-scheduled 14 CFR 135 air taxi aircraft operations were included in the Safety Board's annual general aviation accident total and rate.

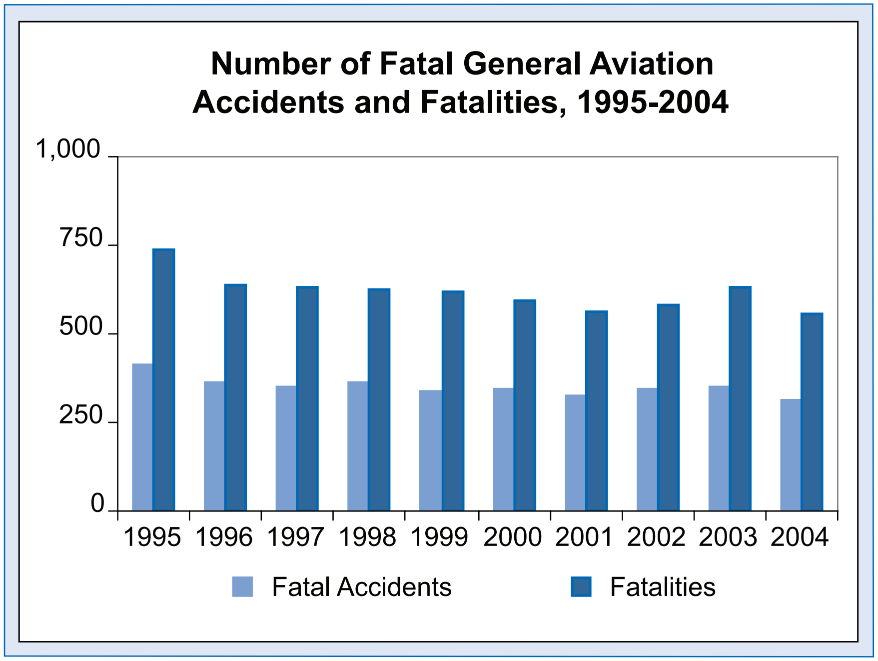




Another measure of accident distribution is the number of accidents per active pilot. Although this measure was considerably more stable from 1995 through 2004 than the per-hour accident rate, it did decrease slightly overall. The per-pilot rate in 2004 was only slightly lower than the 2003 rate.

Accident rate calculations based on flight hours require the use of *GAATAA* activity data extrapolated from a relatively small sample of aircraft owners. As a result, the calculated values are accurate only to the extent that the sample represents the larger population of general aviation operators. For this reason, accident rate data presented in this review typically also include raw frequency data for comparison.





Number of Accidents and Fatalities

Although the number of general aviation accidents fluctuated slightly from year to year, the number of accidents that occurred annually between 1995 and 2004 declined overall from 2,056 in 1995 to 1,619 in 2004, and the number of fatal accidents decreased overall, from 413 to 314.

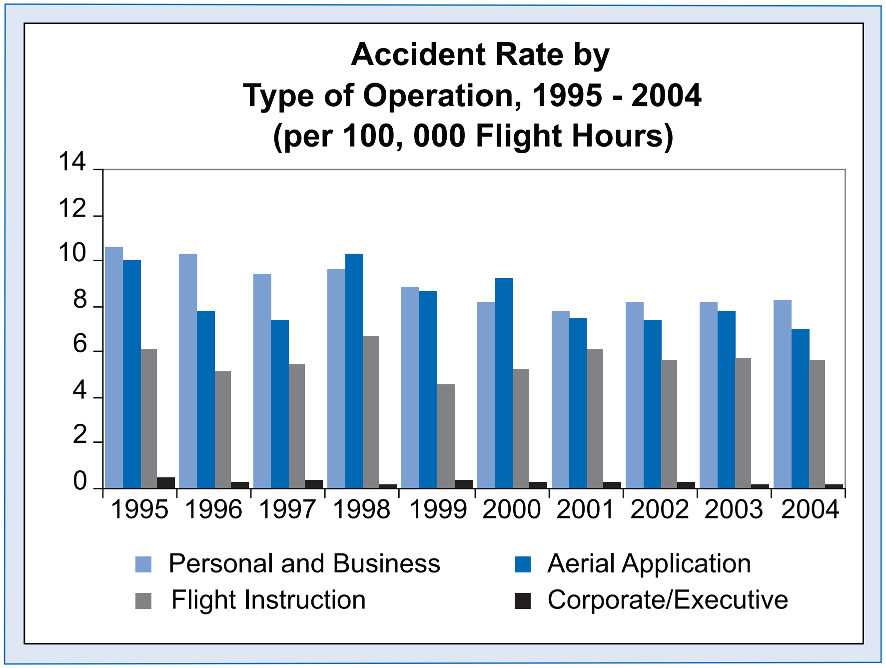
The number of general aviation fatalities also exhibited a generally downward trend from the high of 735 in 1995 to 559 in 2004. It should be noted that 2004 continues a generally downward trend in total fatalities for the 10-year period. It should also be noted that the trend reflects a decrease in general aviation flight hours annually following the events of September 11, 2001.

Accident Rate by Type of Operation

General aviation includes a wide range of operations, each with unique aircraft types, flight profiles, and operating procedures. This diversity is evident in the accident record. However, the *GAATAA* flight data allow for only a coarse representation of the many types of general aviation operations. For some types of operations, such as public aircraft flights,[14] no activity data are available. The data presented here include four operational categories selected because they are representative of general aviation and have activity information available. The categories selected as typical of general aviation activity include personal/business flights,[15] corporate flights, aerial application, and instructional flights.

- Personal flights make up the largest portion of general aviation activity and include all flying for pleasure and/or personal transportation. Although similar to personal flights, business flights include the use of an aircraft for business transportation without a paid, professional crew. Personal and business flights are typically conducted in single- and multi-engine piston airplanes, but may include a range of aircraft including gliders, rotorcraft, and balloons.
- Corporate flights include any business transportation with a professional crew and usually involve larger, multi-engine piston, turboprop, and jet airplanes.
- Aerial application includes the use of specially equipped aircraft for seeding and for spraying pesticides, herbicides, and fertilizer. Aerial application is unique because it requires pilots to fly close to the ground.
- Instructional flights include any flight under the supervision of a certificated flight instructor.[16] Instructional flights typically include both dual training flights and student solo flights. Aircraft used for instruction are often similar to those used for personal flying. However, instructional operations are unique because they often involve the repeated practice of takeoffs and landings, flight maneuvers, and emergency procedures.

In 8 of the last 10 years, personal and business flights have had the highest average accident rate, followed by aerial application. The lowest accident rate was for corporate/executive transportation, which for the 10-year period ranked lowest overall each year.

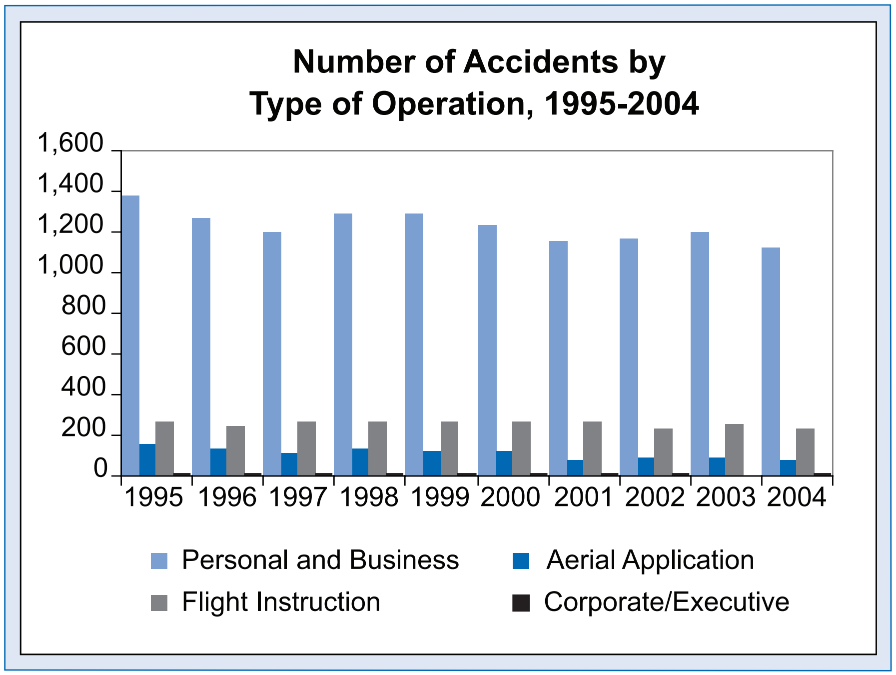


[14] *Annual Review 2004* data include 17 public aircraft accidents, 6 of which resulted in 1 or more fatalities.

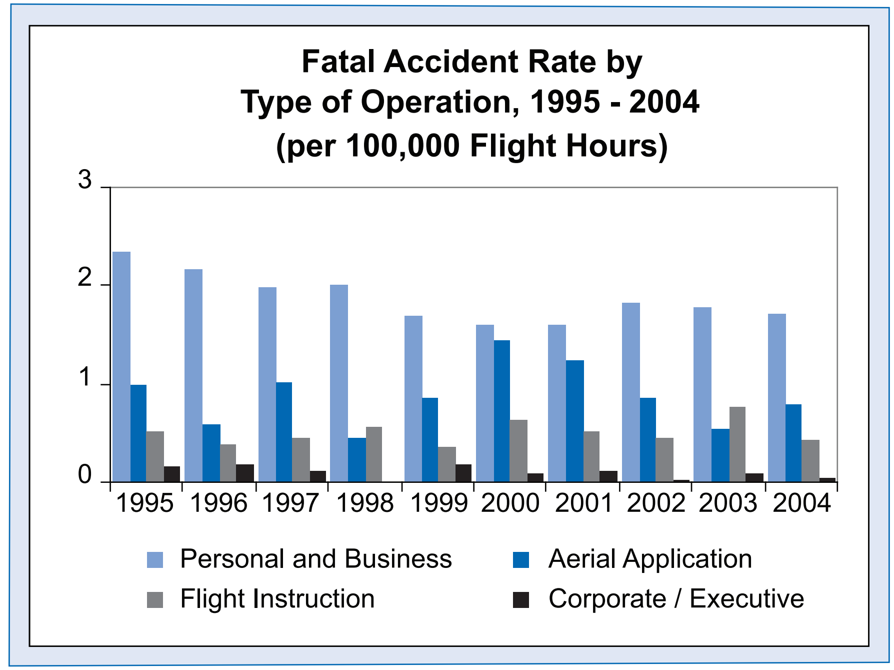
[15] Because of the difficulty of accurately distinguishing between personal and business flying for both the activity survey and the accident record, the rate presented in this review is calculated using combined exposure data (hours flown).

[16] See 14 CFR Part 61, Subpart H, for flight instructor certificate and rating requirements.

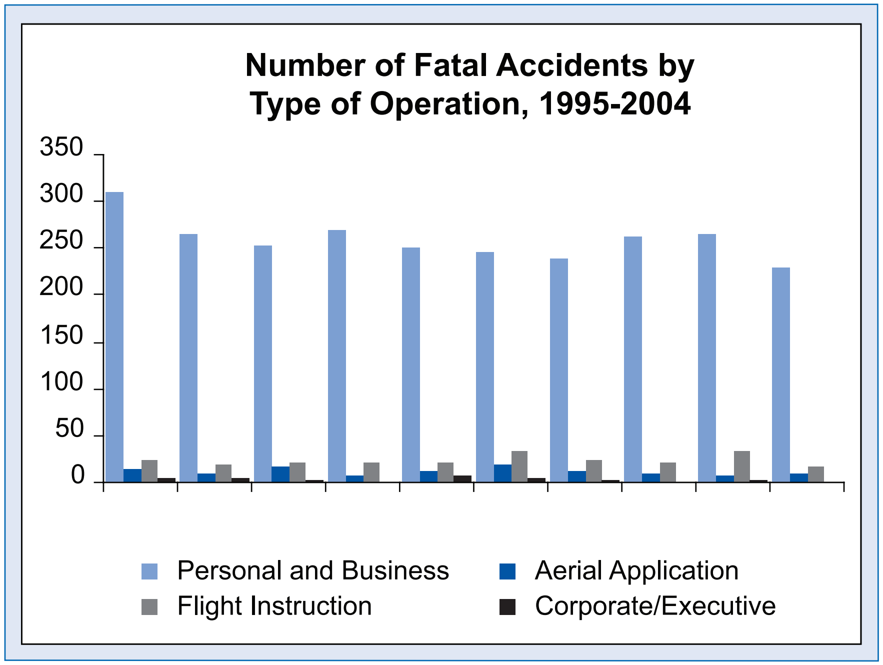
In 2004, the highest proportion of flying time was associated with personal and business operations, which accounted for the largest proportion of accidents, 69% (n = 1,118), a percentage consistent with the 10-year average. Less than 1% of the accidents (n = 6) were corporate/executive operations, 5% were aerial application (n = 80), and 14%, instructional flying (n = 229). Totals for corporate/executive accidents are barely visible when graphed in comparison to accidents involving other types of operations. For both corporate/executive operations and instructional flights, the proportion of flight hours was higher than the proportion of accidents, reflecting the relative safety of these missions.



Throughout the 10-year period, the combined category of personal/business flights also had the highest fatal accident rate. Except for 2000 and 2001, the rate was typically more than double the rate for any other type of flying.



Between 1995 and 2004, an average 259 fatal accidents per year were personal/business flights, compared to an average 23 fatal accidents for instructional flights, 12 for aerial application, and 3 for corporate/executive flights. Differences in the number and rate of fatalities and injuries among types of operation are likely related to the type of aircraft and equipment, the level of pilot training, and the operating environments unique to each type of operation. The number of fatal accidents per year among each type of flight operation exhibits a distribution similar to the number of accidents; personal and business flying accounted for an average 74% of all fatal general aviation accidents and 74% of all fatal injuries for 1995 through 2004.



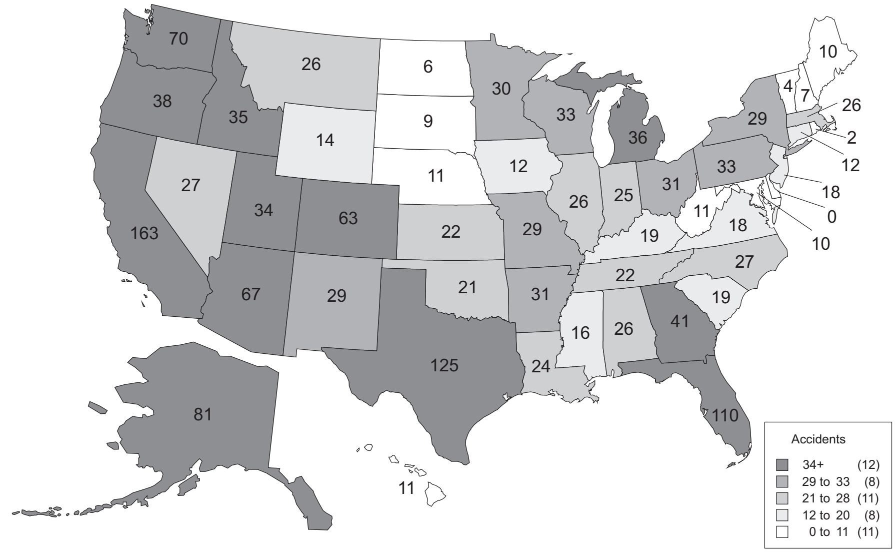
2004 IN DEPTH

Location of General Aviation Accidents in 2004

United States Aircraft Accidents

Geographic location can contribute to general aviation accident totals because of increased activity associated with population density, increased risk due to hazardous terrain, a propensity for hazardous weather, or a concentration of particularly hazardous flight operations. The following map shows state by state the number of all general aviation accidents that occurred within the United States in 2004. Although the specific hourly activity data needed to calculate general aviation accident rates for each state are not available, some assumptions can be made about general aviation activity levels based on the size and population of each state. For example, California, Texas, and Florida had the greatest number of accidents in 2004. U.S. Census Bureau data[17] indicate that California had the highest state population in 2004, followed by Texas (second), and Florida (fourth). In addition, all three states have warm climates that favor year-round flying, and all three are popular travel destinations that attract general aviation traffic from other states. These states also had the largest numbers of active pilots[18] and active aircraft.[19] These data suggest that the high number of accidents in California, Texas, and Florida are related primarily to a high level of activity.

General Aviation Accidents by U.S. State, 2004



Regional differences that affect general aviation accident numbers may also include hazards unique to the local terrain and weather. For example, the operating environment, infrastructure, and travel requirements in Alaska present unique challenges[20] to aviation that are reflected in the general aviation accident record. After California, Texas, and Florida, Alaska had the most general aviation accidents in 2004.

[17] U.S. Census Bureau; data are available at <http://factfinder.census.gov/>.

[18] Available at <http://www.faa.gov/data_statistics/aviation_data_statistics/civil_airmen_statistics/>.

[19] Available at <http://www.faa.gov/data_statistics/aviation_data_statistics/general_aviation/CY2004/>.

The top 10 states by number of general aviation accidents in 2004 are presented here along with the 10-year average. Note that many of the state accident totals for 2004 were below historical averages, but the distribution of accidents among states remained similar during the period.

Foreign Aircraft Accidents

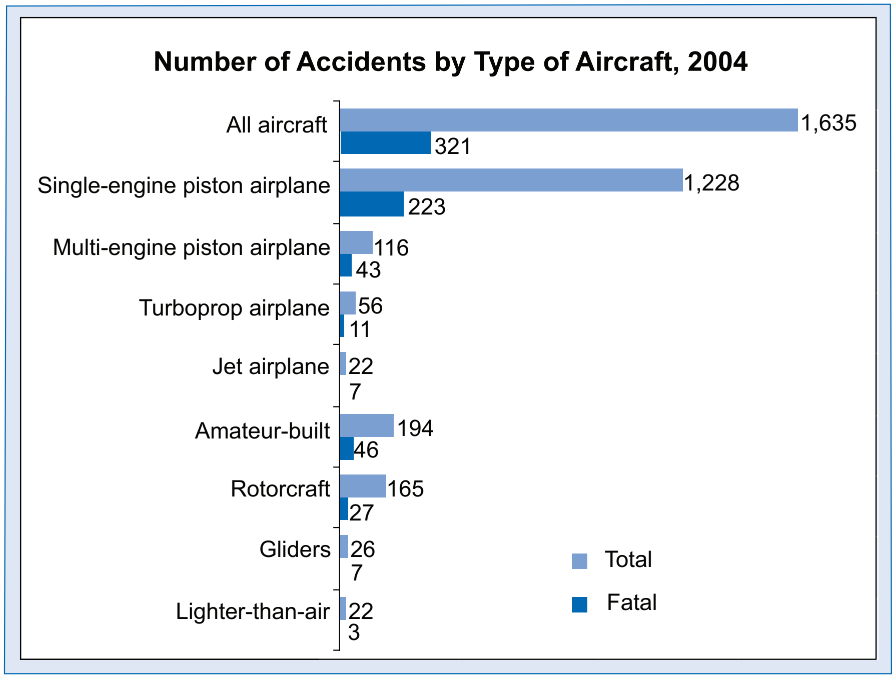
In 2004, U.S.-registered aircraft were involved in 30 accidents outside the 50 United States. Those accidents occurred in 16 different countries and territories, and in the Atlantic and Pacific Oceans. Of those accidents, 10 were fatal, resulting in 18 deaths. Most of these accidents occurred in the Bahamas, with four accidents. As expected, general aviation accidents involving U.S.-registered aircraft outside the United States usually occur in neighboring countries like Canada and Mexico, and the Caribbean island nations, but in 2004, accidents occurred as far away as France, Malaysia, and Romania.

Accidents Involving U.S.-Registered General Aviation Aircraft Outside the 50 United States, 2004

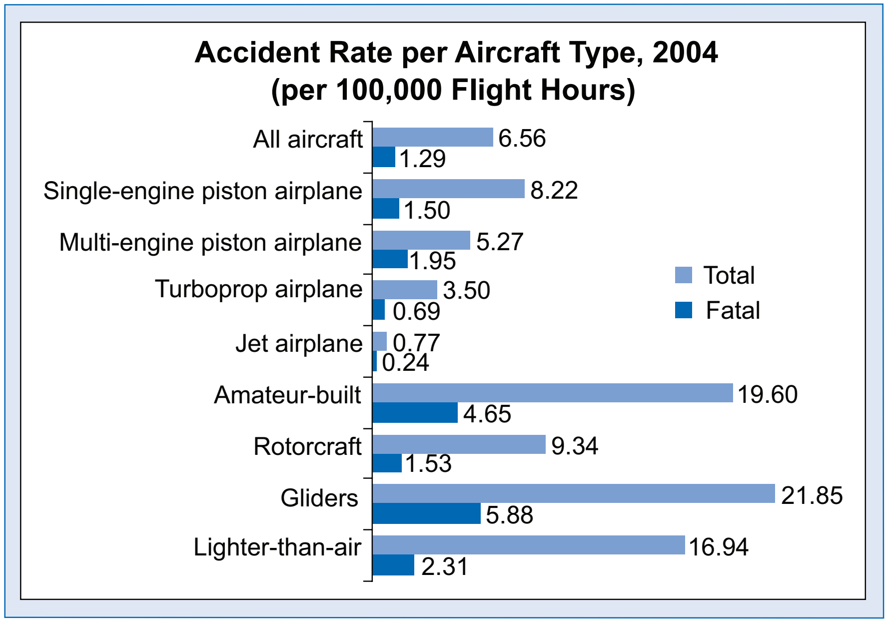
	Number of Accidents	Number of Fatal Accidents	Number of Fatalities
Pacific Ocean			
From Fishing Vessel	1	0	0
Subtotal	**1**	**0**	**0**
Atlantic Ocean			
Left Naples, Italy	1	0	0
Subtotal	**1**	**0**	**0**
Other Locations			
Bahamas	4	1	3
Canada	3	1	1
Chile	1	0	0
Corsica	1	1	2
Dominican Republic	1	0	0
France	2	2	7
Greenland	1	1	1
Honduras	1	1	1
Mexico	3	0	0
Malaysia	1	0	0
Netherlands Antilles	1	0	0
Puerto Rico	3	0	0
Romania	1	0	0
St. Kitts and Nevis	1	0	0
United Kingdom	1	1	1
Virgin Islands	3	2	2
Subtotal	**28**	**10**	**18**
Total	**30**	**10**	**18**

Aircraft Type

The following figure summarizes the total number of general aviation accidents and fatal accidents occurring in 2004 by aircraft type. Most notable is the large number of accidents involving single-engine piston airplanes, which accounted for 75% of all accident aircraft and 69% of all fatal accident aircraft.



In 2004, the per-aircraft accident rate for all aircraft types was 6.56 accidents and 1.29 fatal accidents per 100,000 hours flown.[21] Among fixed-wing powered aircraft, the rate for single-engine piston airplanes was 8.22 accidents and 1.50 fatal accidents per 100,000 hours flown. Amateur-built aircraft[22] had the highest accident rate among all general aviation aircraft, with 19.60 accidents and 4.65 fatal accidents per 100,000 flight hours. Rotorcraft had the second-highest rate among powered aircraft, with 9.34 accidents and 1.53 fatal accidents per 100,000 hours flown. However, glider operations had the second-highest accident rate overall, with 21.85 accidents and 5.88 fatal accidents per 100,000 hours flown.



[21] Note that the reported rates are per aircraft and differ from per-accident rates because each aircraft is counted separately for collisions. Included in the accident totals, but excluded from the associated rates, are three single-engine piston aircraft crashes with a probable cause attributed to stolen/unauthorized use of aircraft.

[22] Title 14 CFR 21.191(g) provides for the issuance of a Special Airworthiness Certificate in the experimental category to permit the operation of amateur-built aircraft. Amateur-built aircraft may be fabricated from plans or assembled from a kit, so long as the *major* portion of construction is completed by the amateur builder(s).

Purpose of Flight

The type of operation or purpose of flight can be defined as the reason a flight is initiated. Activity data by purpose of flight are derived from the *GAATAA Survey,* which includes 14 purpose/use categories. Two of these categories, air taxis and air tours, are covered under 14 CFR Part 135 and are therefore not included in this review. The remaining 12 include the previously mentioned categories of personal, business, instructional, corporate, and aerial application, which together accounted for 90% of all general aviation operations during 2004. The remaining 10% are included in more specific categories, such as external load and medical use. A limitation of the *GAATAA* activity data is that those categories provide only a coarse representation of the range of possible flight operations. For example, personal flying includes but does not distinguish between travel, recreation, or proficiency flying. At the same time, the differences between similar categories like personal and business flying are not easily identified. Accordingly, the purpose-of-flight information presented in this review is limited to the combined categories of personal and business flying, as well as corporate, instructional, and aerial application flights.

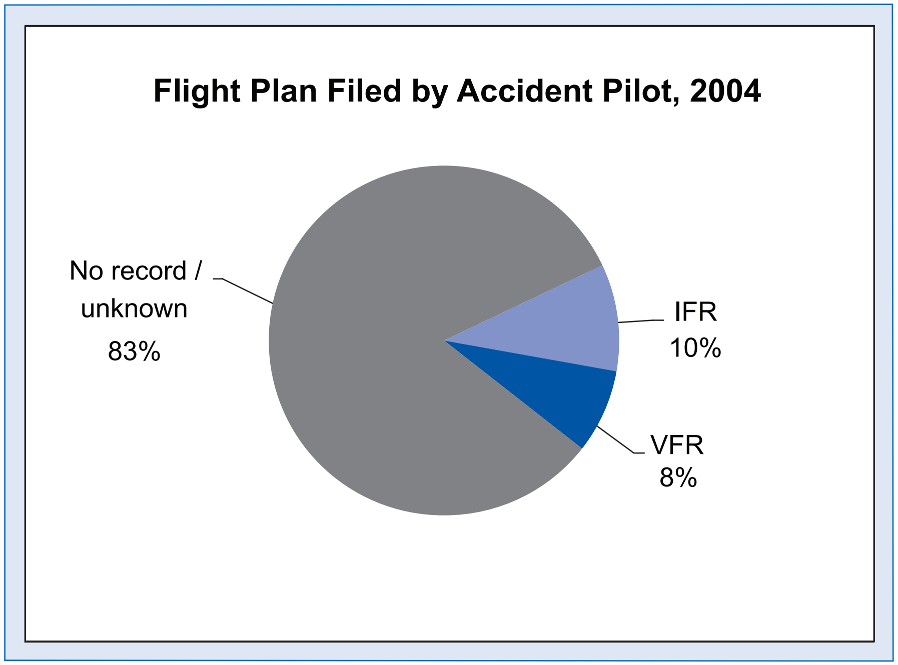
According to the *GAATAA Survey*, most general aviation operations are conducted for personal and/or business purposes. Of the estimated 25 million general aviation hours flown in 2004, more than half—13.5 million—were personal or business flights.[23] Accordingly, a large percentage of general aviation accidents involve personal/business flights. However, personal/business flying is still over-represented in the accident record: although this segment represented about 54% of the general aviation hours in 2004, it accounted for 69% of all general aviation accidents (n = 1,118) and 73% of all fatal accidents in 2004 (n = 230).

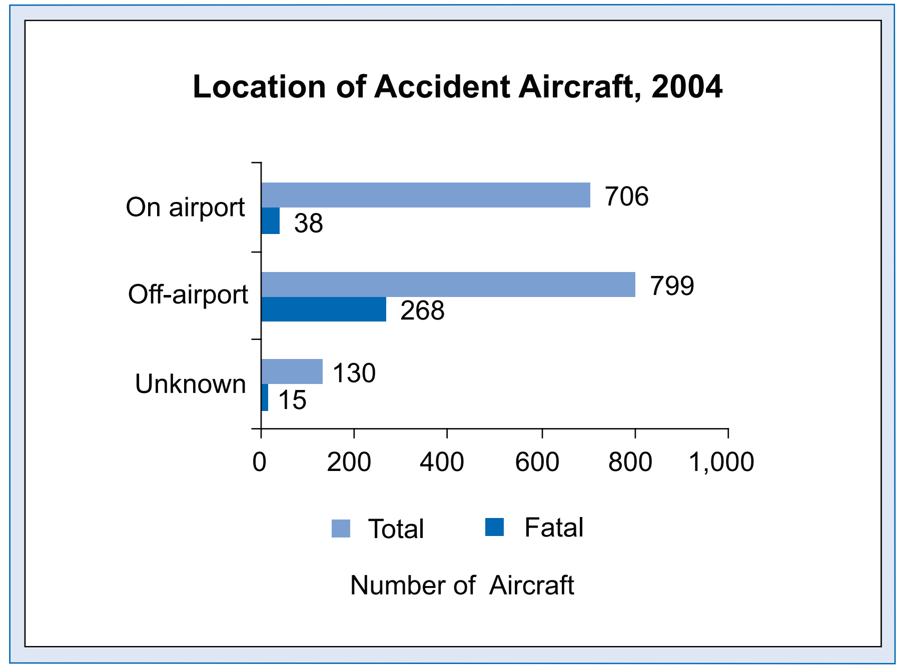
The accident rate for instructional flights was about half that of personal/business flights overall. This relatively low rate is surprising because student pilots could be expected to make more mistakes than experienced pilots. Flight instruction accidents were also less likely to be fatal. Only 7% of the flight instruction accidents that occurred in 2004 resulted in fatalities, compared to 21% of personal/business accidents. When compared with the number of hours flown, the fatal accident rate for instructional flights was 0.42 fatal accidents per 100,000 hours flown. The fatal accident rate for personal/business flights remained the highest in general aviation with 1.71 fatal accidents per 100,000 hours flown.

Flight Plan

In 2004, 1,635 pilots were involved in general aviation accidents, and for those pilots, 1,349 (83%) showed no record of filing a flight plan. In most cases, a flight plan is required only for flight under instrument flight rules (IFR). However, pilots operating under visual flight rules (VFR) on point-to-point flights have the option of filing a flight plan, which aids search and rescue efforts for pilots who fail to arrive at their intended destinations.

[23] *GAATAA Survey 2004*: <http://www.faa.gov/data_statistics/aviation_data_statistics/general_aviation/CY2004/>.

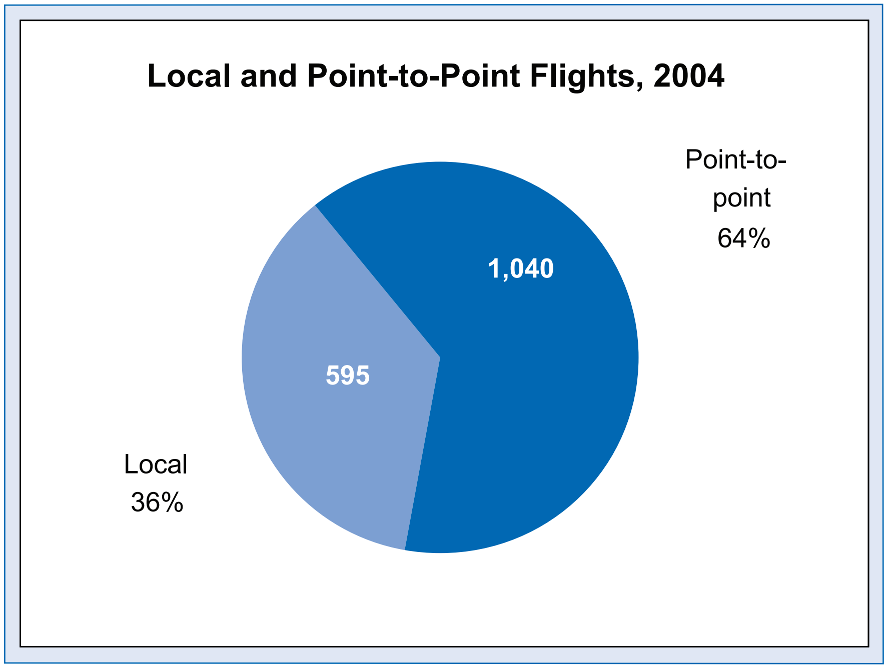




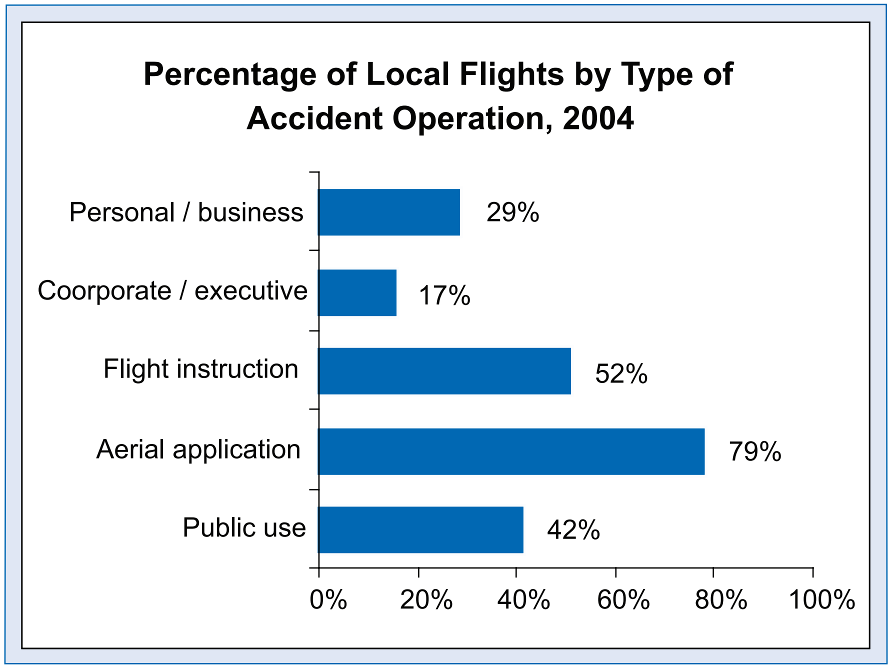
Airport Involvement

Aircraft accident locations were closely split between those occurring on airport property (43%) and those occurring away from an airport (49%). Comparing accident risk based on location is difficult because of the exposure differences between types of operations and types of aircraft. For example, a single-engine piston aircraft used for instructional flights will spend a large percentage of its operating time near an airport while a jet aircraft used for corporate transportation will not. However, a relationship can be observed between the location and severity of accidents. Accidents on or near an airport or airstrip typically involve aircraft operating at relatively low altitudes and airspeeds while taking off, landing, or maneuvering to land. In contrast, accidents that occur away from an airport typically involve the climb, cruise, maneuvering, and descent phases of flight, which typically occur at higher altitudes and higher airspeeds. As a result, these accidents are more likely to result in higher levels of injury and aircraft damage than accidents that occur on an airstrip or near an airport. Most fatal accidents in 2004 (85%) were located away from an airport or airstrip.

Another distinction that can be drawn between flight profiles is between local and point-to-point operations. A local flight is one that departs and lands at the same airport, and a point-to-point flight is one that lands at an airport other than the one from which it departed. Typical local flight operations include sightseeing, flight instruction, proficiency flights, pleasure flights, and most aerial observation and aerial application flights. Conversely, point-to-point flights include any operation conducted with the goal of moving people, cargo, or equipment from one place to another. Typical point-to-point operations include corporate/executive transportation, personal and business travel, and aircraft repositioning flights. A comparison of the numbers of accident aircraft on local flights with those on point-to-point flights illustrates that the percentages of aircraft on point-to-point flights accounted for more accident aircraft.



The activity data necessary to compare accident rates for local and point-to-point flights are not available. However, a comparison of the percentage of local and point-to-point accident flights conducted for different purposes provides an indirect measure of the types of flying represented in both flight profiles. The following figure shows that most personal/business flights were point-to-point, while more than half of instructional flights were local. Corporate/executive transportation and aerial application operations were also inversely proportional, with 83% of corporate flights being point-to-point and 79% of aerial application flights being local.

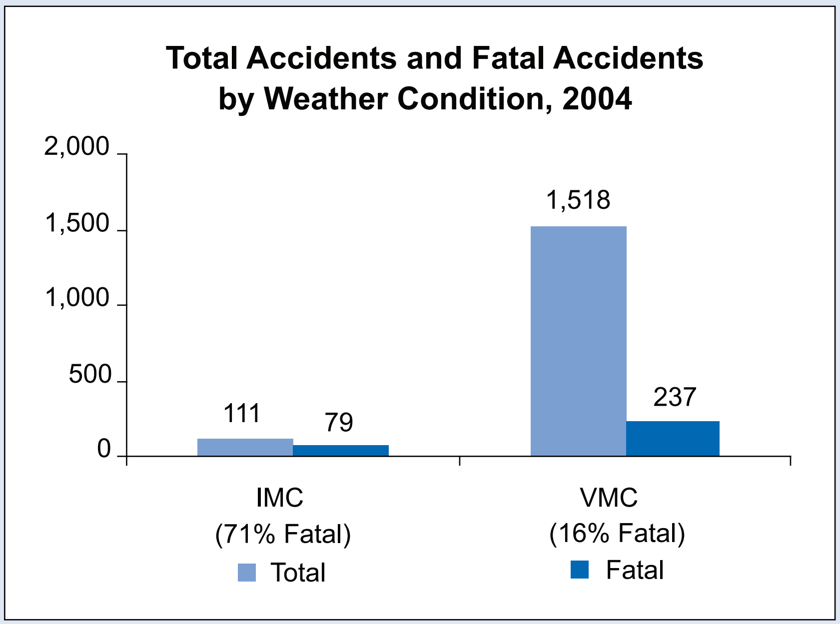


Environmental Conditions

Many hazards are unique to the type of flight operation, type of aircraft, and flight profile, but environmental conditions may be hazardous to all flight operations and all types of aircraft to some degree. Aircraft control, for example, is highly dependant on visual cues related to speed, distance, orientation, and altitude. When visual information is degraded or obliterated because of clouds, fog, haze, or precipitation, pilots must rely on aircraft instruments. Because of the difficulties associated with flying an aircraft solely by reference to instruments, the FAA has established specific pilot, aircraft, and procedural requirements[24] for flight in instrument meteorological conditions

[24] Title 14 CFR 61.579(c), 91.167-193, 91.205(d).

(IMC). According to the FAA *Pilot/Controller Glossary*,[25] instrument meteorological conditions are defined as "meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling less than the minima[26] specified for Visual Meteorological Conditions (VMC)." Weather minima differ based on altitude, airspace, and lighting conditions, but 3 statute miles visibility and a cloud clearance of 1,000 feet above, 500 feet below, and 2,000 feet horizontal distance are typical. The following figure illustrates the percentage of accidents and fatal accidents that occurred in VMC and IMC. A comparison of the percentages of accidents in each weather condition that resulted in a fatality illustrates the hazards associated with flight in IMC. In 2004, only 16% of the accidents that occurred in visual conditions resulted in a fatality, but 71% of accidents in instrument conditions were fatal.



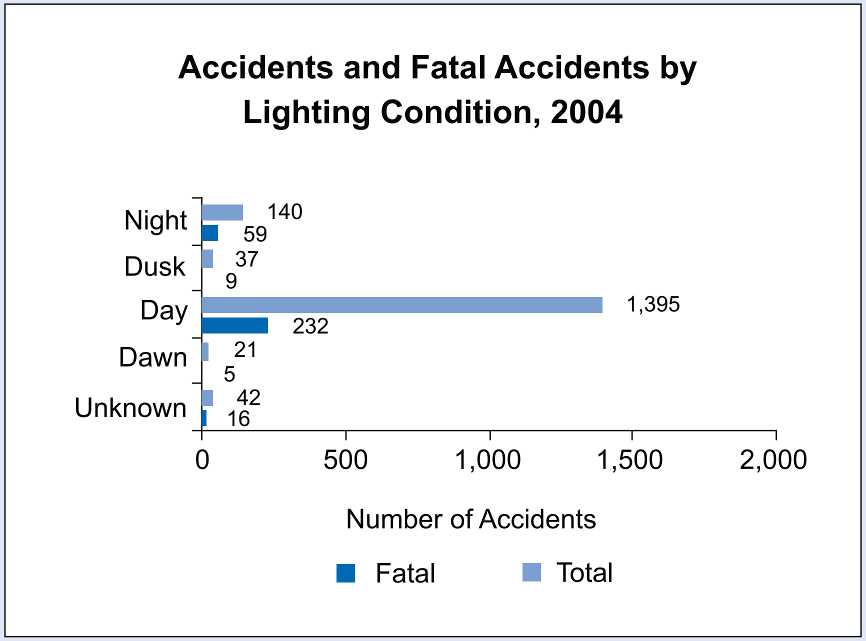
Although instrument conditions were present for only 7% of all accidents, 25% of fatal general aviation accidents in 2004 occurred in IMC. One reason for the disproportionate number of fatal accidents in IMC is that such accidents are more likely to involve pilot disorientation, loss of control, and collision with terrain or objects—accident profiles that typically result in high levels of damage and injury. Instrument conditions may also contribute to accident severity by further complicating situations that might be more easily handled in visual conditions. For example, a forced landing due to an engine malfunction or failure, which might result in minor damage if it occurred in visual conditions, might pose an even greater threat to a pilot flying in instrument conditions because reduced visibility would hinder selection of a suitable landing site.

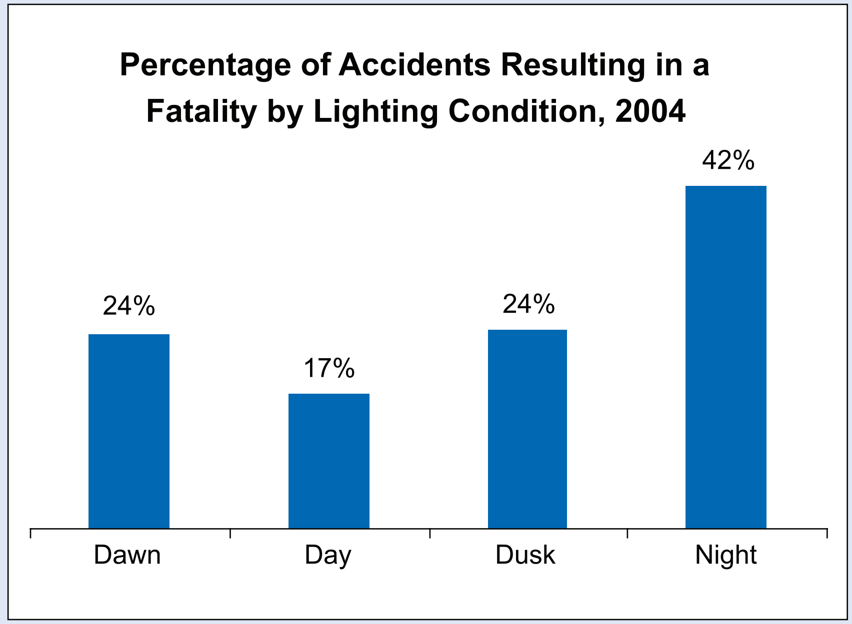
Lighting Conditions

Lighting conditions can present a similar hazard to pilots because of physiological factors related to night vision, difficulties in seeing potential hazards such as mountains, terrain, and unlighted obstructions, and perceptual illusions associated with having fewer visual cues. The following figures illustrate that, similar to IMC, most accidents occurred in daylight conditions but a larger percentage of the accidents that occurred at night resulted in fatalities.

[25] FAA, *Pilot/Controller Glossary*, Washington, D.C., available at <http://faa.gov/atpubs/PCG/INDEX.HTM>

[26] Minima for visual meteorological conditions are specified in 14 CFR 91.155.





In fact, accidents that occurred at night were more than twice as likely as daylight accidents to be fatal. Like weather-related accidents, accidents at night are more likely to involve disorientation, loss of control, and/or collision with objects or terrain, resulting in higher levels of injury. The reduction in visual cues at night also hinders pilots from identifying deteriorating weather conditions and further complicates their ability to deal with any aircraft equipment malfunctions.

Injuries and Damage for 2004

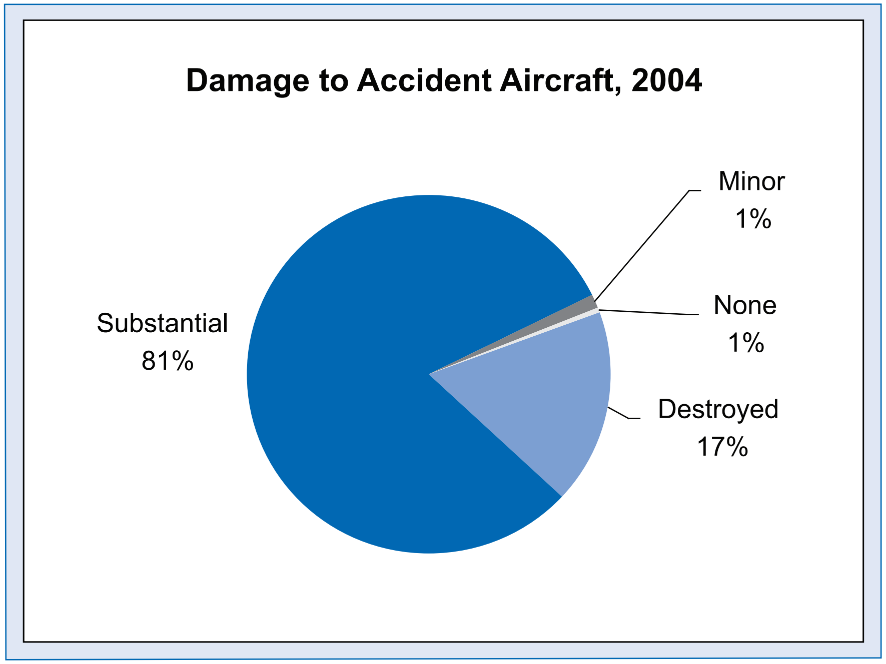
Aircraft Damage

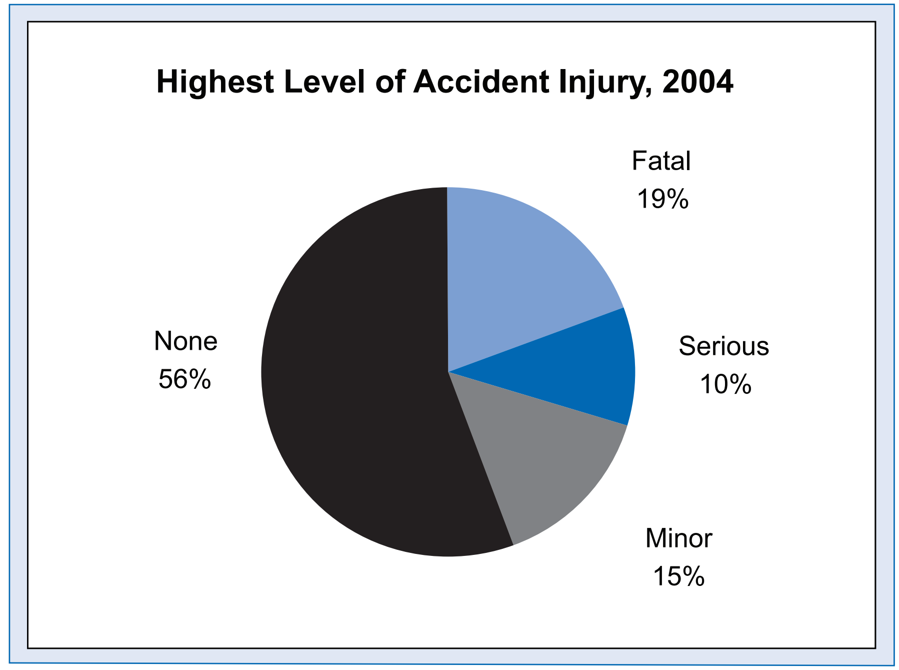
Safety Board investigators record aircraft damage as either “destroyed,” “substantial,” or “minor.” Title 49 CFR 830.2 defines “substantial damage” as “damage or failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component.” Although not specifically defined in 49 CFR 830.2, “destroyed” can be operationally defined as any damage in which repair costs exceed the value of the aircraft,[27] and “minor” damage as any damage that is not classified as either “destroyed” or “substantial.”

[27] Missing or unrecoverable aircraft are also considered “destroyed.”

Nearly 8 of every 10 aircraft involved in accidents during 2004 sustained substantial damage, and about 1 in 5 accident aircraft were destroyed. "Minor" and "no damage" classifications together comprised about 1% of accident aircraft.

the percentage of general aviation accidents resulting in each level of injury during 2004. Most notable is the fact that more than half the accidents did not result in injury.



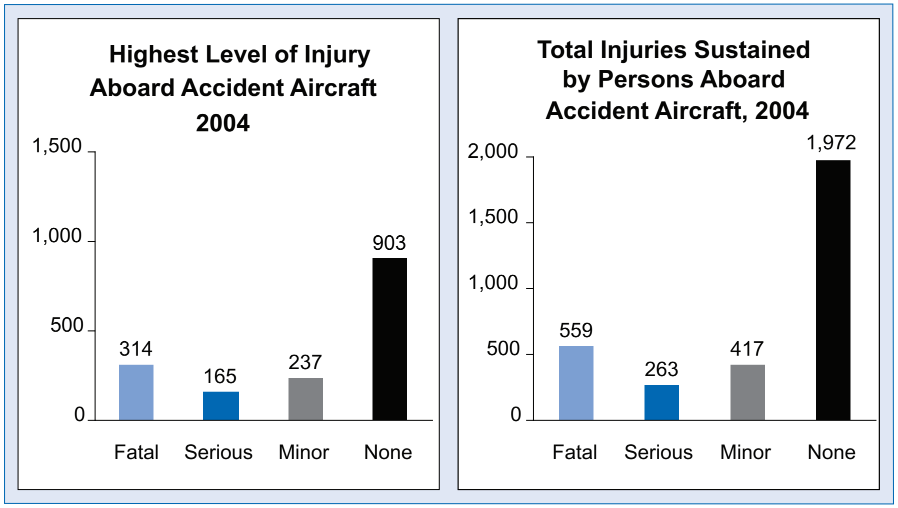


Accident Injuries

In accordance with 49 CFR 830.2, Safety Board investigators categorize general aviation injuries as "fatal," "serious," or "minor." A fatal injury is defined as "any injury which results in death within 30 days of the accident." Title 49 CFR 830.2 also outlines several attributes[28] of serious injury that include, but are not limited to, hospitalization for more than 48 hours, bone fracture, internal organ damage, or second- or third-degree burns. The following figure depicts

The following figures illustrate both the number of accident aircraft in each injury category and the corresponding number of persons aboard those aircraft who sustained injuries in each category. Categorization of injury level in an accident is based on the highest level of injury sustained by an occupant of an accident aircraft. Again, most persons who were aboard general aviation aircraft that were involved in accidents sustained no injuries.

[28] See appendix B for the complete definition of injury categories.



General Aviation Accident Injuries, 2004

Personal Injuries	Fatal	Serious	Minor	None	Total
Pilot	295	158	228	954	1,635
Copilot	20	3	10	40	73
Flight instructor	10	8	13	72	103
Dual student	4	1	4	11	20
Check pilot	2	0	1	6	9
Other crew	10	1	4	29	44
Passenger	218	92	157	860	1,327
Total aboard	559	263	417	1,972	3,211
On ground	0	3	8	0	11
Other aircraft	0	0	0	0	0
Total	559	266	425	1,972	3,222

Injuries by Role for 2004

The table to the right presents detailed information about the types of injuries incurred by all persons involved in general aviation accidents during 2004. The distribution of general aviation accident injuries varies with the type of operation and the size of aircraft; the number of injuries experienced by any group of persons varies with their level of activity (that is, their exposure to risk). For example, all aircraft have a pilot, but not all have passengers on board.

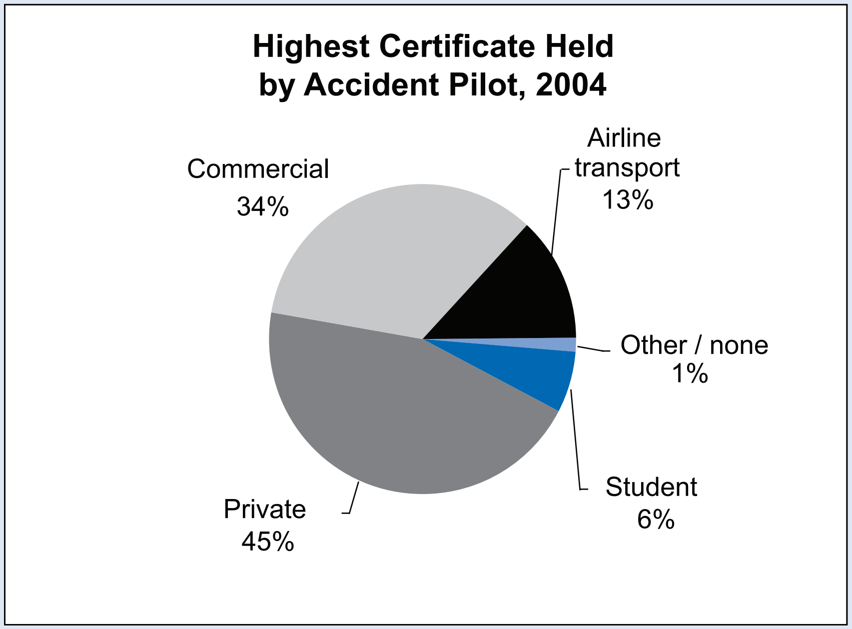
In 2004, 467 passengers suffered some level of injury in general aviation accidents, compared to the 714 pilots and copilots who were injured. Pilots sustained the highest percentage of injuries, suffering 53% of all fatalities, 60% of all serious injuries, and 55% of all minor injuries.

In addition to injuries sustained by persons on board the accident aircraft, 11 persons on the ground sustained injuries as a result of general aviation accidents. For example, one person in an automobile was seriously injured when an aircraft collided with vehicles during a forced landing on the freeway, a passenger was seriously injured after being struck by an aircraft propeller, and three people sustained minor injuries when the aircraft impacted a residence following an uncontrolled descent.

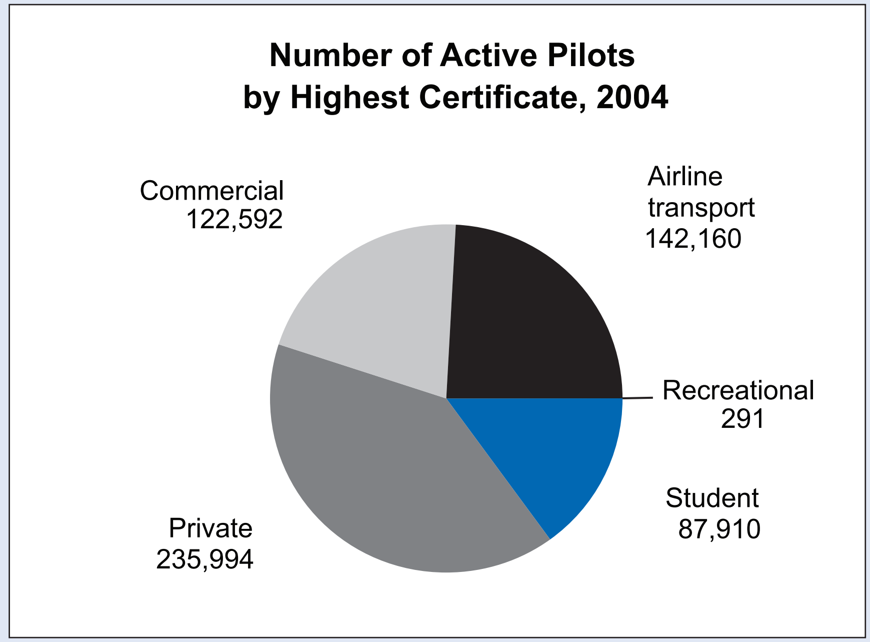
Accident Pilots

Rating

Of the 1,635 pilots involved in general aviation accidents in 2004, the largest percentage held a private pilot certificate.[29] The second-largest percentage held a commercial pilot certificate, which is required for any person to act as pilot-in-command of an aircraft for compensation or hire.[30]



When compared to the number of active pilots in 2004 holding each type of pilot certificate, commercial pilot certificate holders were over-represented among general aviation accidents. Although commercial pilot certificate holders accounted for only 20% of all active general aviation pilots, they were involved in 34% of all general aviation accidents in 2004.

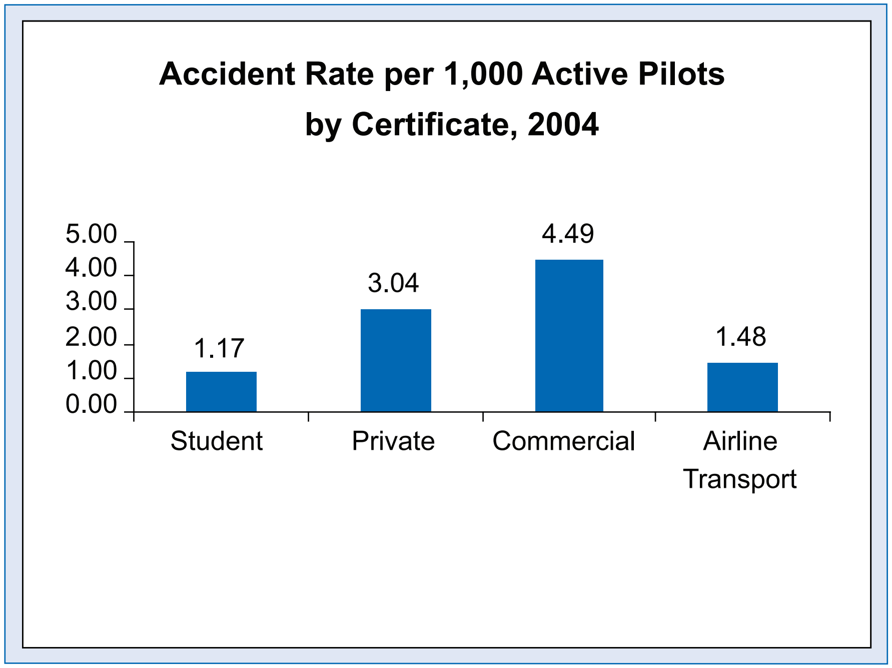


Similarly, the accident rate was highest for commercial pilot certificate holders during 2004, with 4.49 accidents per 1,000 active pilots. One possible explanation for the higher numbers of accidents is that commercial certificate holders may be employed as pilots and would therefore be likely to fly more hours annually than student or private

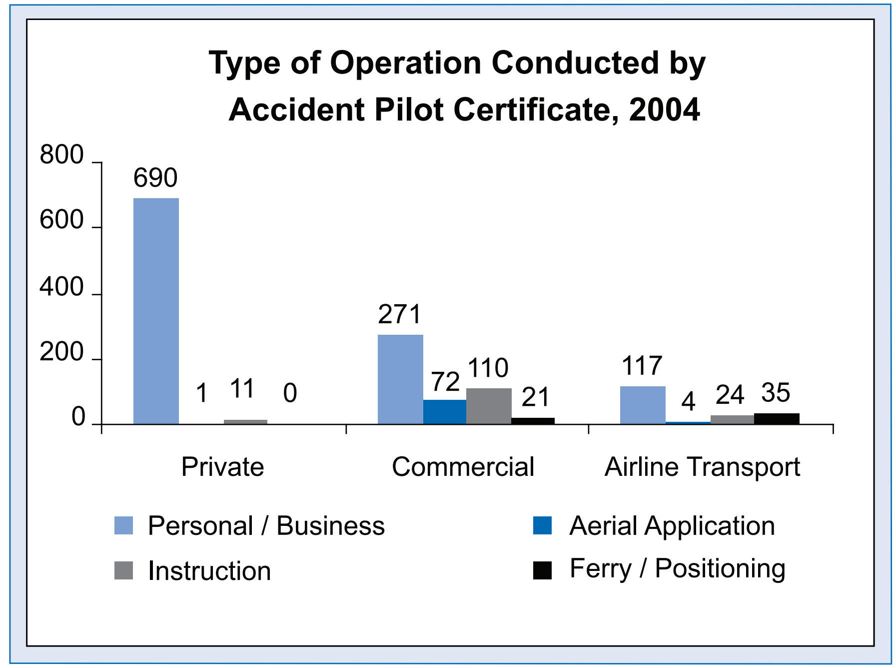
[29] Available at <http://www.faa.gov/data_statistics/aviation_data_statistics/general_aviation/CY2004/>.

[30] See 14 CFR 61.133 for the privileges granted by a commercial pilot certificate.

pilots. However, more than one-third of commercial pilots involved in accidents during 2004 (34%) were conducting personal flights and were not involved in commercial operations at the time of the accidents.



(1,603 of accident pilot records with data available, 2004)



Because annual flight-hour data are not compiled separately for pilots holding each type of certificate, it is not possible to compare activity-based accident rates. The *U.S. Civil Airmen Statistics*[31] also do not include information about the type of operation that certificate holders engage in. Examples of other commercial operations not presented in the figure above include corporate/executive transportation, sightseeing flights, banner towing, and aerial observation.

[31] Available at <http://www.faa.gov/data_statistics/aviation_data_statistics/general_aviation/CY2004/>.

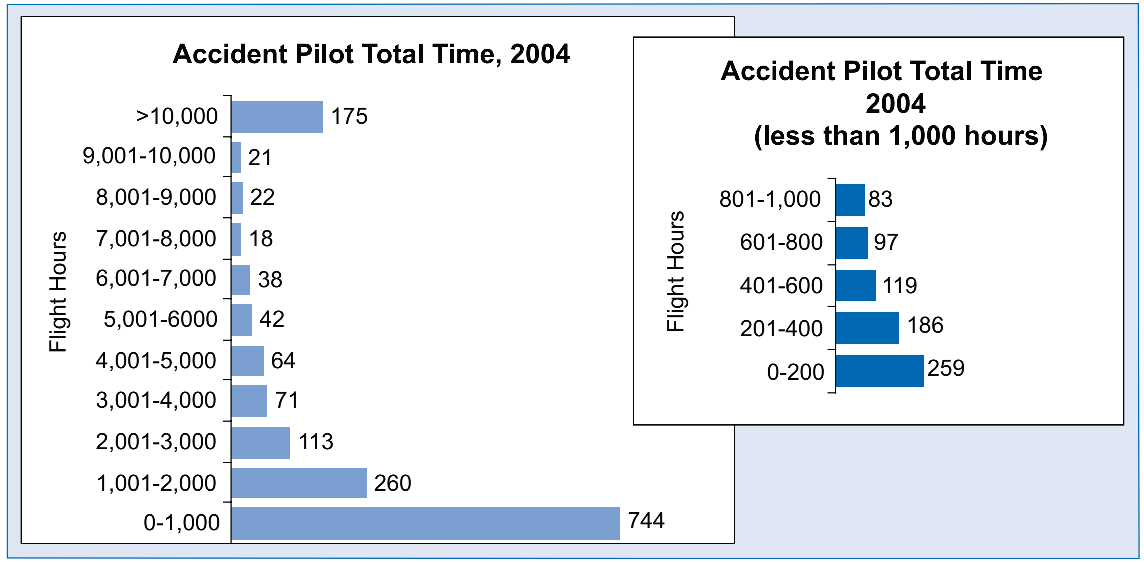
Total Time

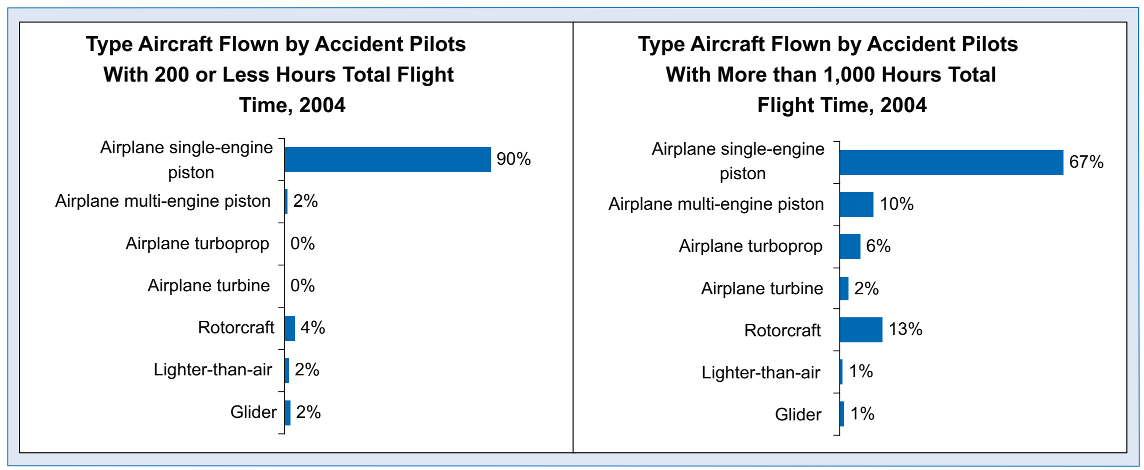
For the 1,568 accident pilots for whom total flight experience data are available (as shown in the figure on this page, upper right), 47% were pilots with a total flight time of 1,000 hours or less. The following figure depicts the distribution of experience among accident pilots. The inset focuses on those pilots with less than 1,000 hours. The largest percentage of accident pilots in this group had 200 hours or less of total flight time. When compared to all accident pilots with available data, about 16% of accident pilots had 200 hours of flight experience or less.

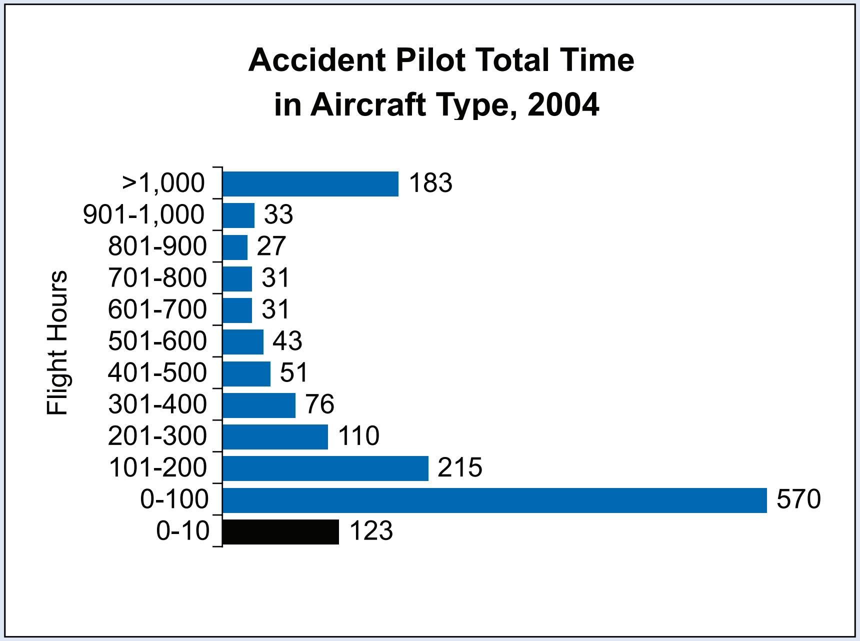
It is not surprising that 9 of 10 accident pilots with 200 hours total flight time or less were flying single-engine piston airplanes. Most accident pilots with more than 1,000 hours were also flying single-engine piston airplanes, but this group also operated a more diverse selection of aircraft—multi-engine piston, turboprop, and turbine-powered airplanes—and more than twice as many rotorcraft.

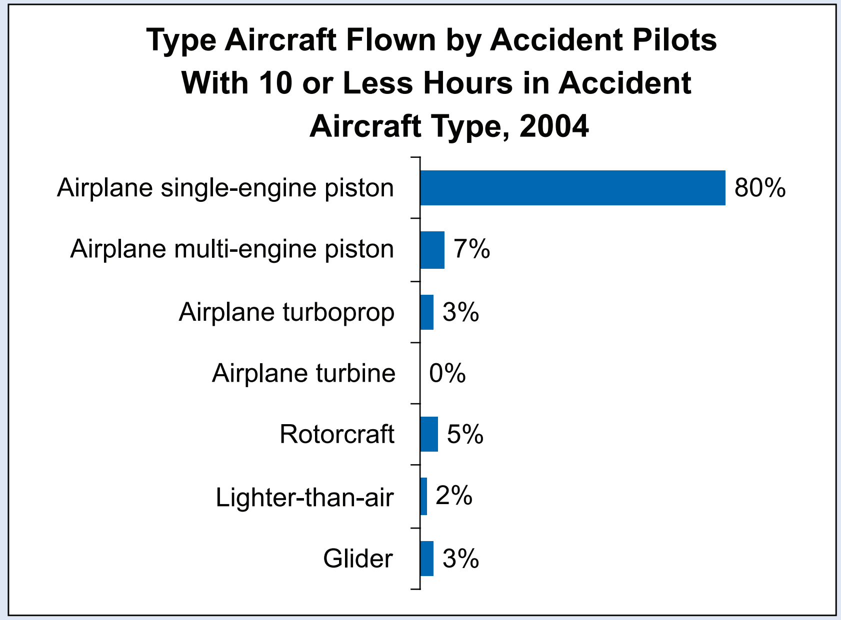
Time in Type of Aircraft

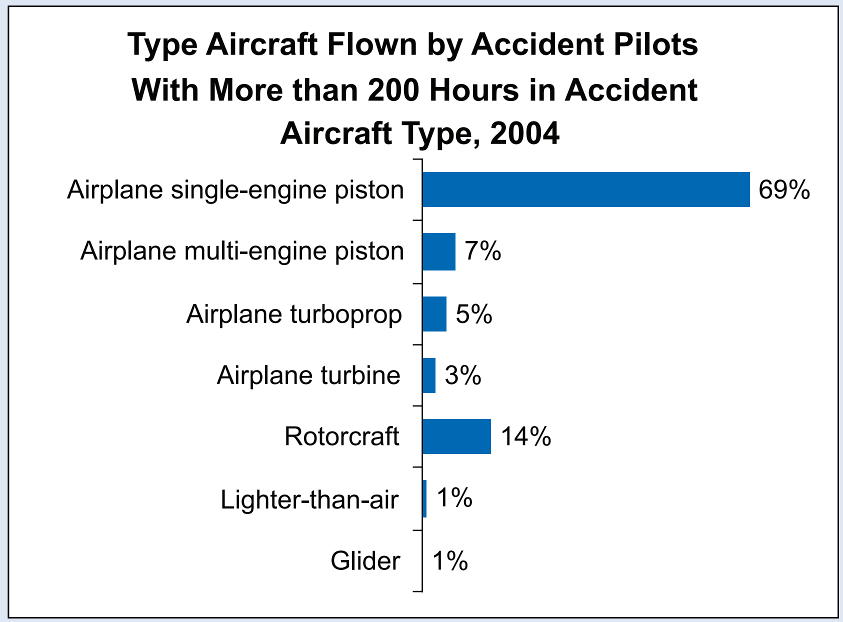
Of the 1,370 accidents in 2004 for which pertinent data are available (as shown in the figure on this page, lower right), 42% involved pilots with 100 hours or less of time in the accident aircraft make and model. Of those, 123 pilots (9% of all accident pilots for whom data are available) had less than 10 hours in type. Most accident pilots with less than 10 hours of flight time in make and model were flying single-engine piston aircraft.









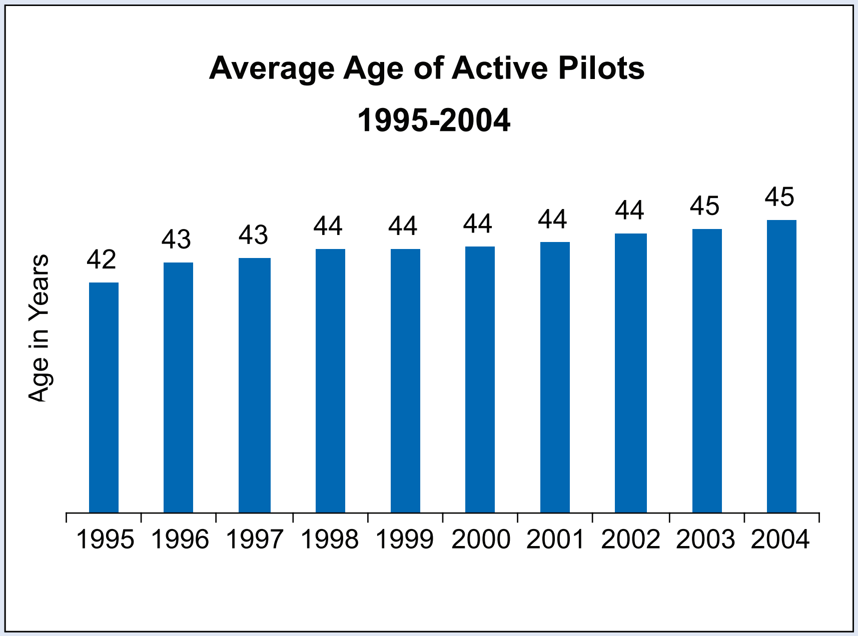


Pilots may have low time in type because they are new pilots with low total time or they are experienced pilots who are transitioning to a new aircraft. Two groups of pilots that might be expected to have accumulated significant time in make and model are those who own their own airplanes and fly them often and professional pilots who fly the same aircraft often. A large number of general aviation pilots who own aircraft have single-engine piston airplanes. Helicopters and multi-engine piston, jet, and turboprop airplanes are more likely to be operated by professional pilots. Although not specifically detailed in the figure above, it is worth noting that 34 of the 123 accident pilots in 2004 who had less than 10 hours in the accident aircraft type were operating amateur-built aircraft.

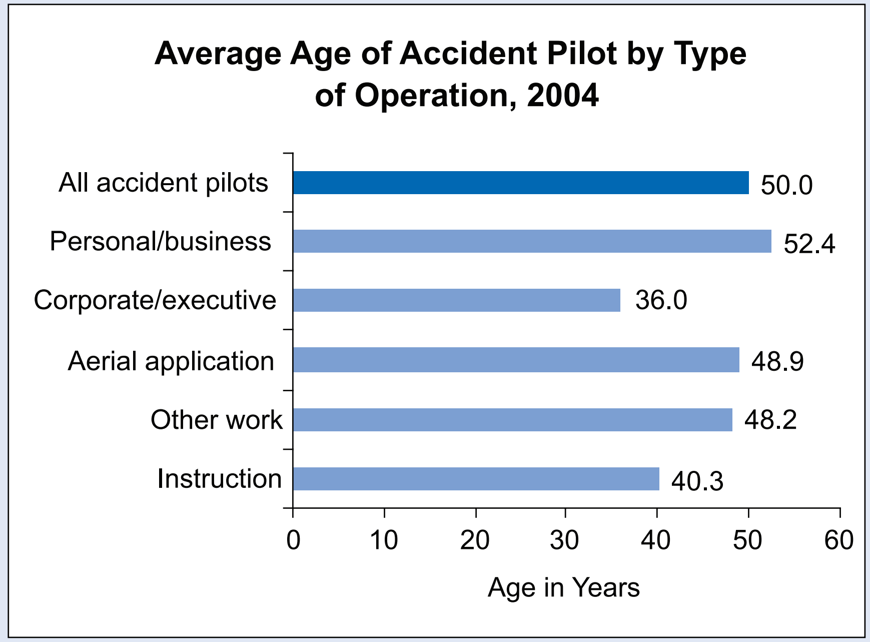
Comparison of the two figures in the right column, page 26, shows that accident pilots with more than 200 hours in make and model were more likely than pilots with fewer hours in type to be flying rotorcraft or multi-engine piston, jet, or turboprop airplanes.

Age

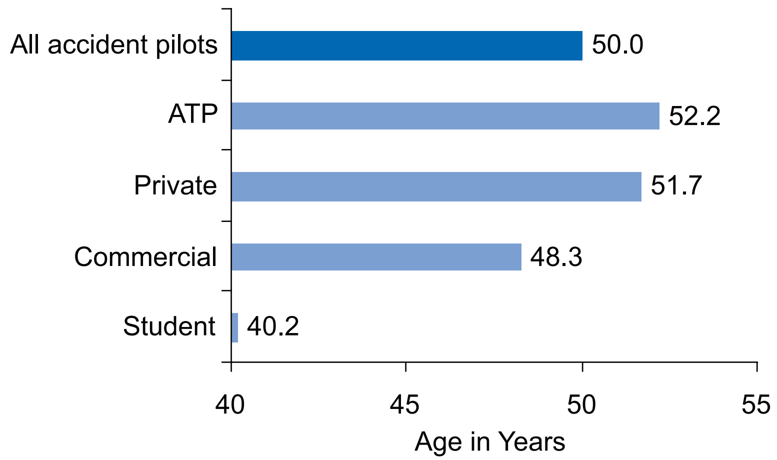
The average age of all active pilots in the U.S. increased steadily from 1995 through 2004 and by 2004 was 45[32] years. In contrast, the average age of general aviation accident pilots was 50. Despite the difference in average age, no meaningful conclusions can be made regarding specific age-related accident risk because FAA flight-hour activity numbers are not available for each age group. Age differences could be the result of activity if opportunities for recreational flying were to increase with age.



The two figures that follow on this page and the next show the relationship of the accident pilot's age by type of operation and by highest pilot certificate.



32 Available at <http://www.faa.gov/data_statistics/aviation_data_statistics/general_aviation/CY2004/>.



Average Age of Accident Pilot by Highest Pilot Certificate, 2004

Accident Occurrences for 2004

Safety Board accident reports document the circumstances of an accident as "accident occurrences" and "sequence of events." Occurrence data can be defined as *what* happened during the accident. A total of 54 occurrence codes are available to describe the events for any given accident.[33] Because aviation accidents are rarely limited to a single occurrence, each occurrence is coded as part of a sequence (that is, occurrence 1, occurrence 2, etc.), with as many as six different occurrence codes in one accident. For accidents that involve more than one aircraft, the list of occurrences may be different for each aircraft. Of the 1,601 accident aircraft in 2004 for which data are available, 1,285 cited 2 or more occurrences, 725 cited 3 or more, 178 cited 4 or more, 12 cited 5 or more, and 2 cited a total of 6.

The excerpt from a brief report shown here, which is for a 2004 accident with four occurrences, illustrates how an accident with multiple occurrences is coded. In this accident, an airplane entered an inverted spin during a skydiving operation when a parachute deployed while the parachutist exited the airplane. The parachute became entangled around the landing gear and the parachutist could not be freed. The pilot, who was wearing a parachute, and the remaining parachutists jumped from the airplane. The airplane then impacted a flat field, inverted, and the entangled parachutist was killed. Each of these occurrences was coded in order, as shown.

Example of Occurrence Findings Cited in an NTSB Accident Brief, 2004

Occurrence #1: MISCELLANEOUS/OTHER
Phase of Operation: CRUISE

Occurrence #2: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: CRUISE

Occurrence #3: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: DESCENT – UNCONTROLLED

Occurrence #4: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT – UNCONTROLLED

[33] Two of the codes, missing aircraft and undetermined, do not represent operational events.

Occurrence data do not include specific information about why an accident may have happened; the first occurrence can instead be considered the first observable link in the accident chain of events. The following table displays first occurrences for all year-2004 general aviation accident aircraft with sequence of events data available. To simplify the presentation of accident occurrence data, similar occurrences can be grouped into eight major categories.

Among the eight major categories of first occurrences, the largest percentage of accidents (26%) related to aircraft power. Among the individual occurrences, the most common involved a loss of control in flight (13%), followed closely by loss of control on the ground (13%). Although occurrences involving loss of aircraft control on the ground resulted in only 4 fatal accidents in 2004, loss-of-control occurrences in flight resulted in a total of 77 fatal accidents—more than one-quarter of all fatal accidents and more than twice that of any other single occurrence.

General Aviation Accident First Occurrences, 2004

First Occurrences	Total	Fatal
Collision – In-flight	217	73
In-flight Collision with Object	115	35
In-flight Collision with Terrain/Water	63	22
Midair Collision	22	14
Undershoot	17	2
Near Collision Between Aircraft	0	0
Noncollision – In-flight	414	162
Loss Of Control - In-flight	215	77
Airframe/Component/System Failure/Malfunction	96	19
In-flight Encounter with Weather	92	62
Abrupt Maneuver	4	3
Vortex Turbulence Encountered	2	1
Altitude Deviation, Uncontrolled	1	0
Forced Landing	4	0
Decompression	0	0
Collision – On-ground or Water	93	1
On Ground/Water Collision with Object	37	0
On Ground/Water Encounter with Terrain/Water	40	0
Collision Between Aircraft (Other Than Midair)	10	0
Dragged Wing, Rotor, Pod, Float or Tail/Skid	6	1
Noncollision – On-ground or Water	399	7
Loss of Control - On Ground/Water	213	4
Hard Landing	114	1
Overrun	46	0
Nose Over	11	1
Roll Over	8	1
Propeller/Rotor Contact to Person	1	0
Propeller Blast or Jet Exhaust/Suction	1	0
Nose Down	0	0
Ditching	0	0
On Ground/Water Encounter with Weather	5	0

First Occurrences (Cont.)	Total	Fatal
Power Related	420	55
Loss of Engine Power	161	25
Loss of Engine Power(Total) - Nonmechanical	117	11
Loss of Engine Power(Total) - Mech Failure/Malf	57	8
Loss of Engine Power(Partial) - Nonmechanical	38	7
Loss of Engine Power(Partial) - Mech Failure/Malf	43	3
Propeller Failure/Malfunction	1	0
Rotor Failure/Malfunction	3	1
Engine Tear-away	0	0
Landing Gear	25	0
Gear Collapsed	6	0
Wheels-up Landing	11	0
Main Gear Collapsed	2	0
Gear Retraction on Ground	2	0
Nose Gear Collapsed	3	0
Complete Gear Collapsed	0	0
Wheels-down Landing in Water	1	0
Tail Gear Collapsed	0	0
Other Gear Collapsed	0	0
Gear Not Extended	0	0
Gear Not Retracted	0	0
Miscellaneous	31	3
Miscellaneous/Other	18	2
Fire	9	1
Cargo Shift	0	0
Fire/Explosion	2	0
Hazardous Materials Leak/Spill	0	0
Explosion	2	0
Undetermined	2	2
Missing Aircraft	1	1
Undetermined	1	1

Phase of Flight

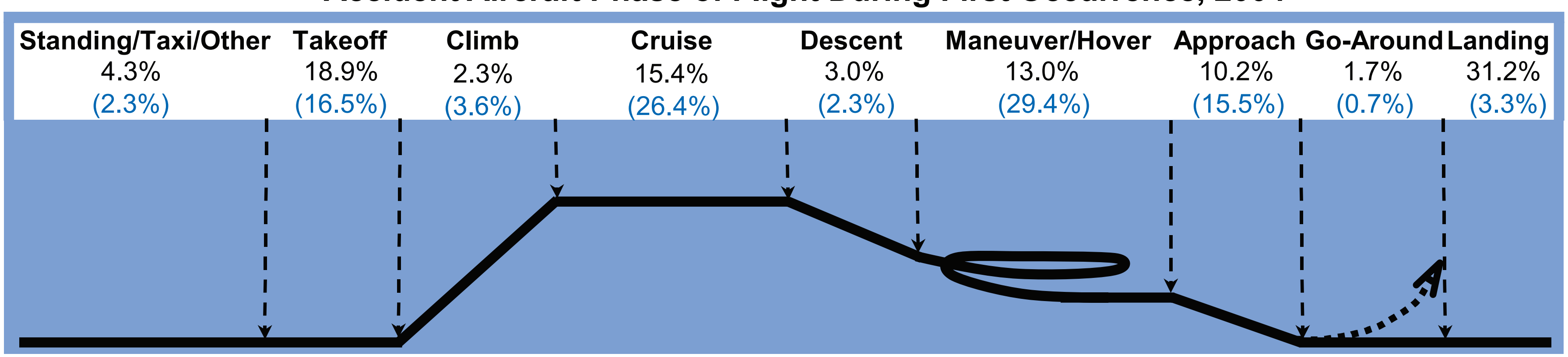
The figure below displays the percentage of accident aircraft in each phase of flight at the time of the first occurrence. The phase of flight defines when, during the operation of the aircraft, the first occurrence took place. Fifty distinct phases of flight are used to describe the operational chronology of occurrences. To simplify this information, the detailed phases are grouped into the nine broad categories shown. For example, the category “approach” includes any segment of an instrument approach, or position in the airport traffic pattern, and continues until the aircraft lands on the runway. The upper set of numbers shows the percentage of accidents associated with each phase for first occurrences, and the numbers in parentheses show the percentage of fatal accidents in each phase associated with first occurrences.

As shown here, half of all general aviation accidents (50%) occurred during either takeoff or landing, despite the relatively short duration of these phases compared to the entire profile of a normal flight. This high number of accidents reflects the increased workload during takeoff and landing when the flight crew must control the aircraft, change altitude and speed, communicate with air traffic control (ATC) and/or other aircraft, and maintain separation from obstacles and other aircraft. Aircraft systems are also stressed during takeoff and landing with changes to engine power settings, the possible operation of retractable landing gear, flaps, slats, and spoilers, and changes in cabin pressurization. In addition, while the aircraft is at low altitude, it is also most susceptible to hazards caused by wind and weather conditions.

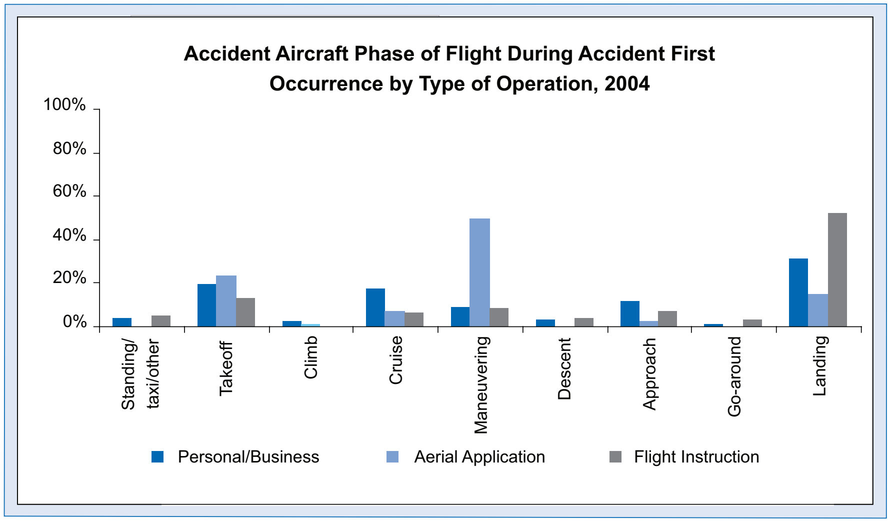
Notably, landing accounted for the largest percentage of total accident first occurrences (31%) of any single phase but only 3% of fatal accident first occurrences. The combination of cruise and maneuvering phases accounted for over half (56%) of fatal accident first occurrences, but less than one-third (28%) of all accidents. These differences reflect the relative severity of accidents that are likely to occur during each phase. Accidents during cruise and maneuvering are more likely to result in higher levels of injury and aircraft damage due to higher speeds and altitudes.

The likelihood of an aircraft accident first occurrence during each phase of flight varies by aircraft type and type of operation due to the unique hazards associated with each. For example, flight instruction typically involves a lot of time practicing takeoffs and landings. As a result, about 52% of all first occurrences for 2004 involving instructional flights occurred during landing compared to 31% of personal/business flights and 15% of aerial application flights.

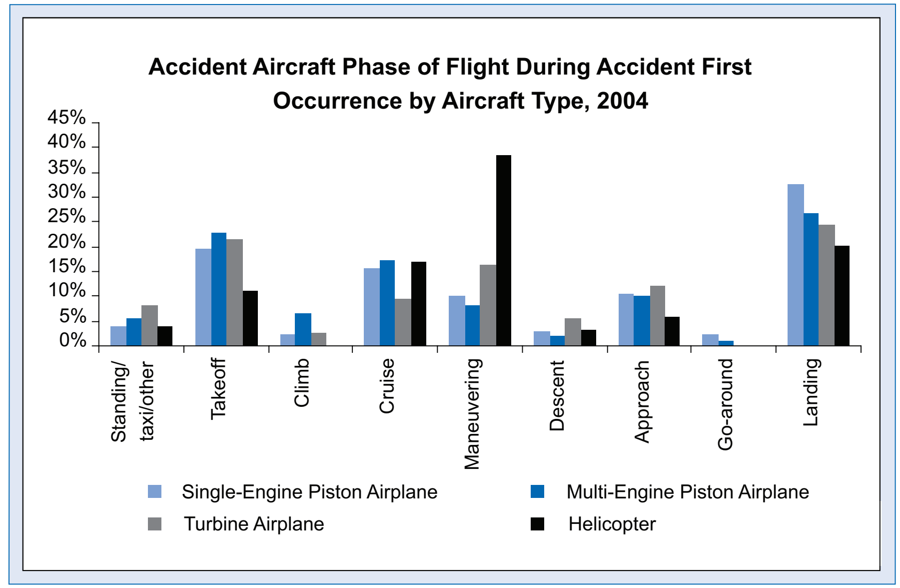
Accident Aircraft Phase of Flight During First Occurrence, 2004



1,601 accident aircraft with phase of flight data



Accident phase-of-flight differences among aircraft types are the result of the amount of time spent in each phase, aircraft-specific hazards associated with that phase, and the type of operations typically conducted with that aircraft. For example, the largest percentage of first occurrences for accidents involving helicopter flights, about 39%, occurred while maneuvering. The percentage of accidents during this phase reflects the hazards unique to helicopters while hovering and during operations that are unique to helicopters, such as carrying external loads. In contrast, the largest percentage of accidents involving single-engine piston aircraft occurred during landing. Takeoff accounted for 20-25% of accidents involving airplanes, but only 11% of accidents involving helicopters.



Chain of Occurrences

An accident's first occurrence and phase of flight during first occurrence indicate how and when an accident begins. However, the entire accident can also be viewed as a chain of all the accident occurrences cited in the order in which they happen. As previously discussed, accident events often include a combination of multiple occurrences, with many possible combinations. For example, of the 1,601 accidents that occurred during 2004 for which occurrence data are available, 405 unique combinations of accident occurrences were cited. The following tables, which list the top ten combinations of occurrences for all accidents and fatal accidents, illustrate the most common events.

Rank	Chain Of Occurrences - All GA Accidents, 2004	Number of Accidents
1	1) LOSS OF CONTROL - IN FLIGHT - 2) IN FLIGHT COLLISION WITH TERRAIN/WATER	133
2	1) IN FLIGHT COLLISION WITH OBJECT	59
3	1) LOSS OF CONTROL - ON GROUND/WATER - 2) ON GROUND/WATER ENCOUNTER WITH TERRAIN/WATER	57
4	1) HARD LANDING	54
5	1) IN FLIGHT COLLISION WITH TERRAIN/WATER	52
6	1) LOSS OF CONTROL - ON GROUND/WATER - 2) ON GROUND/WATER COLLISION WITH OBJECT	38
7	1) IN FLIGHT COLLISION WITH OBJECT - 2) IN FLIGHT COLLISION WITH TERRAIN/WATER	31
8	1) ON GROUND/WATER COLLISION WITH OBJECT	30
9	1) IN FLIGHT ENCOUNTER WITH WEATHER - 2) LOSS OF CONTROL - IN FLIGHT - 3) IN FLIGHT COLLISION WITH TERRAIN/WATER	29
10	1) LOSS OF CONTROL - IN FLIGHT - 2) IN FLIGHT COLLISION WITH OBJECT	26

The top ten occurrence chains cited in fatal accidents are similar to those cited for all accidents. Loss of control followed by in-flight collision with terrain or water tops both lists, with almost half those accidents being fatal. It is important to note that, although this was the most frequent chain of occurrences in 2004, it accounted for only 8% of all accidents for the year.

Rank	Chain Of Occurrences - Fatal GA Accidents, 2004	Number of Accidents
1	1) LOSS OF CONTROL - IN FLIGHT - 2) IN FLIGHT COLLISION WITH TERRAIN/WATER	60
2	1) IN FLIGHT COLLISION WITH TERRAIN/WATER	20
3	1) IN FLIGHT ENCOUNTER WITH WEATHER - 2) LOSS OF CONTROL - IN FLIGHT - 3) IN FLIGHT COLLISION WITH TERRAIN/WATER	20
4	1) IN FLIGHT COLLISION WITH OBJECT	16
5	1) IN FLIGHT COLLISION WITH OBJECT - 2) IN FLIGHT COLLISION WITH TERRAIN/WATER	14
6	1) IN FLIGHT ENCOUNTER WITH WEATHER - 2) IN FLIGHT COLLISION WITH TERRAIN/WATER	13
7	1) AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION - 2) LOSS OF CONTROL - IN FLIGHT - 3) IN FLIGHT COLLISION WITH TERRAIN/WATER	11
8	1) LOSS OF CONTROL - IN FLIGHT - 2) IN FLIGHT COLLISION WITH OBJECT	11
9	1) LOSS OF ENGINE POWER - 2) FORCED LANDING - 3) LOSS OF CONTROL - IN FLIGHT - 4) IN FLIGHT COLLISION WITH TERRAIN/WATER	9
10	1) MIDAIR COLLISION	9

A diverse range of events can, in combination, result in an accident. Fatal accidents, however, are more likely to result from an in-flight collision, often preceded by loss of control and/or weather encounters or equipment malfunctions. For example, all of the top ten chains of fatal accident occurrences included an in-flight collision with terrain or object, events that are more likely to result in the high impact forces likely to cause serious injury. In contrast to the severity of these cases, most accidents in 2004 did not involve catastrophic events, and a large number of accidents involved aircraft on the ground that resulted in minor or no injuries.

Most Prevalent Causes/ Factors for 2004

Probable Causes, Factors, Findings, and the Broad Cause/ Factor Classification

Besides coding accident occurrences, the Safety Board makes a determination of probable cause with the objective of defining the cause and effect relationships in the accident sequence. The probable cause could be described as *why* the accident happened. In determining probable cause, the Board considers the facts, conditions, and circumstances of the event. Within each accident occurrence, any information that helps explain why that event happened is identified as a "finding" and may be further designated as either a "cause" or "factor." The term "factor" is used to describe situations or circumstances that contributed to the accident cause. The details of probable cause are coded as the combination of all causes, factors, and findings associated with the accident. Just as accidents often include a series of events, the reason why those events led to an accident reflects a combination of multiple causes and factors. For this reason, a single accident report can include multiple cause and factor codes, as shown in the following brief.

Example of NTSB Accident Brief, 2004

Occurrence #1: IN FLIGHT ENCOUNTER WITH WEATHER
Phase of Operation: CRUISE

Findings
1. (F) PREFLIGHT BRIEFING SERVICE - NOT FOLLOWED - PILOT IN COMMAND
2. (C) PLANNING/DECISION - INADEQUATE - PILOT IN COMMAND
3. (C) VFR FLIGHT INTO IMC - INADVERTENT - PILOT IN COMMAND
4. (F) WEATHER CONDITION - FOG
5. (F) WEATHER CONDITION - DRIZZLE/MIST
6. (F) WEATHER CONDITION - OBSCURATION

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: DESCENT - UNCONTROLLED

Findings
7. (C) CLEARANCE - NOT MAINTAINED - PILOT IN COMMAND
8. TERRAIN CONDITION - GROUND

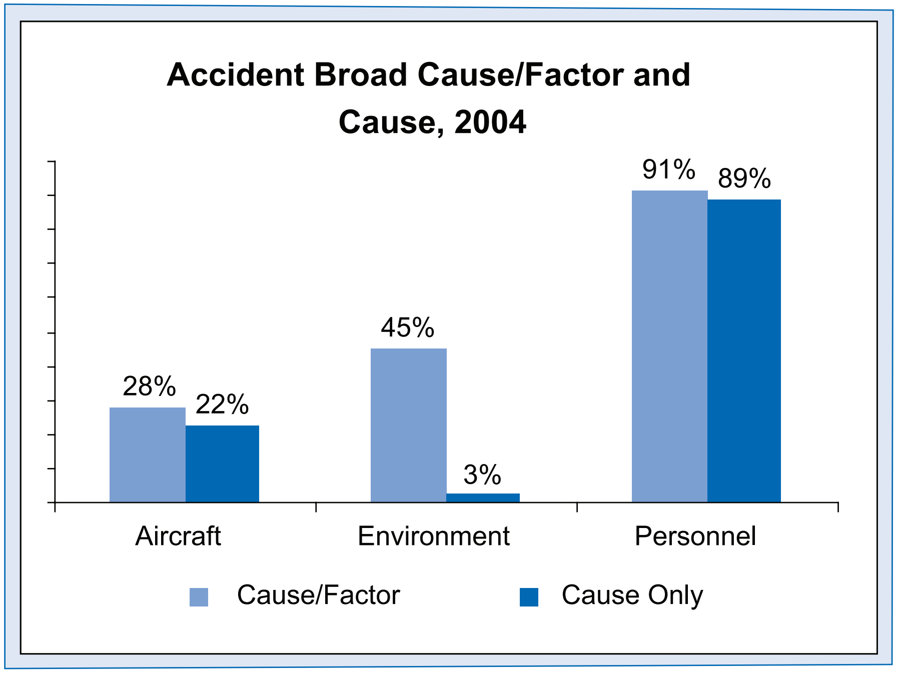
Findings Legend: (C) = Cause, (F) = Factor

The National Transportation Safety Board determines the probable cause(s) of this accident as follows: the pilot's inadequate planning/decision which resulted in VFR flight into IMC, and his failure to maintain terrain clearance. Contributing factors were the pilot's failure to follow the briefing recommendation, fog, mist, and observation.

During a cross-country flight, the pilot encountered instrument meteorological conditions (IMC), and the airplane was destroyed after impacting the terrain in a nose-low attitude. Radar data depicted the airplane traveling in a west-northwesterly direction. Then, approximately 4 minutes before the accident, the airplane executed a series of 360-degree turns. The investigation revealed that before the flight, the pilot had obtained a weather briefing and the briefer informed the pilot that a VFR flight was not recommended. Witnesses at the departure airport stated that before the flight, the pilot and passenger seemed tired and anxious to get home. A witness located near the accident site reported misty and foggy weather conditions and visibility of about 200 feet. In this accident, the pilot's decision-making about the flight, inadvertent flight into IMC, and inability to maintain clearance from terrain were cited as causes. The preflight briefing and weather were all cited as factors, and the terrain was cited as the only finding.

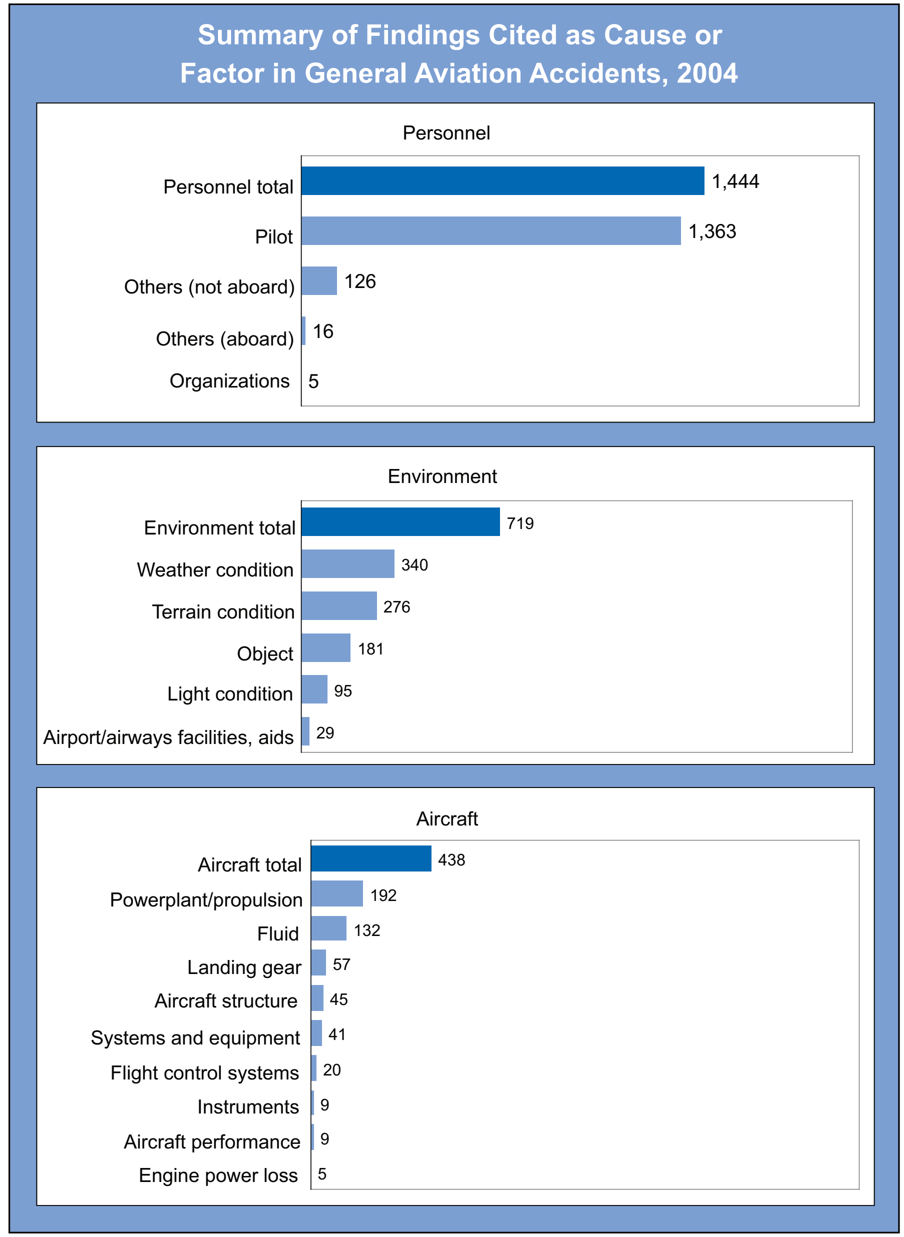
To simplify the presentation of probable cause information in this review, the hundreds of unique codes used by investigators to code probable cause can be grouped into three broad cause/factor categories: aircraft, environment, and personnel. The following figure shows the percentage of general aviation accidents that fall into each category. Personnel-related causes or factors were cited in 91% of the 1,585 general aviation accident reports for 2004 for which cause/factor data were available (see the following figure). Environmental causes/factors were cited in 45% of these accident reports, and aircraft-related causes/factors were cited in 28%.[34]

[34] Because the Safety Board frequently cites multiple causes and factors for an aircraft accident, the number of causes and factors will result in a sum greater than the total number of accidents.



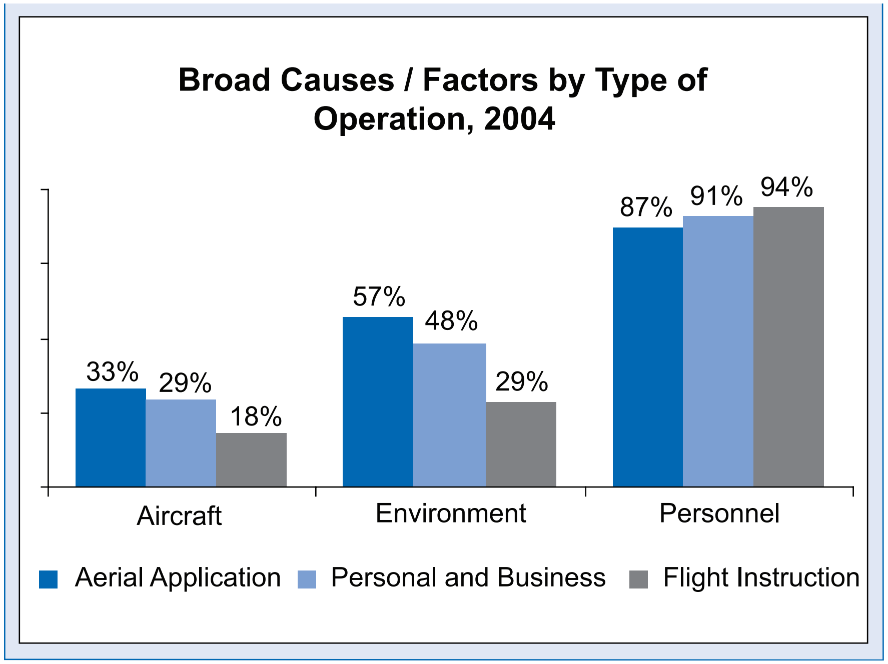
Environmental conditions are rarely cited as an accident cause but are more likely to be cited as a contributing factor. In 2004, only 47 of 719 environmental citations (3% of all causes/factors cited) were listed as a cause, with the remainder listed as contributing factors. For example, rough terrain might be cited as a contributing factor, but not a cause, to explain why an aircraft was damaged during a forced landing due to engine failure. In that case, the origin(s) of the engine failure would be cited as cause, but the terrain would be cited as a factor because it contributed to the accident outcome.

As mentioned previously, several hundred unique codes are available to document causes/factors, as summarized in the group of tables to the right (1,585 accidents with findings).



As the figure on this page shows, most causes and factors attributed to general aviation accidents in 2004 were related to personnel. Much like the pilot and passenger injury differences discussed previously, part of the reason why personnel are cited so often may have to do with exposure to risk. Personnel, and pilots in particular, are associated with every flight. However, potential aircraft and environmental accident causes and factors depend on a range of variables, including the type of flight, type of aircraft, time of day, time of year, and location.

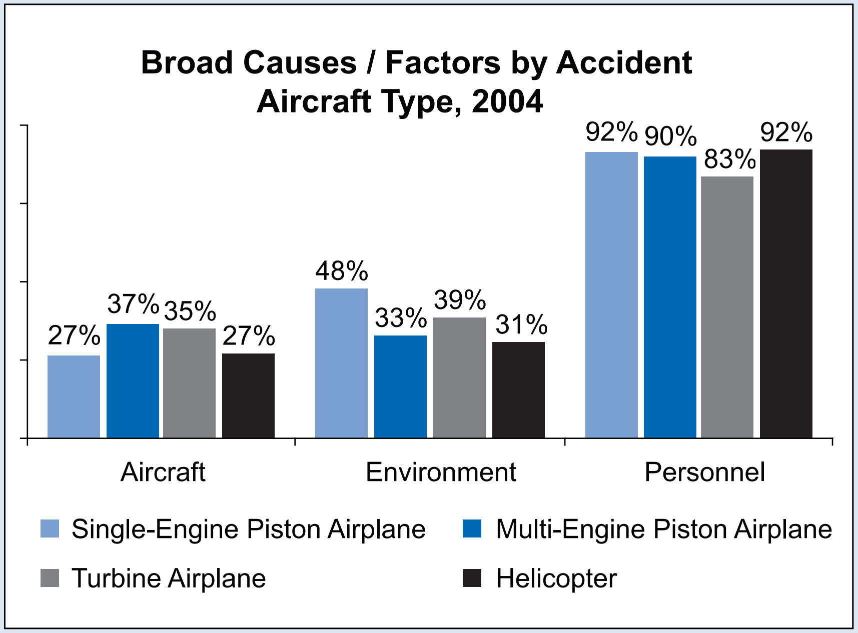
Although the pilot was the most frequently cited individual in the personnel category in 2004, other persons not aboard the aircraft were also cited as a cause or factor in 126 accidents. Such personnel included flight instructors, maintenance technicians, and airport personnel. In the broad category of environmental factors, weather conditions were cited in 340 (21%) of the accidents. Powerplant-related[35] causes/factors, cited in 192 (12%) of all general aviation accidents, were the most commonly cited aircraft factors.



The figure on this page shows how specific accident causes and factors varied by type of flight operation. For example, personnel were cited in 94% of instructional flight accidents and 91% of personal/business accidents, compared to 87% of aerial application accidents. The high percentage of personnel causes/factors for flight instruction accidents is likely the result of aircraft control and decision-making errors due to students' lower level of skill and ability, as well as the large amount of time practicing maneuvers like takeoffs and landings that are more likely to result in accidents. In contrast, aerial application accidents cited a higher percentage of aircraft causes/factors, most likely because the low altitude flown during spray operations allows few options for recovery in the event of a mechanical failure.

A comparison of the causes/factors cited in accidents involving different types of aircraft reveals similar results. The higher percentage of multi-engine piston accidents that cited aircraft causes/factors in 2004 is likely a result of more complex systems as compared to single-engine piston airplanes. Conversely, the high reliability of turbine engines likely contributes to the low percentage of aircraft-related findings for those aircraft. There is also a noticeable drop in the percentage of environmental cause/factor citations progressing from single- to multi-engine piston, and to turbine airplane accidents, mirroring increases in the typical range, performance, and equipment capabilities of those aircraft.

[35] Powerplant/propulsion causes and factors include any partial loss or disruption of engine power, as well as the malfunction or failure of any part(s), equipment, or system associated with engine propulsion. Engine power loss refers only to the total loss of engine power.



Human Performance and Explanatory Causes / Factors, 2004

	All Accidents	Fatal Accidents
Human Performance Issues	1,349	270
Aircraft handling/control	960	222
Planning/decision	532	122
Use of aircraft equipment	146	16
Maintenance	87	19
Communications/information/ATC	56	11
Meteorological service	8	7
Airport	2	0
Dispatch	0	0
Underlying Explanatory Factors	139	57
Physiological condition	49	36
Qualification	39	15
Psychological condition	35	6
Procedure inadequate	9	3
Aircraft/equipment inadequate	5	0
Institutional factors	5	3
Information	3	2
Material inadequate	2	0
Facility inadequate	0	0

Human Performance

The information recorded in the personnel category refers primarily to *whose* actions were a cause or factor in an accident. However, details about the actions or behavior that may have led to an accident, causal data related to human performance issues, and any underlying explanatory factors are also recorded. The information in these categories can be thought of as *how* and *why* human performance contributed to the accident. For example, if a pilot becomes disoriented and loses control of an aircraft after continuing visual flight into instrument flight conditions, the pilot's inability to maintain control would be cited as a "cause" in the personnel category, and planning/decision-making would likely also be cited in the human performance issues category.

Of the 1,349 accidents for which the cause or factor was attributed to human performance in 2004, the most frequently cited cause/factor was aircraft handling and control (71%), followed by planning and decision-making (39%) and use of aircraft equipment (11%). Issues related to personnel qualification were cited in about 28% of the 139 accidents with underlying explanatory factors related to human performance. Examples of qualification issues that were cited in the 2004 accident record included lack of total experience, lack of recent experience, and lack of certification.

Weather as a Cause/Factor

Because general aviation aircraft are usually smaller, slower, and more limited in maximum altitude and range than transport-category aircraft, they can be more vulnerable to hazards posed by weather. Smaller aircraft are affected to a greater degree by adverse wind conditions, and precipitation, icing, and convective weather have a greater effect on aircraft that lack the speed, altitude, and/or range capabilities to avoid those conditions. Weather conditions cited most often as a cause or factor in general aviation accidents are related to winds, including gusts, crosswind, and tailwind.

The top three environmental causes/factors cited in general aviation accidents in 2004 were all related to wind. Because aircraft are most susceptible to the effects of wind during takeoffs and landings, the effect of adverse wind was reflected in a high percentage of general aviation accidents that occurred during those phases of flight.

As previously discussed, most landing accidents do not result in fatal injuries. Because of the strong association of wind with landing accidents, it is not surprising that most wind-related accidents in 2004 were not fatal. The wind-related weather factors gusts, crosswind, and tailwind were cited as a cause/factor in 182 accidents, but only 4 of those accidents were fatal. Among fatal general aviation accidents, the three most frequently cited weather factors were related to conditions that resulted in reduced visibility, including clouds, low ceiling, and fog. Accidents under conditions of low visibility typically involve either loss of aircraft control and/or collision with obstacles or terrain, both of which are likely to result in severe injuries and aircraft damage. The high number of fatal general aviation accidents occurring in low visibility weather led the Safety Board to conduct a safety study of these accidents.[36] Several of the weather-related accidents that occurred during 2004 were included in that study.

	All Accidents	**Fatal Accidents**
Weather Condition	340	85
Gusts	69	3
Crosswind	64	0
Tailwind	49	1
Low ceiling	31	27
Clouds	30	28
High density altitude	20	4
High wind	20	4
Carburetor icing conditions	18	0
Fog	18	14
Downdraft	15	3
Icing conditions	11	6
Thunderstorm	10	7
Windshear	9	0
Turbulence	7	3
Rain	7	4
Sudden windshift	6	0
Snow	5	5
Unfavorable wind	5	0
Drizzle/mist	5	5
Variable wind	4	1
Turbulence, terrain induced	3	1
Obscuration	3	2
Dust devil/whirlwind	3	0
Below approach/landing minimums	2	1
Haze/smoke	2	1
Other	2	1
Turbulence, clear air (CAT)	1	0
Temperature, high	1	0
Temperature, low	1	1
Thermal lift	1	0
Whiteout	1	0
Turbulence (thunderstorms)	1	1
Turbulence, convection induced	1	1
Ice fog	1	1

Note: due to the possibility of multiple findings, the sum of causes/factors is greater than the total number of accidents.

[36] National Transportation Safety Board, *Risk Factors Associated with Weather-Related General Aviation Accidents*, NTSB/SS-05/01 (Washington, DC: 2005).

Focus on General Aviation Safety: Regulatory Changes Associated with the Sport Pilot Certificate and Light Sport Aircraft

This section includes statistical data and a discussion of significant regulatory changes related to the sport pilot certificate and light sport aircraft that went into effect in 2004. This section is not meant to be an exhaustive discussion of all aspects of the regulatory changes, but rather a discussion of the details of an issue important to general aviation.

The approach used in this section of the 2004 *Annual Review* differs from the rest of this review and from most other annual reviews by including data from accidents that occurred after the review year. An accident investigation—particularly when fatalities are involved—may take a year or more to complete. The Safety Board typically produces an annual review of accidents after more than 95% of the investigations during that year are complete, resulting in a difference between the publication year of an annual review and the date of accidents analyzed. The new light sport aircraft and sport pilot certificate rules were selected as the special topic for the 2004 review because the rule was enacted in 2004, and it represents a significant regulatory change affecting general aviation.

New Regulation

In July 2004, the FAA issued the final rule for certification of aircraft and airmen for the operation of light sport aircraft, and the rule went into effect in September that year. The associated changes to 14 CFR Parts 1, 21, 43, 45, 61, 65, and 91 established new maintenance, certification, and operational regulations for a new designation of aircraft—light sport—as well as requirements for sport pilots.

Light Sport Aircraft

The regulatory changes enacted in 2004 grew out of an industry desire to recognize a group of aircraft new to U.S. general aviation.[37] These aircraft are heavier and more capable than traditional ultralights, but far less sophisticated than larger aircraft, and are used primarily for recreation. As defined by 14 CFR 1.1, light sport aircraft are "… aircraft, other than helicopter or powered-lift," that meet the specifications below:

Maximum weight
- 1,320 pounds for operation not intended to take place over water
- 1,430 pounds for operations intended to take place on water

Maximum airspeed in level flight with maximum continuous power
- Not more than 120 knots

Maximum stall speed: 45 knots

Configuration
- Single reciprocating engine
- Fixed or ground-adjustable propeller
- Non-pressurized cabin
- Fixed landing gear

Maximum seating capacity: 2, including pilot

Six Classes
- Airplanes
- Gliders
- Balloons
- Weight shift (new class)
- Powered parachute (new class)
- Gyroplane (experimental light sport only)

[37] Although light sport aircraft (LSA) represent a new concept for domestic aviation, similar "microlight" aircraft have been common in European general aviation for many years, and many of the first LSA models available in the U.S. were imported.

The two types of light sport aircraft airworthiness certificates are special light sport (S-LSA) and experimental light sport (E-LSA). S-LSAs are factory-built aircraft manufactured in accordance with American Society for Testing and Materials (ASTM) consensus standards for light sport aircraft. Applicants for special airworthiness certificates for S-LSAs are required to provide the FAA with a manufacturer's statement of compliance (FAA Form 8130-15) and satisfactory evidence that the aircraft was manufactured to the applicable consensus standards.[38] Since S-LSAs are not built under a type certificate, an FAA inspector or designated airworthiness representative (DAR) must complete a records inspection, documentation review, and airworthiness inspection of each aircraft built. For the same reason, there is no mechanism for issuing supplemental type certificates (STCs) or airworthiness directives (ADs) for S-LSAs. Therefore, the manufacturer must approve all modifications and is responsible for issuing service alerts and bulletins when necessary.

E-LSAs can include a wide range of experimental aircraft, including kit- or amateur-built aircraft that meet the operational definition of an LSA, existing two-seat ultralight trainers brought onto the registry,[39] or manufactured LSAs whose owners wish to modify or otherwise operate in a manner requiring the aircraft to be recertified as an E-LSA rather than an S-LSA.

A significant change associated with light sport aircraft was the introduction of an industry consensus standard in lieu of the traditional FAA aircraft certification requirements.[40] In response to comments on the light sport/sport pilot notice of proposed rulemaking (NPRM),[41] the FAA stated why it made this change: "the consensus standard process will minimize costs while meeting the level of safety appropriate for these aircraft." The FAA accepted the first industry consensus standards for manufactured light sport aircraft in February 2005, a few months after the law passed.

Sport Pilots

The sport pilot airman certificate differs from the private pilot certificate in that it requires a minimum of 20 hours total flight time compared to the 40 hours required by the private pilot certificate, with some additional operating limitations. Sport pilots may only operate light sport aircraft or aircraft that meet the light sport definition.[42] Sport pilots may not carry more than one passenger and may not operate an aircraft at night, above 10,000 feet mean sea level, when flight visibility is less than 3 statute miles, or in class A airspace. Additional training and a logbook endorsement are required for a sport pilot to operate an aircraft in B, C, or D airspace, or to operate from a control-towered airport.

In addition to new training requirements and operating limitations,

[38] See 14 CFR 21.190 and FAA Order 8130.2F, "Airworthiness Certification of Aircraft and Related Products."

[39] Two-place ultralight trainers formerly operated under an exemption in 14 CFR Part 103.

[40] The National Technology Transfer and Advancement Act of 1995 mandated that federal agencies "use technical standards that are developed or adopted by voluntary consensus standards bodies." The guidance for using consensus standards stated, "federal agencies and departments shall consult with voluntary, private sector consensus bodies and shall, when such participation is in the public interest and is compatible with agency and departmental missions, authorities, priorities, and budget resources, participate with such bodies in the development of technical standards." The Office of Management and Budget provided related guidance that, "when properly conducted, standards development can increase productivity and efficiency in Government and industry, expand opportunities for international trade, conserve resources, improve health and safety, and protect the environment."

[41] *Federal Register*, Vol. 69, No. 143 (Tuesday, July 27, 2004), p. 44788.

[42] Examples of previously type-certificated aircraft that meet the light-sport operational definition include models of Piper Cub, Taylorcraft, Aeronca, Luscombe, and Ercoupe.

the sport pilot certificate includes a self-certification medical requirement. Pilots holding a sport pilot certificate or operating under its provisions[43] are not required to hold a medical certificate to act as pilot-in-command, but may instead use a valid, current driver's license and determine for themselves whether they are medically fit to fly.

Accidents

Between September 1, 2004, and October 31, 2007, 19 general aviation accidents involved pilots holding a sport pilot certificate, and 41 general aviation accidents involved S-LSA airplanes piloted by airmen holding certificates of all levels. These accidents are summarized below.

Sport Pilot Accidents

Of the 19 accidents for which the accident pilot held a sport pilot certificate, two resulted in fatalities (a total of three fatalities), five resulted in serious injuries (a total of five serious injuries), two resulted in a minor injury, and the remaining ten accidents resulted in no injuries.

Only two of the accident pilots who held a sport pilot certificate were flying S-LSAs. Another two pilots were flying normally certificated aircraft that met the operational definition of LSA. The remaining pilots were flying amateur-built aircraft that met the operational definition of LSA or existing ultralights registered or re-registered in the experimental light sport category—including one power-parachute and one gyroplane.

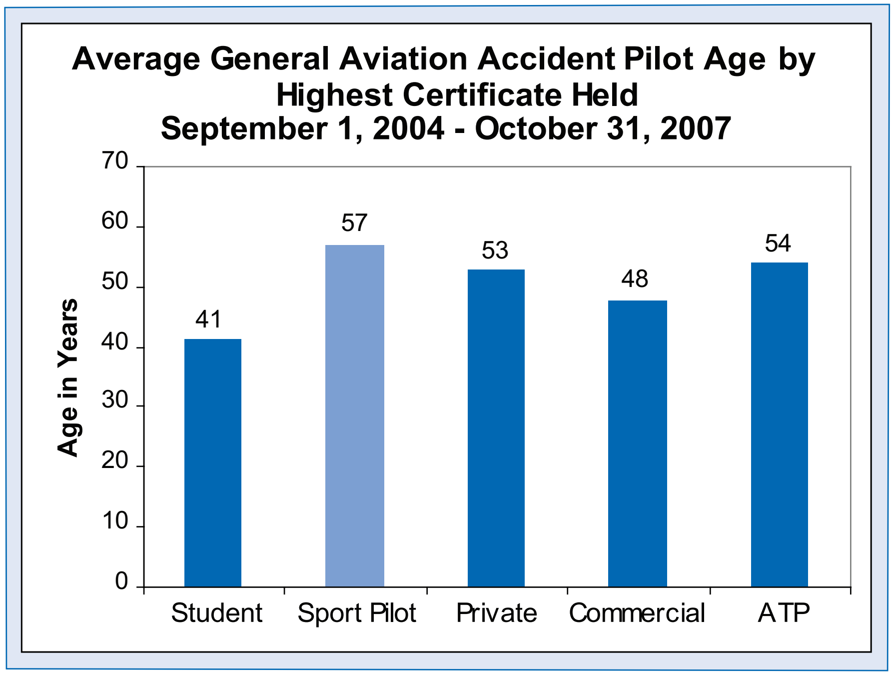
As the following table indicates, the average number of flight hours for accident pilots holding sport pilot certificates was noticeably lower than for those holding private certificates. The average pilot-in-command and total flight times of sport pilots were slightly higher than student pilots and noticeably lower than private pilots. The low number of total hours among sport pilots might have been due in part to the recent introduction of the sport pilot certificate.

Average Flight Time of General Aviation Accident Pilots by Highest Certificate Held
September 1, 2004-October 31, 2007

		Student	Sport Pilot	Private	Commercial	ATP
Last 90 Days	All Aircraft	26	29	26	95	99
	Same make/model	24	31	21	60	48
Pilot in Command	All Aircraft	49	213	857	3,716	9,071
	Same make/model	20	92	293	987	818
Total	All Aircraft	91	255	1,070	4,357	12,092
	Same make/model	54	100	865	1,195	903

[43] Airmen holding a private, commercial, or airline transport pilot certificate may act as pilot-in-command of an aircraft meeting the definition of light sport using the driver's license medical provision, while adhering to the operational limitations of the sport pilot certificate.

As shown below, accident pilots holding sport pilot certificates were older on average than holders of all other types of pilot certificate. The driver's license medical provision may contribute to the popularity of the sport pilot certificate and may encourage persons to apply who are concerned about their ability to meet the medical requirements for another pilot certificate.



Despite the apparent simplicity of using a driver's license in lieu of a medical certificate, sport pilots must also meet the requirements of 14 CFR 61.23(c)(2), which state that the person must:

(i) Comply with each restriction and limitation imposed by that person's U.S. driver's license and any judicial or administrative order applying to the operation of a motor vehicle;

(ii) Have been found eligible for the issuance of at least a third-class airman medical certificate at the time of his or her most recent application (if the person has applied for a medical certificate);

(iii) Not have had his or her most recently issued medical certificate (if the person has held a medical certificate) suspended or revoked or most recent Authorization for a Special Issuance of a Medical Certificate withdrawn; and

(iv) Not know or have reason to know of any medical condition that would make that person unable to operate a light-sport aircraft in a safe manner.

The bottom line is that, even if pilots use driver's licenses in lieu of medical certificates, they are still responsible as pilot-in-command for ensuring that they are fit to conduct a flight safely and that they do not fly if they know of any condition that could affect their ability to fly.

Light Sport Aircraft Accidents

Due to the potentially large variations in aircraft types that may be certificated as E-LSA, the aircraft-specific data presented in this section are limited to S-LSA airplanes. Of the 41 accidents between September 1, 2004, and October 31, 2007, involving S-LSA airplanes, 7 were fatal[44] (11 fatalities); 6 resulted in serious injuries (8 serious injuries); 7 resulted in minor injuries (11 minor injuries); and the remaining 21 resulted in no injuries. The total number of accidents as of October 31, 2007, was small enough that percentages associated with accident subgroups may not yet indicate a trend; however, the ratio of fatal S-LSA accidents to total S-LSA accidents is similar to that of general aviation overall at approximately 17%.

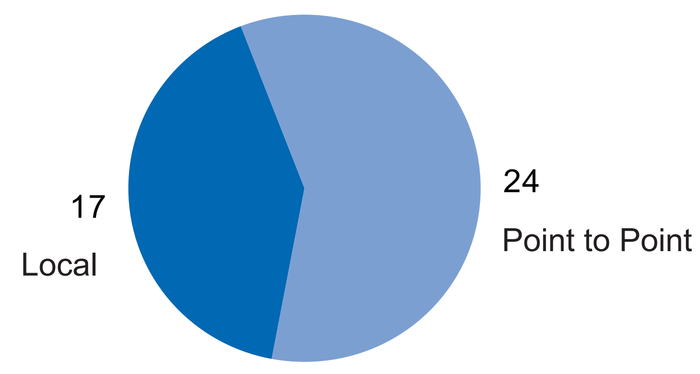
[44] One accident involved an aircraft that, at the time of writing, was missing and presumed to involve fatal injury.

Although the privileges of the sport pilot certificate include some restrictions on where and how flight operations can be conducted, there are no similar restrictions on the operation of light sport aircraft. Rather than being a lower class of aircraft, many light sport aircraft are equipped with advanced avionics, glass cockpit displays, and autopilots. A properly equipped light sport aircraft can be certified for instrument flight and can be flown in any condition or for any purpose allowed by the certification of the pilot-in-command. Of the S-LSA accidents included in this review, all but one occurred during daylight hours and all 41 occurred in VMC. In addition to personal recreation, light sport aircraft can be used to conduct flight training and can be offered for rental.[45] Twelve of the S-LSA accident aircraft were being used for instructional flights at the time of the accident and the remaining 29, for personal/business flights. Seventeen of the S-LSA accident aircraft were being used for local flights.

The sport pilot rule establishes a new type of pilot certificate; however, any holder of a higher level pilot certificate may also use the driver's license medical provision to act as pilot-in-command of an E-LSA, S-LSA, or normally certificated aircraft that meets the operational definition of an LSA, as long as he or she adheres to the operational limitations of the sport pilot certificate. Only two of the accident pilots flying S-LSA aircraft held a sport pilot certificate as their highest level of certification. Three of the accident pilots held student pilot certificates and the remaining pilots held private certificates or greater.

The figure on the next page compares data concerning the average number of flight hours for pilots flying S-LSA and normally certificated single-engine piston aircraft involved in accidents occurring between September 1, 2004, and October 31, 2007. Note that the average number of flight hours for accident pilots flying S-LSA airplanes is relatively high overall and very similar to the single-engine pilots on average. The exception is the time in make/model, which is understandably low because the aircraft type is new. Accordingly, these averages may change in the future but they do indicate that most persons piloting S-LSA airplanes hold a private pilot or greater certificate and had previous flying experience.

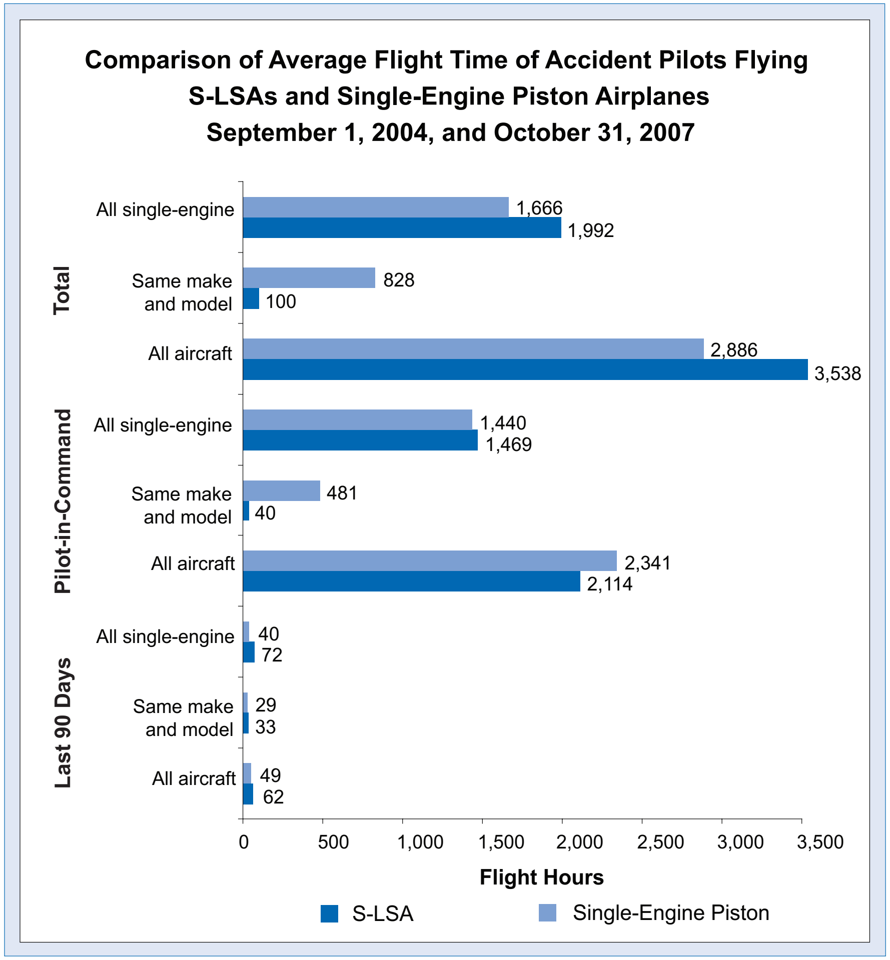
Accidents Involving S-LSA Aircraft on Local and Point-to-Point Flights September 1, 2004 - October 31, 2007

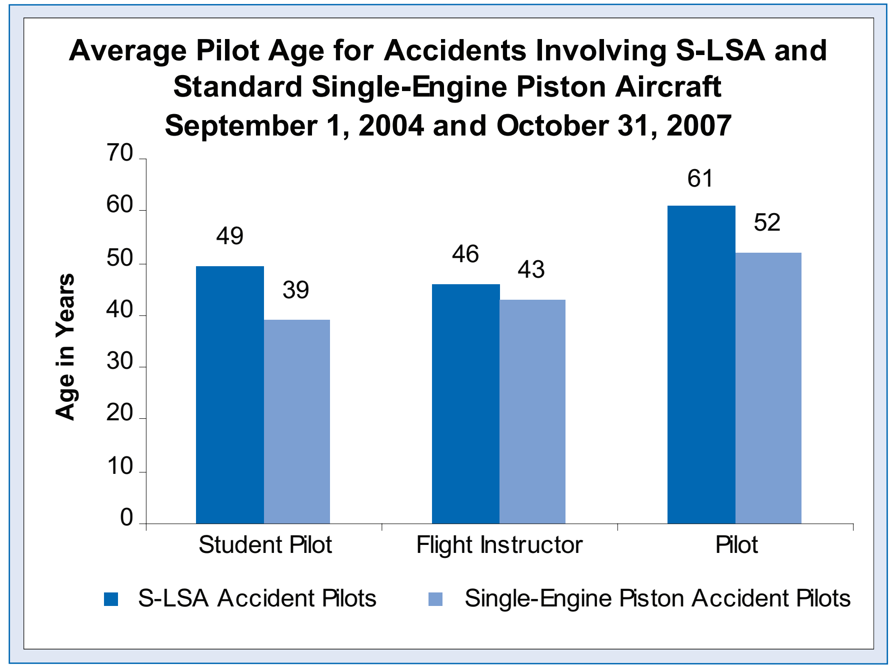


As mentioned previously, sport pilots using driver's licenses in lieu of medical certificates may do so because they are concerned that they may be unable to pass the medical examination required to continue or resume flying. When compared to accident pilots flying single-engine piston aircraft during the same period, pilots and student pilots flying S-LSA airplanes were noticeably older than those flying single-engine piston aircraft.

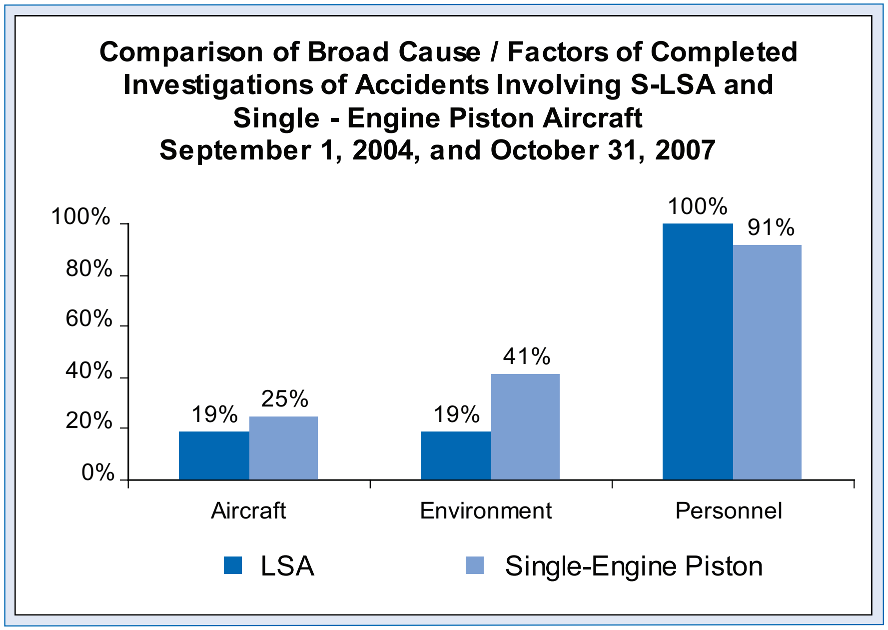
At least 10 of the 41 accident pilots held either no medical certificate or an expired certificate and were using the driver's license provision. As previously mentioned, 14 CFR 61.23(c)(2) states that when using the driver's license provision, pilots-in-command cannot fly if they are taking medication or experiencing a condition that would make them ineligible for a medical certificate.

[45] Experimental light sport aircraft may be used for flight instruction, but may not be rented.





As of publication, probable cause was available for 32 of the 41 accidents involving S-LSA airplanes. The breakdown of broad cause/factor categories cited in S-LSA investigations indicates that personnel were cited in all of the accidents with probable cause released and that light sport aircraft were involved in more loss-of-control and hard landings than type-certificated single-engine piston-powered airplanes. The percentages of cases citing aircraft or environment as cause or factor were lower than for accidents involving other single-engine piston aircraft, but the validity of this finding may be limited by the small number of S-LSA investigations that have been completed.



Summary

The recent addition of the light sport aircraft and sport pilot certificate regulations is a significant change for U.S. general aviation. It appears that the largest effect to date may have been to encourage inactive pilots to resume flying, or to transition pilots to light sport aircraft to take advantage of the driver's license medical provisions of the certificate. This change may affect general aviation for years to come as pilots—and the population in general—continue to age. As more data are collected on sport pilot and light sport aircraft operations, it will be important to follow the use of the medical provision, as well as pilot and aircraft-related data, to identify any effect of the new rule on general aviation safety.

Appendix A: The National Transportation Safety Board Aviation Accident/Incident Database

The National Transportation Safety Board is responsible for maintaining the government's database on civil aviation accidents. The Safety Board's Accident/Incident Database is the official repository of aviation accident data and causal factors. The database was established in 1962 and about 2,000 new event records are added each year.

The Accident/Incident Database is primarily composed of aircraft accidents. An "accident" is defined in 49 CFR 830.2 as "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." The database also contains a select number of aviation "incidents," defined in 49 CFR 830.2 as "occurrences other than accidents that are associated with the operation of an aircraft and that affect or could affect the safety of operations."

Accident investigators use the Safety Board's Accident Data Management System (ADMS) software to enter data into the Accident/Incident Database. Shortly after the event, a preliminary report containing a few data elements such as date, location, aircraft operator, type of aircraft, etc. becomes available. A factual report with additional information concerning the occurrence is available within a few months. A final report, which includes a statement of the probable cause and other contributing factors, may not be completed for months until the investigation is closed.

An accident-based relational database is currently available to the public at http://www.ntsb.gov/ntsb/query.asp#query_start. It contains records of about 40,000 accidents and incidents that occurred between 1982 and the present. Each record may contain more than 650 fields of data concerning the aircraft, event, engines, injuries, sequence of accident events, and other topics. Individual data files are also available for download at ftp://www.ntsb.gov/avdata, including one complete data set for each year beginning with 1982. The data files are in Microsoft Access (.mdb) format and are updated monthly. This download site also provides weekly "change" updates and complete documentation.

Appendix B: Definitions

Definitions of Safety Board Severity Classifications

The severity of a general aviation accident or incident is classified as the combination of the highest level of injury sustained by the personnel involved (that is, fatal, serious, minor, or none) and level of damage to the aircraft involved (that is, destroyed, substantial, minor, or none). Accidents include those events in which any person suffers fatal or serious injury, or in which the aircraft receives substantial damage or is destroyed. An event that results in minor or no injuries *and* minor or no damage is not classified as an accident.

Definitions for Highest Level of Injury

Fatal—Any injury that results in death within 30 days of the accident.

Serious—Any injury that (1) requires the individual to be hospitalized 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% of the body surface.

Minor—Any injury that is neither fatal nor serious.

None—No injury.

Definitions for Level of Aircraft Damage

Destroyed—Damage due to impact, fire, or in-flight failures to the extent that the aircraft cannot be repaired economically.[1]

Substantial Damage—Damage or failure that adversely affects the structural strength, performance, or flight characteristics of the aircraft, and that would normally require major repair or replacement of the affected component. Engine failure or damage limited to an engine if only one engine fails or is damaged, bent fairings or cowling, dented skin, small puncture 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."[2]

Minor Damage—Any damage that neither destroys the aircraft nor causes substantial damage (see definition of substantial damage for details).

None—No damage.

[1] Title 49 CFR 830.2 does not define "destroyed." This term is difficult to define because aircraft are sometimes rebuilt even when it is not economical to do so.

[2] See 49 CFR 830.2.

Appendix C: The National Transportation Safety Board Investigative Process

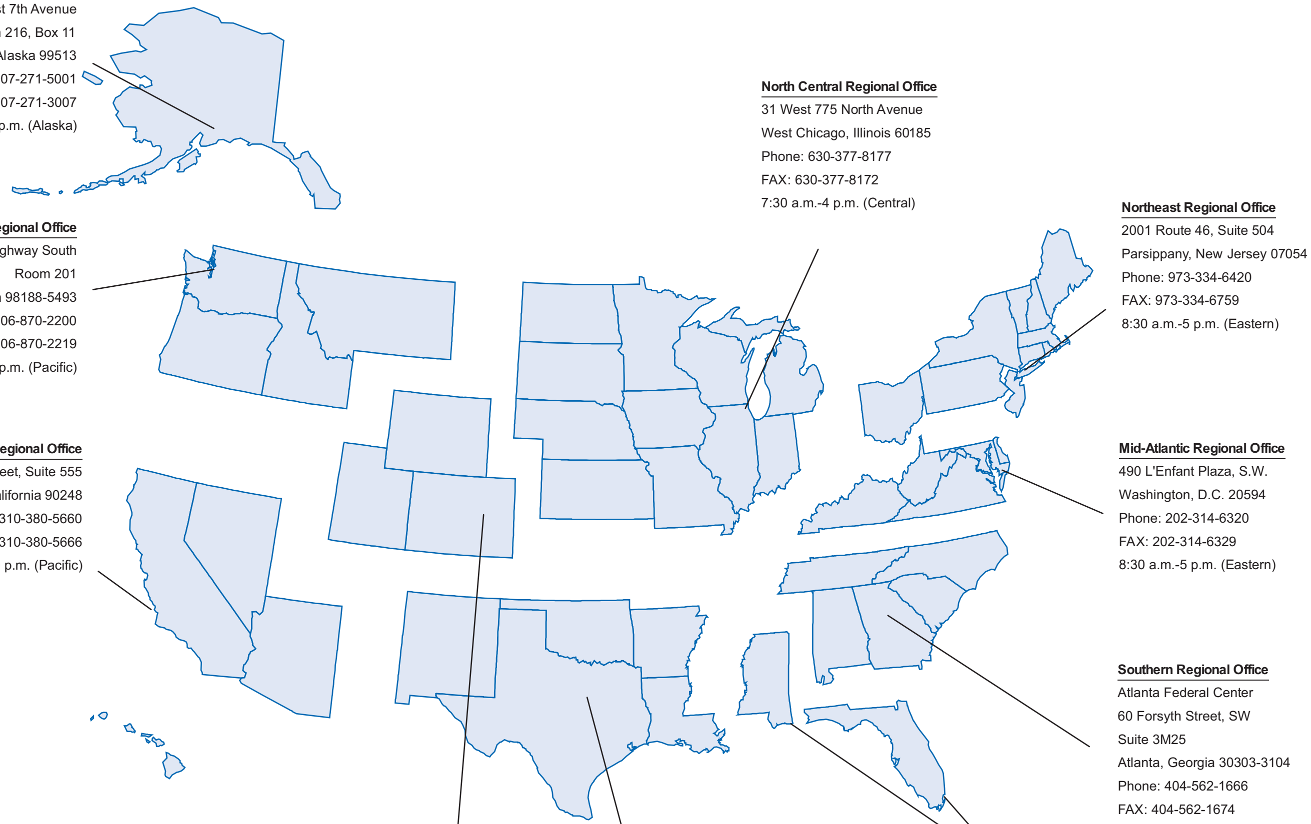
The National Transportation Safety Board investigates every accident that occurs in the United States involving civil aviation and public aircraft flights that do not involve military or intelligence agencies. It also provides investigators to serve as U.S. Accredited Representatives as specified in international treaties for aviation accidents overseas involving U.S.-registered aircraft or involving aircraft or major components of U.S. manufacture.[1] Investigations are conducted from Safety Board Headquarters in Washington, D.C. or from one of the 10 regional offices in the United States (see appendix D).

In determining probable cause(s) of a domestic accident, investigators consider the facts, conditions, and circumstances of the event. The objective is to ascertain those cause and effect relationships in the accident sequence about which something can be done to prevent recurrence of the type of accident under consideration.

Note the distinction between the population of accidents investigated by the Safety Board and those that are included in the *Annual Review of Aircraft Accident Data, U.S. General Aviation*. Although the Safety Board is mandated by Congress to investigate all civil aviation accidents that occur on U.S. soil (including those involving both domestic and foreign operators), the *Annual Review* describes accidents that occurred among U.S.-registered aircraft in all parts of the world.

[1] For more detailed information about the Safety Board's investigation of aviation accidents or incidents, see 49 CFR 831.2.

Appendix D: National Transportation Safety Board Regional Offices[1]



Alaska Regional Office
222 West 7th Avenue
Room 216, Box 11
Anchorage, Alaska 99513
Phone: 907-271-5001
FAX: 907-271-3007
8 a.m.-4:30 p.m. (Alaska)

Northwest Regional Office
19518 Pacific Highway South
Room 201
Seattle, Washington 98188-5493
Phone: 206-870-2200
FAX: 206-870-2219
8 a.m.-4:30 p.m. (Pacific)

Southwest Regional Office
1515 W. 190th Street, Suite 555
Gardena, California 90248
Phone: 310-380-5660
FAX: 310-380-5666
7 a.m.-3:30 p.m. (Pacific)

Central Mountain Regional Office
4760 Oakland Street, Suite 500
Denver, Colorado 80239
Phone: 303-361-0600
FAX: 303-361-0619
7:30 a.m.-4 p.m. (Mountain)

South Central Regional Office
624 Six Flags Drive
Suite 150
Arlington, Texas 76011
Phone: 817-652-7800
FAX: 817-652-7803
7:30 a.m.-4 p.m. (Central)

North Central Regional Office
31 West 775 North Avenue
West Chicago, Illinois 60185
Phone: 630-377-8177
FAX: 630-377-8172
7:30 a.m.-4 p.m. (Central)

Northeast Regional Office
2001 Route 46, Suite 504
Parsippany, New Jersey 07054
Phone: 973-334-6420
FAX: 973-334-6759
8:30 a.m.-5 p.m. (Eastern)

Mid-Atlantic Regional Office
490 L'Enfant Plaza, S.W.
Washington, D.C. 20594
Phone: 202-314-6320
FAX: 202-314-6329
8:30 a.m.-5 p.m. (Eastern)

Southern Regional Office
Atlanta Federal Center
60 Forsyth Street, SW
Suite 3M25
Atlanta, Georgia 30303-3104
Phone: 404-562-1666
FAX: 404-562-1674
8:00 a.m.-4:300 p.m. (Eastern)

Southeast Regional Office
8405 N.W. 53rd Street
Suite B-103
Miami, Florida 33166
Phone: 305-597-4610
FAX: 305-597-4614
8 a.m.-4:30 p.m. (Eastern)

[1] As of fiscal year 2004.