United States General Accounting Office

GAO

Report to Congressional Requesters

August 2001

GENERAL AVIATION

Status of the Industry, Related Infrastructure, and Safety Issues

GAO

Accountability ★ Integrity ★ Reliability

GAO-01-916

Contents

Abbreviations

AGATE	Advance General Aviation Transport Experiments
AIP	Airport Improvement Program
AIR 21	Aviation Investment and Reform Act for the 21st Centery
AOPA	Aircraft Owners and Pilots Association
EAA	Experimental Aircraft Association
FAA	Federal Aviation Administration
GADIT	General Aviation Data Improvement Team
GAMA	General Aviation Manufacturers Association
GARA	General Aviation Revitalization Act
GPS	Global Position System
NASA	National Aeronautical and Space Administration
NASAO	National Association of State Aviation Officials
NATA	National Air Transportation Association
NBAA	National Business Aviation Association
NPIAS	National Plan of Integrated Airport Systems
NTSB	National Transportation Safety Board
PCATD	Personal Computer-based Aviation Training Device
SATS	Small Aircraft Transportation System

G A O
Accountability * Integrity * Reliability

United States General Accounting Office
Washington, D.C. 20548

August 31, 2001

The Honorable John L. Mica
Chairman
The Honorable William O. Lipinski
Ranking Minority Member
Subcommittee on Aviation
Committee on Transportation and Infrastructure
House of Representatives

The Honorable John J. Duncan, Jr.
House of Representatives

In response to your request to conduct a comprehensive overview of the status of general aviation, especially since the passage the General Aviation Revitalization Act (GARA), we addressed three research questions.

- What did key indicators in general aviation activity show in the years leading up to GARA and what have they shown since then?
- What funding is available for general aviation airports and is it sufficient to accommodate planned development?
- What are the trends in general aviation accident rates and the causes of accidents, and how have the Federal Aviation Administration(FAA) and the industry attempted to improve safety?

We are sending copies of this report to interested congressional committees and to the Secretary of Transportation; the Administrator of FAA; and the Director, Office of Management and Budget. We will also make copies available to others on request.

If you or your staffs have any questions about this report or would like to discuss it further, I can be reached at (202) 512-2834. Key contributors to this report are listed in appendix II.

Gerald L. Dillingham

Gerald L. Dillingham

Director, Physical Infrastructure Issues

Executive Summary

Purpose

Over the past decade, the booming growth in scheduled commercial airline traffic has tended to obscure developments in another part of the aviation industry—general aviation. General aviation covers all civil aircraft not flown by commercial airlines or the military. Its tens of thousands of aircraft include corporate jets, medical-evacuation helicopters, and airplanes owned by recreational fliers and hobbyists. Three out of every four takeoffs and landings in the United States belong to general aviation flights.

In 1994, concerned that general aviation was in decline, the Congress passed the General Aviation Revitalization Act (GARA), which sought to boost the industry by placing limitations on product liability lawsuits against aircraft manufacturers. The Chairman and Ranking Minority Member of the Subcommittee on Aviation, House Committee on Transportation and Infrastructure, asked GAO to provide a comprehensive overview of general aviation, especially since the passage of GARA. To attain this objective, GAO focused its review on three questions: (1) What did key indicators of general aviation activity show in the years leading up to GARA and what have they shown since then? (2) What funding is available for general aviation airports and is it sufficient to accommodate planned development? and (3) What are the trends in general aviation accident rates and in the causes of accidents, and how have the Federal Aviation Administration (FAA) and the industry attempted to improve safety?

Background

The Federal Aviation Administration divides general aviation activities into use categories. The largest of these categories is personal flying, which is defined as flying for pleasure or personal transportation and not for business purposes. In 1998, personal flying accounted for 36 percent of all general aviation hours flown, nearly three times more than the next largest segment—business flying, which refers to activities carried out in connection with the pilot's occupation or private business. The other major use categories include corporate flying, which involves the use of an aircraft owned by a corporation or business and flown by a professional pilot; instructional flying; and aerial application, which includes activities such as agricultural spraying.

The general aviation fleet consists of about 219,000 active aircraft with an average age of about 27 years. Certain activities are generally associated with certain types of aircraft. For example, corporate flying usually involves the use of business jets while personal and instructional flying usually involve the use of single-engine propeller aircraft. The largest category of aircraft is single-engine propeller, which in 1998 made up 70 percent of the general aviation fleet.

Although general aviation aircraft can take off and land at almost any airport—including many of the nation's 538 commercial service airports—an extensive system of airports is designated for general aviation operations. About 2,500 of the public-use general aviation airports within this system are included in FAA's National Plan of Integrated Airport Systems, which identifies airports that are significant to national air transportation and to which FAA allocates funding for infrastructure development.

In 1994, the Congress passed the General Aviation Revitalization Act in an attempt to revitalize the general aviation industry by limiting liability costs. The law established an 18-year limit for product liability lawsuits against the manufacturers of airframes, engines, and components for aircraft with 20 or fewer seats. Previously, there had been no time limit on manufacturers' liability.

FAA is responsible for overseeing the safety of general aviation. To do this, it determines the requirements for pilot certification and develops regulations and recommendations designed to improve safety. FAA's pilot certification process establishes increasingly stringent piloting and medical requirements for five levels of certification: student, recreational, private, commercial, and air transport. The level of certification determines the type of aircraft a pilot can fly and the types of responsibilities the pilot can undertake. The first four levels of certification allow a pilot to fly for an increasingly wide range of general aviation activities. An air transport license allows a pilot to fly for scheduled commercial airlines.

To consider trends in general aviation, GAO reviewed FAA's forecasts of the general aviation industry through 2007 and analyzed FAA's and industry's data on key indicators of general aviation manufacturing and flying activity. To look at funding for airport infrastructure, GAO analyzed FAA's data on airport development projects and their costs, reviewed available funding sources, and compared expected funding to planned development. To describe the safety record of general aviation, GAO analyzed accident data from the National Transportation Safety Board (NTSB) and FAA, and it reviewed studies and reports on the causes of general aviation accidents. Finally, GAO assembled a group of six aviation experts and asked them and additional experts about the general aviation industry, its airport infrastructure needs, and its safety.

Results in Brief

Trends show that there was a decline in most general aviation indicators prior to the 1994 enactment of GARA and that this decline reversed in the years after GARA—sharply in manufacturing indicators and to a lesser extent in flying activity indicators. Prior to GARA, aircraft production, pilot activity, and hours flown all fell sharply. For example, manufacturers' aircraft shipments fell from 18,000 in 1978 to a low of 928 in 1994. The downturn was attributed in part to high costs associated with liability issues, but also to downturns in the economy and lifestyle changes that reduced public interest in flying. According to experts, trends in general aviation since GARA was enacted suggest that the law has reduced manufacturers' liability concerns, leading to a rebound in the manufacturing industry. For example, shipments of new aircraft tripled between 1994 and 2000, from 928 to 2,816. However, aircraft prices did not fall in the years after GARA. For example, the average price of a new piston aircraft increased from $162,000 in 1994 to $220,000 in 1999, an increase of 25 percent in constant dollars. General aviation flying activity indicators such as hours flown and number of pilot licenses also rose after the enactment of GARA, although at a slower rate. In addition to GARA, experts attributed the growth in manufacturing indicators and less-strong growth in other indicators to a number of factors with mixed implications, including the popularity of a new type of aircraft ownership called fractional ownership, the strong economy, the continued high price of aircraft, and the same lifestyle changes that contributed to the pre-GARA slump.

The amount of federal funding available for capital development at general aviation airports has consistently been below what has been requested by the airport officials to fund their airports' planned projects. In 2000, for example, the amount of federal funding available was almost $900 million short of what was requested to fund airports' eligible planned projects. In order to best allocate scarce resources, FAA uses a priority system to fund projects that it considers to be most important. The fiscal year 2001 Department of Transportation appropriations increases funding for general aviation airports in general and for particular types of projects, but funding will still be short of what airport officials requested to fund eligible planned projects. One industry association recommended that more airports build longer runways to accommodate business aircraft, and a different expert suggested that general aviation airports focus on developing facilities to accommodate technologically advanced aircraft. However, general aviation experts have differing opinions about the adequacy of facilities at general aviation airports. Several general aviation experts with whom GAO spoke regarding general aviation airports mentioned that they were concerned with community pressure to close airports.

The safety of general aviation has been improving. The total number of accidents declined from 3,233 in 1982 to 1,989 in 1998—a decrease of 41 percent—while the accident rate fell from about 10 to about 7 accidents for every 100,000 flight hours. Even with these improvements, general aviation's accident rate remains about 24 times higher than the accident rate of scheduled commercial aviation. Within general aviation, some types of flying are safer than others. The safety record of corporate flying, for example, rivals that of commercial passenger airlines. Other types of flying, such as personal and aerial application, have considerably higher accident rates. More than two-thirds of general aviation's accidents, both fatal and nonfatal, are caused by pilot error, including mistakes related to procedure, skill, and judgment. Besides determining the requirements for pilot certification, FAA oversees the safety of general aviation by working with federal agencies and industry groups to identify safety improvements. FAA must decide whether to implement recommended improvements through voluntary programs, official guidance, or regulations. Most initiatives and recommendations seek to enhance safety through improvements in one of three areas: training, technology, and the procedures that are designed to govern operations such as takeoffs, landings, and flight patterns.

Principal Findings

General Aviation Activity Has Increased Since the Mid-1990s; Experts Cite GARA, Economy, and Other Factors

In the years prior to GARA, indicators of general aviation manufacturing and other activities all declined. Along with a steep decline in manufacturers' shipments of aircraft, the number of employees working in the industry fell 65 percent between 1978 and 1988. The size of the active general aviation fleet dropped by one-quarter between 1980 and 1994, from about 200,000 aircraft to about 150,000. The number of pilot licenses and the number of hours flown in general aviation also declined steadily between 1980 and 1994. For example, the number of student pilot licenses decreased more than one third, from 150,000 in 1980 to 96,000 in 1994. While GAO's group of general aviation experts said that product liability costs played a large role in the decline of the industry, they cited other factors as well, including the economic recessions of the early 1980s and early 1990s and the high cost of aircraft ownership and operation. The experts also noted that lifestyle changes seem to have led to reduced interest in general aviation flying.

Since GARA was enacted, the number of product liability cases has dropped off significantly, and manufacturing has rebounded, with shipments of piston aircraft, for example, increasing nearly fourfold between 1994 and 2000. At the same time, the price of aircraft continued to rise. Indicators of flying activity have also increased, but at a slower rate than manufacturing. The number of aircraft in the general aviation fleet has steadily increased since the enactment of GARA. The total number of hours flown in general aviation increased 32 percent, to almost 32 million, between 1994 and 1999, the most recent year for which data are available. The number of active pilots in the three pilot license categories that cover only general aviation (student, private, and commercial, as opposed to the air transport license, which covers scheduled commercial flying as well) continued to decline for several years following the enactment of GARA, falling 10 percent between 1994 and 1998. In 1999 and 2000, however, the numbers of pilots with each type of pilot certificate increased.

While GAO's experts rated GARA as the most significant contributor to the recent rise in general aviation manufacturing indicators, it also cited other factors. The factors experts rated as most important after GARA were the development of fractional ownership plans for business aircraft and the growth of the national economy. In fractional ownership, individuals or companies purchase a share in an aircraft for their occasional use. Fractional ownership has grown steadily since its introduction in the mid-1980s. When asked to consider why other general aviation activity indicators did not show as great a surge as manufacturing, one expert cited the continuing high cost of aircraft, and another mentioned that lifestyle changes have led to less overall interest in general aviation flying.

FAA's most recent forecast for general aviation predicts continued growth in all areas. FAA expects the general aviation aircraft fleet to increase at an average annual rate of 0.9 percent during the 13-year forecast period. The forecast indicates that the number of hours flown will increase 2.1 percent annually, with the growth concentrated in the turbojet segment. It also predicts that the pilot population will continue to increase at an annual rate of 2 percent. This forecast attributes the projected increase to U.S.

economic growth as well as to industrywide programs designed to recruit new pilots to general aviation.

Federal Funding for Capital Development at General Aviation Airports Falls Short of Eligible Requests, but Importance of Funding Gap Is Unclear

There is not enough money available through general aviation airports' combined funding sources—including federal and state grants and bond proceeds—to fund all planned projects. General aviation experts, however, had differing opinions about the adequacy of current facilities and future development needs at these airports. Recognizing that not all projects will receive funding, FAA's funding system gives priority to projects, such as repairing runways and removing obstructions from landing areas, that FAA views as most important to general aviation's safety and efficiency.

FAA's 5-year authorization and fiscal year 2001 appropriation will increase the level of federal assistance for capital development projects at general aviation airports, although it will still not cover all requested projects that are eligible for funding. The fiscal year 2001 Department of Transportation appropriations act appropriates significantly greater funding to airport projects in general, and the provisions of the Aviation Investment and Reform Act for the 21st Century (AIR 21), passed by the Congress in April 2000, provide more of these moneys specifically to general aviation airport projects. Several of these changes affect the Airport Improvement Program (AIP), including an increase in the authorized level of AIP funding; automatic funding to all airports with project requests if appropriations reach a certain level; and an increase in funding available through funds collected by large commercial airports from passenger facility charges, a portion of which is turned back to FAA and redistributed to general aviation airports.

Safety Record of General Aviation Improving; FAA Works With Others to Improve Training, Technology, and Procedures

Between 1982 and 1998, the number of accidents and the accident rate for general aviation declined. Nonetheless, in 1998, the accident rate for general aviation was about 24 times higher than that of commercial aviation, accounting for 99 percent of the accidents and 85 percent of the deaths.

Some types of general aviation flying are riskier than others. Personal flying comprised only about one-third of total general aviation hours flown in 1998 but accounted for more than three-quarters of fatal accidents. Corporate flying comprised about 10 percent of total general aviation hours but accounted for only 1 percent of fatal accidents. Because accident rates vary so significantly by segment, the safety trend for general aviation may be affected by differences in the growth rate of different segments. Growth is projected to occur much faster in turbine aircraft, used almost exclusively for corporate flying, than in single-engine piston aircraft, used mostly for personal and recreational flying. If this projection is correct, the safety record of general aviation may improve because of the lower accident rates associated with corporate flying. The general aviation experts with whom GAO spoke attributed the disparity in accident rates to a number of different factors, including differences in the level of expertise of pilots and the safety equipment typically used. Furthermore, commercial aviation is subject to more oversight and regulation than general aviation, which is valued by pilots for its freedom from such constraints.

While a broad range of factors contribute to general aviation accidents, the majority of them are associated with pilot error. According to our analysis of NTSB's accident data, 80 percent of the fatal accidents and 72 percent of the nonfatal accidents that occurred between 1994 and 1998 involved pilot error. Previous studies have found that between 60 and 80 percent of general aviation accidents are associated with pilot error. Mechanical failures were involved in 13 percent of the fatal accidents and 25 percent of the nonfatal accidents. The remaining accidents were due to other factors such as misdirections from air traffic control.

FAA works to improve the safety of general aviation in a variety of initiatives with other federal agencies and industry organizations. One broad initiative, Safer Skies, was developed with industry organizations to improve the safety record of commercial and general aviation. Experts involved in the initiative are jointly analyzing U.S. and global data to identify the most serious threats to aviation safety and to find the root causes of accidents. The experts are then developing recommendations on changes in training, technology, or procedures that would prevent or reduce these accidents. In a previous report, GAO noted that FAA's goal of reducing general aviation accidents by 20 percent in 2007 may not challenge the general aviation community enough to continue the kinds of safety improvements that have led to previous reductions in accidents.

FAA and Safer Skies focus some of their research efforts on seeking ways to improve training. For example, in March 2000, the weather joint safety implementation team of Safer Skies released implementation plans for reducing weather-related accidents in general aviation through changes in the training curriculum for both initial and ongoing training. A similar Safer Skies training effort will target accidents caused by controlled flight into terrain, which occurs when a pilot flies an airworthy aircraft into terrain or another obstacle without being aware of the impending collision.

FAA also works with other groups to research and develop technology that will improve aircraft safety. For example, in 1994, the National Aeronautical and Space Administration (NASA) created the Advanced General Aviation Transport Experiments (AGATE), a consortium of industry, higher-education, and government entities, including NASA and FAA, that focuses on developing advanced technologies for general aviation, including technologies that will reduce accidents. Finally, FAA and other groups, including Safer Skies, work to increase the safety of general aviation through improving the procedures that govern flight patterns, including landings and takeoffs. Safer Skies has developed recommendations in this area, including standardizing and expanding the use of markings for towers and wires and developing new procedures for airspace communications, navigation, and surveillance (CNS).[1]

Recommendations for Executive Action

This report does not contain recommendations.

[1] *Aviation Safety: Safer Skies Initiative Has Taken Initial Steps to Reduce Accident Rates by 2007* (GAO/RCED-00-111, June 28, 2000).

Introduction

Most consideration in the nation's rapidly growing aviation industry focuses on commercial passenger and cargo airlines. Attention to general aviation, which includes most aviation operations other than commercial and military, is often the result of an accident that involves a well-known figure, such as the 1999 crash of John F. Kennedy, Jr.'s, airplane.

In fact, general aviation is an important component of the nation's air transportation system and economy, accounting for 96 percent of all civilian aircraft and three out of every four takeoffs and landings. General aviation airports provide a vast network of landing areas across the country. And while most general aviation pilots fly only for personal use, others use their general aviation training as a base for moving into other parts of civilian aviation such as piloting for commercial passenger and cargo airlines.

General Aviation Activities Are Diverse and Provide Important Benefits

General aviation encompasses a wide variety of operations, including the training of new pilots, crop dusting, and providing air tours for sightseers and transportation for business executives. In addition, general aviation provides rapid transportation for medical and other civil emergencies.[1]

The Federal Aviation Administration (FAA) divides general aviation activities into use categories. About 85 percent of general aviation flying falls into one of five categories, as described in table 1. The largest of these categories is personal flying, which is defined as flying for pleasure or personal transportation and not for business purposes. In 1999, personal flying accounted for 36 percent of all general aviation hours flown, nearly twice as much as the next largest segment—instructional flying. The remaining categories include many diverse activities, such as medical

[1]These activities are regulated under one of several FAA regulations: operations that involve transportation for hire, such as air tours and medical evacuation, are regulated under Part 135, which has higher standards of safety; operations such as personal and business flying are regulated under Part 91, which does not have as stringent safety requirements. Other parts govern specific operations, such as Part 137, which regulates agricultural aircraft operations, and Part 133, which regulates rotorcraft external load operations. From a strictly regulatory standpoint, only Part 91 operations are considered general aviation, but FAA and others generally include other operations in this category for descriptive purposes and trend monitoring because they are more similar to general aviation than commercial aviation. General aviation aircraft include all U.S. registered civil aircraft not operated under 14 C.F.R. Part 121 (scheduled commercial airlines) or Part 135. General aviation also includes on-demand air carriers that operate nonscheduled commercial service under 14 C.F.R. Part 135.

services, aerial advertising, aerial mapping and photography, and aerial application of seeds or chemicals.

Table 1: Table 1: Use Categories of General Aviation

Use	Percentage of aviation hours flown	Description
Personal	35.6	Use of aircraft for pleasure or personal transportation and not for business purposes. 
Instructional	18.6	Flying under the supervision of a flight instructor. 
Corporate	11.4	Use of aircraft owned or leased by a corporation or business and flown by a professional pilot. 

Use	Percentage of aviation hours flown	Description	
Business	11.3	Use of aircraft in connection with the pilot's occupation or private business.	
Air taxi; air tours	7.6	Carrying passengers or cargo for hire using small aircraft; commercial sightseeing.	
Other uses	15.5	Examples include: Aerial observation, including activities such as aerial mapping and photography, search and rescue, highway traffic reporting; Aerial application, including activities such as distributing seeds for reforestation, or chemicals for fire fighting operations or pest control; Public use: Federal, state, or local government owned or leased aircraft used for the purpose of fulfilling a government function.	

Note: Air taxis and some air tours are regulated under Part 135 rather than Part 91, Federal Aviation Regulations. However, these operations have been described as general aviation, which is regulated under Part 91.

Source: FAA; 1999 data and the General Aviation Manufacturers Association.

General aviation benefits both the users of transportation services and the economy at large. For example, it increases the efficiency and productivity of businesses by reducing the travel time that would be required to drive or use more congested commercial airports; provides public health services, such as transporting patients and medical equipment; provides public safety services, such as monitoring floods or fires; alleviates congestion at commercial airports and provides an important transportation link to small communities not served by commercial air carriers; and provides training for new pilots.

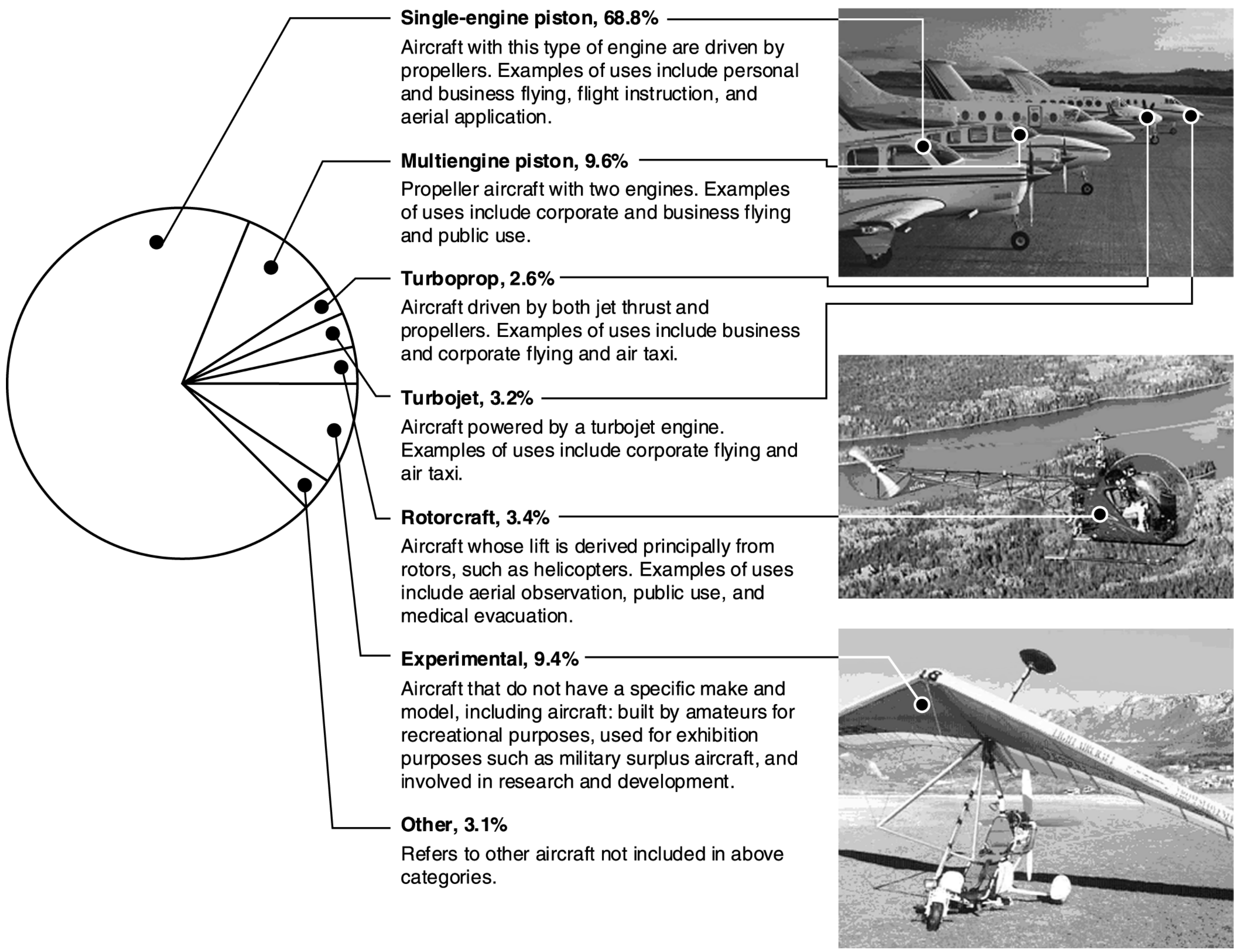
General aviation's economic benefits are difficult to measure quantitatively, and studies on this topic have had limitations that have reduced the certainty of the studies' findings. Nevertheless, according to a series of nationwide studies done for FAA on the effects of general aviation on economic activity, jobs, and earnings, general aviation's contribution to the national economy has grown in the past decade. A report issued for FAA in 2000 estimated that in 1998, general aviation generated about $64.5 billion in total economic activity at the national level, an increase of $26.5 billion from the 1988 level of $38 billion.[2] In 1998, general aviation accounted for about 0.7 percent of the gross domestic product and 7 percent of the total contribution of civil aviation. State studies show that general aviation's economic impact on the states' economies is generally less than 1 percent. However, according to these estimates, general aviation makes important contributions to the states in terms of economic output, jobs, and earnings that are generated. Appendix I provides more detailed information on the transportation and economic benefits of general aviation as well as on the limitations of the studies on this issue.

[2] *The Economic Impact of Civil Aviation on the U.S. Economy—2000*, prepared for FAA and MCA Research Corporation by Wilbur Smith Associates with Applied Management Solutions, Inc. (Mar. 2000); and *The Economic Impact of Civil Aviation on the U.S. Economy*, Wilbur Smith Associates (June 1989).

General Aviation Industry Includes a Variety of Aircraft and Airports and Presents Special Safety Issues

All types of aircraft can be used in general aviation operations, including single- and multiengine piston aircraft, turboprops and turbojets, rotorcraft such as helicopters, and gliders. The general aviation fleet consists of about 219,000 active aircraft. While this fleet of general aviation aircraft is diverse, certain activities are generally associated with certain types of aircraft. For example, corporate flying generally involves the use of turboprop and turbojet aircraft; personal and instructional flying generally involve the use of small propeller aircraft. The largest category of aircraft is single-engine propeller, which in 1999 made up 69 percent of the general aviation fleet. Additional types of general aviation aircraft and their uses are described in figure 1.

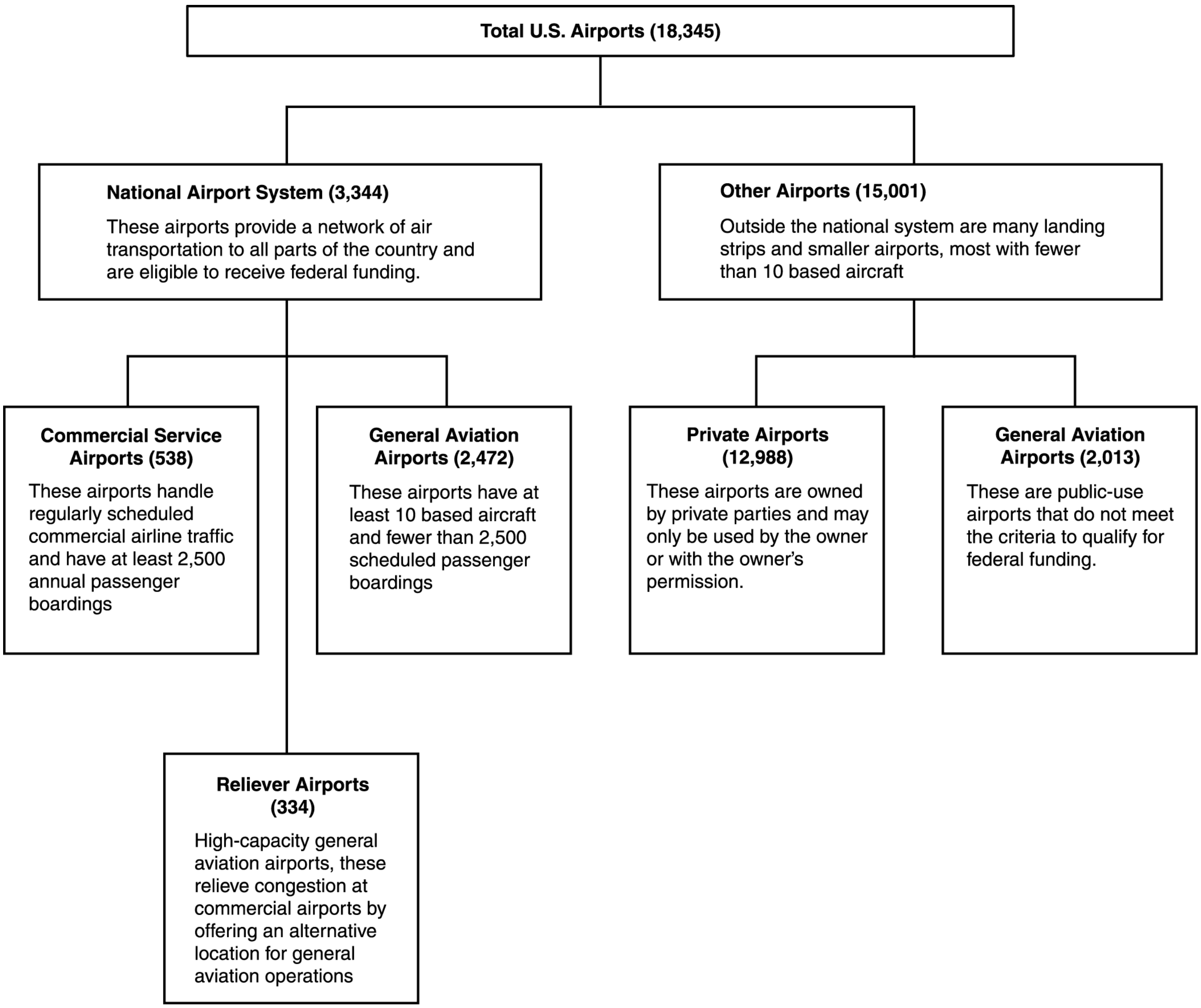
Figure 1: Composition of General Aviation Fleet, 1999



Source: FAA and the General Aviation Manufacturers Association.

Although general aviation aircraft can take off and land at almost any airport, including most of the nation's 538 commercial service airports, there is an extensive system of general aviation airports. Figure 2 illustrates the categories of airports in the United States. There are approximately 13,000 private-use general aviation airports and 4,800 public-use general aviation airports in the United States. About 2,500 general aviation airports are included in FAA's National Plan of Integrated Airport Systems (NPIAS), which identifies airports that are significant to national air transportation and to which FAA allocates funding for capital development. Reliever airports are a special category of general aviation airports in the NPIAS. Usually located near commercial airports, reliever airports are intended to help relieve congestion at commercial airports by diverting general aviation traffic away from commercial airports. FAA has designated 334 general aviation airports as reliever airports.

Figure 2: Categories of Airports in the United States



Source: GAO's analysis of FAA's data.

The safety record of general aviation is sometimes brought to light when high-profile accidents occur. General aviation accidents, like commercial aviation accidents, can result from pilot error, mechanical failure, or other causes. Although the number of accidents in general aviation has decreased markedly during the past few years, its accident rate remains much higher than that of commercial aviation. Commercial aviation, because it involves the flying public, is subject to greater oversight and regulation than general aviation. While FAA's primary effort to reduce general aviation accidents is to ensure that all regulations and requirements are met, FAA has also emphasized voluntary training and technology to reduce the accident rate of general aviation.

General Aviation Manufacturing, Burdened by Liability Costs, Declined in the 1980s

In the late 1960s and early 1970s, aviation manufacturers became more frequent targets of product liability lawsuits that were brought by survivors of airplane crashes or families of victims of airplane crashes. This surge in the number of lawsuits came on the tail of a 1963 California Supreme Court ruling that adopted a rule of "strict liability," which maintained that companies may be held liable for a product found to be defective or dangerous without proof of negligence. Other courts across the nation soon followed suit, shifting a greater liability burden toward manufacturers.

As a result of the large number of lawsuits brought against aviation manufacturers, insurers increased the premiums they charged for product liability insurance. Manufacturers, some of whom were self-insured, also incurred costs from defending an increasing number of lawsuits. The escalating costs associated with product liability were reflected in rising aircraft prices, and by the 1980s, new aircraft sales plummeted as more and more prospective buyers chose to purchase used airplanes or to build their own airplanes from kits. The manufacturing industry began to suffer; between 1978 and 1988, production fell 94 percent, and the number of employees working in the industry fell 65 percent. By the end of 1986, two manufacturers, Beech and Cessna, had shut down most of their production lines for single-engine piston aircraft; and Piper, another manufacturer, had sought Chapter 11 bankruptcy protection.

The Federal Government Plays a Role in Funding and Overseeing General Aviation

The federal government manages the national airspace system, including general aviation, with the goal of ensuring the adequate and safe operation of the system. The federal role includes allocating funds for airport improvements, controlling air traffic, issuing training rules for aviation personnel, and certifying the airworthiness of aircraft and other aviation equipment. A number of offices are responsible for related areas of the industry. These include the Office of Airport Planning and Programming, which provides funding for airport construction and improvements; the

Aircraft Certification Service, which ensures that the types of aircraft in use are safe and airworthy; and the General Aviation and Commercial Division of the Flight Standards Service, which develops policies for the certification of pilots and instructors.

FAA supports the nation's airport infrastructure by providing funds for airport development and maintenance through the Airport Improvement Program (AIP). Funds for this program, some of which are collected from taxes on airport users, are authorized and appropriated by the Congress and distributed among qualifying airports by FAA. The federal government provides more funding to general aviation airports than any other single source.

FAA is responsible for overseeing the safety of general aviation. To do this, FAA determines the requirements for pilot certification and develops regulations and recommendations for pilot activities and training as well as for the use of technologies and the procedures that govern the use of airspace and airports. FAA's pilot certification process establishes increasingly stringent piloting and medical requirements for certificates allowing pilots to fly in more advanced circumstances. In addition to certifications, pilots may also receive ratings, which allow them to perform additional activities or to fly certain types of aircraft. For example, pilots may receive ratings for activities such as instrument flying or for flying particular types of aircraft such as seaplanes or multiengine planes. To help ensure pilot proficiency, FAA also has requirements for recent flight experience, including requiring pilots to perform three takeoffs and landings within a 90-day period if they intend to carry passengers (or three night-time takeoffs and landings if they intend to carry passengers at night), requiring a flight review every 2 years, and requiring instrument-rated pilots to fly in instrument conditions for 6 hours within every 6-month period in order to maintain their instrument rating.

Table 2 summarizes FAA's requirements for the different certificates, along with the activities each certificate permits a pilot to perform.

Table 2: FAA's Requirements for Pilot Certification

Certificate	Piloting requirements	Medical requirements	Types of activities pilots can or cannot perform
Student	None	Third class medical certificate; must be renewed every 3 years.	Pilot may not carry passengers or operate without visual reference to the ground; pilot may operate solo cross-country flights only if deemed prepared by the flight instructor.
Private	Pilot must pass flight test and written knowledge test and have logged at least 40 hours of flight instruction and solo flight time.	Third class medical certificate; must be renewed every 2 years.	Pilot may not carry passengers for hire.
Commercial	Pilot must pass flight test and written knowledge test, hold a private pilot certificate, be instrument-rated, and have logged at least 250 flight hours.	Second class medical certificate; must be renewed every year.	Pilot can engage in flight activities for hire, including acting as second in command for commercial airlines. Pilot is eligible to obtain a flight instructor certificate.
Airline transport	Pilot must pass flight test and written knowledge test, hold a commercial certificate, and have logged at least 1,500 flight hours.	First class medical certificate, must be renewed every 6 months.	Pilot can fly as pilot in command for scheduled commercial cargo or passenger airlines and is eligible to obtain a flight instructor certificate.

Note: Student pilot certificates are issued for a 2-year period. Other certificates are issued without a specific expiration date, but pilots must have current medical certificates and comply with recency of flight requirements where applicable. First class medical certificates have the most stringent requirements, and third class certificates have the least stringent.

Source: 14 C.F.R Part 61.

In addition to establishing certification requirements, FAA also oversees flight schools that operate under Part 141 of the Federal Aviation Regulations. These schools are certified and monitored by FAA: Students are tested on a periodic basis and taught a curriculum that is approved by FAA. Other flight schools operate under Part 61 and do not have as high a degree of FAA oversight. Students at Part 61 schools are not required to be tested periodically throughout their training and may receive all of their training from one instructor rather than from multiple instructors. At Part 61 schools, students are not required to be taught according to an FAA-approved curriculum unless they are using a Personal Computer-based Aviation Training Device (PCATD). However, many large Part 61 schools use a commercially developed curriculum that is based on FAA-approved curricula. Part 141 students may be examined for their pilot's certificate after 35 hours of flight time, and Part 61 students may be examined after 40 hours of flight time. Finally, FAA requires all general aviation pilots to undergo a biennial flight review, in which the pilot's skills are assessed.

In 1994, the federal government became involved in two projects aimed at revitalizing the industry. First, the Congress enacted the General Aviation Revitalization Act (GARA), which established an 18-year statute of repose for lawsuits against manufacturers of general aviation aircraft, parts, and components. Under this provision, no civil actions can be brought against a manufacturer for damages for death or injury arising out of an accident more than 18 years after the aircraft, part, or component is delivered to a purchaser. Second, FAA and the National Aeronautical and Space Administration (NASA), which plays a role in developing technology related to general aviation, joined in the Advanced General Aviation Transport Experiments (AGATE) initiative. AGATE, a consortium of industry, higher education, and government entities, was developed in response to the fact that new aircraft being manufactured were not taking full advantage of the most advanced technologies available. AGATE was intended to help revitalize the general aviation industry by advancing the use of new technology in aircraft and developing new training methods for pilots.

Recently, NASA initiated the Small Aircraft Transportation System (SATS) Program, a 5-year, $69 million program scheduled to run from fiscal year 2001 through fiscal year 2005. SATS is designed to demonstrate the viability of new technologies for enabling small aircraft to affordably reduce many of the expected problems in the nation's transportation system, such as increasing congestion on highways and at the major airports serving commercial passenger airlines.[3] For example, SATS envisions the development and use of easy-to-operate all-weather aircraft that can fly into the more than 5,000 existing public use general aviation airports with minor modification to airports' landing and navigational facilities. NASA officials claim that a successful SATS program will be able to double the number of communities with air transportation, alleviate the gap between transportation demand and supply, and create new economic growth for communities throughout the nation.

Objectives, Scope, and Methodology

The Chairman and Ranking Minority Member of the Subcommittee on Aviation, House Committee on Transportation and Infrastructure, asked us to provide a comprehensive overview of general aviation, especially since

[3]Many of these new aircraft technologies have been developed in NASA's AGATE, which preceded SATS.

the passage of GARA. Specifically, we addressed three main questions in our review:

- What did key indicators in general aviation activity show in the years leading up to GARA and what have they shown since then?
- What funding is available for general aviation airports and is it sufficient to accommodate planned development?
- What are the trends in general aviation accident rates and in the causes of accidents, and how have FAA and the industry attempted to improve safety?

In collecting and analyzing data on flying activity, manufacturing, infrastructure, and safety, we focused on fixed-wing aircraft, as they represent the largest portion of general aviation aircraft. To respond to the first question, we reviewed FAA's forecasts of the general aviation industry through 2007; analyzed data from the industry and FAA on trends in general aviation aircraft manufacturing, the supply of pilots, and the hours flown from 1979 through 1999; and interviewed FAA and industry officials about expected developments in the industry. In addition, we sought the opinions of six aviation experts: two from academia who had written extensively on general aviation issues as identified through a computerized bibliographic search of relevant publications; three industry association officials from the Aircraft Pilots and Owners Association (AOPA), the General Aviation and Manufacturers Association (GAMA), and the National Association of State Aviation Officials (NASAO); and an FAA official. These experts responded to our questions about the general aviation industry.

To answer the second question, we analyzed FAA data from fiscal year 2000 to identify planned airport development projects and their costs, reviewed available funding sources, and compared expected funding to planned development. We identified relevant recent funding legislation and FAA documents. In addition, we interviewed industry and FAA officials about current and future infrastructure needs. Finally, to identify general aviation airports that may have raised funds through bond issuance, we analyzed a database maintained by a private data vendor. We then telephoned the airports we had identified to determine the amount of funds actually raised, if any.

To reply to the third question, we analyzed accident data from the National Transportation Safety Board (NTSB) for the years 1994 through 1998. NTSB sometimes assigns more than one cause to accidents. To facilitate the classification of accidents by the type of error involved in the accident, we limited our analysis to the first cause cited. This approach followed the classification used in a previous study done for FAA. We categorized the causes according to a framework developed for FAA that distinguished among deficiencies in procedural knowledge, perceptual and motor skills, and decision-making.[4] In addition, we reviewed studies and reports on the causes of general aviation accidents, including FAA accident data from 1982 through 1998. Finally, we interviewed the group of experts we had found on general aviation safety.

We conducted our work from December 1999 through May 2001 in accordance with generally accepted government auditing standards.

[4]*Judgement Evaluation and Instruction in Civil Pilot Training*, Jensen, R.S. and R.A. Benel (FAA-RD-78-24, December 1977).

Post-GARA Growth Strongest in Manufacturing

General aviation reached a peak in the late 1970s as indicated by factors such as aircraft production, pilot activity, and hours flown. This peak was followed by a long downturn that persisted through most of the 1980s and the early 1990s and has been attributed to high manufacturing costs associated with product liability issues as well as other factors. GARA was enacted in 1994 with the goal of revitalizing the industry by limiting product liability costs. Trends in general aviation since GARA was enacted suggest that since the law went into effect, liability costs have been less burdensome to manufacturers, shipments of new aircraft have increased, and technological advances have been made. Indicators of general aviation activity, such as the numbers of hours flown and active pilots, have also risen in the years since GARA, but their growth has not been as marked as the growth in manufacturing. Our group of experts noted that a number of factors in addition to GARA contributed to the rebound of manufacturing and other indicators of general aviation activity. These experts also noted a number of factors that may be continuing to slow the growth in flying activity indicators as compared with manufacturing indicators. FAA forecasts continued growth for all areas of general aviation.

Pre-GARA Slump in Manufacturing Attributed to Liability Concerns and Other Factors

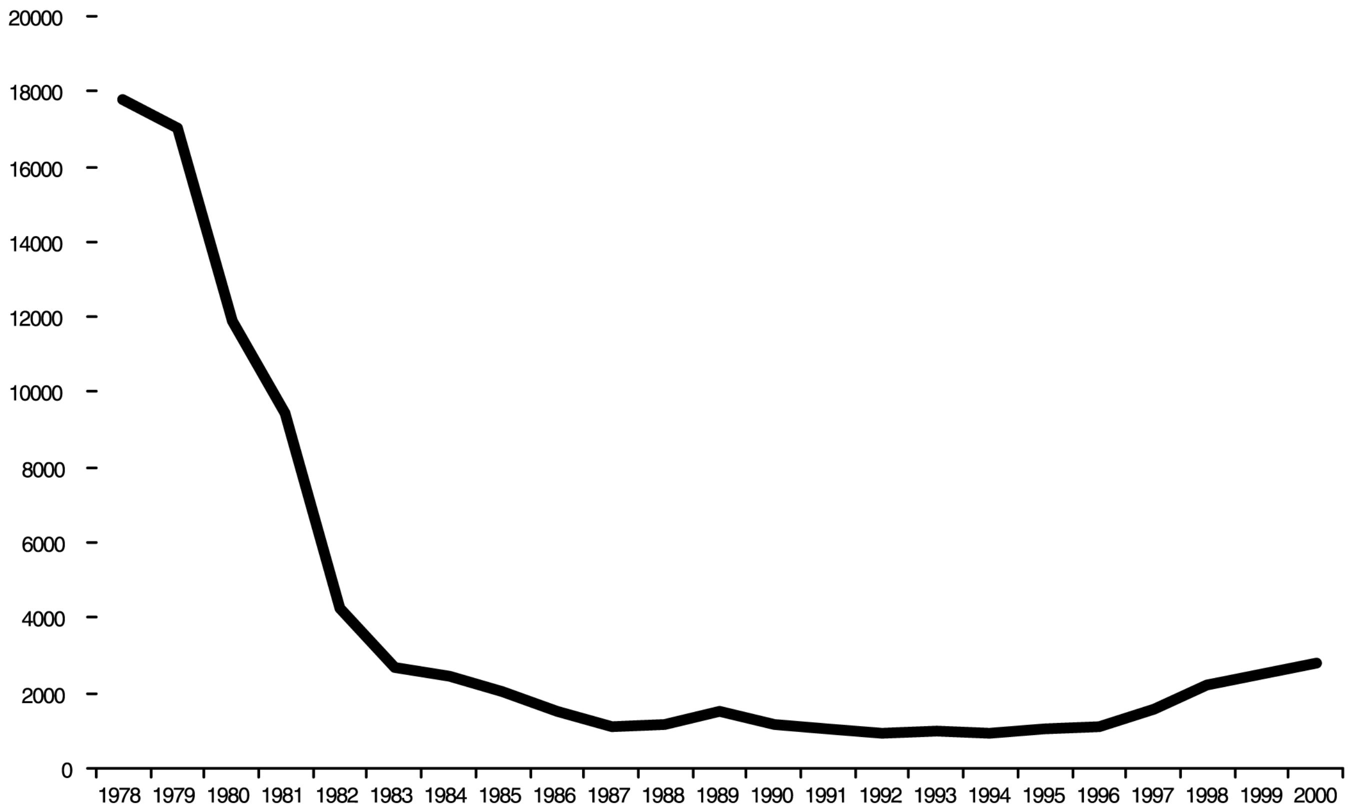
During the 15 years preceding the enactment of GARA in 1994, indicators of general aviation activity declined or remained flat, with the decline most pronounced in manufacturing. This downward trend was attributed to high aircraft manufacturing costs associated with product liability issues, a sluggish economy, and changes in lifestyle that reduced interest in general aviation flying.

Manufacturing and Activity Indicators Declined in the 1980s and Early 1990s

In the years prior to GARA, general aviation manufacturing indicators declined significantly. Aircraft shipments from U.S. manufacturers fell from 18,000 in 1978 to 928 in 1994.[1] (See fig. 3.) Between 1980 and 1991, the number of employees working in general aviation manufacturing fell by almost half.

[1]Shipments are the number of aircraft delivered by manufacturers to individual pilots, corporations, or aircraft distributors.

Figure 3: Number of General Aviation Aircraft Shipped by U.S. Manufacturers, 1978 Through 2000



Source: GARA.

The downturn in general aviation manufacturing was reflected in other areas of the industry as well. The number of fixed-wing aircraft in the general aviation fleet dropped by more than one-quarter between 1984 and 1994, from about 200,000 aircraft to about 150,000 aircraft.[2] The total number of active pilots also declined in this time period, with the number of pilots holding private certificates falling from about 320,000 in 1984 to about 284,000 in 1994. The decrease was even more noticeable in the number of student pilots, which fell from about 150,000 in 1980 to about 96,000 in 1994, a decrease of more than a third. The number of hours flown in general aviation also declined. Total hours fell by 22 percent between

[2]The active general aviation fleet is defined as all aircraft registered with FAA that have flown at least 1 hour in a given year.

1985 and 1994, with hours flown in the business segment falling by about half and hours flown in the corporate segment falling by more than a third. There was, however, limited growth in certain segments. Instructional and personal flying, for example, both were on the rise during the mid- and late 1980s.

Pre-GARA Slump Attributed to Liability Issues, Other Costs, Economic Contributions, and Changes in Lifestyle

According to the experts we consulted and other industry observers, the escalating number of product liability lawsuits that general aviation manufacturers were subject to in the 1970s and 1980s adversely affected the industry. A study commissioned by the General Aviation Manufacturers Association (GAMA) in 1986 found that paid claims and out-of-pocket defense expenses for the entire U.S. general aviation industry[3] grew from $24 million a year in 1976 to $210 million a year in 1986. In 1987, the three major U.S. manufacturers of single-engine piston aircraft, Beech[4], Cessna, and Piper, said that their annual costs for product liability ranged from $70,000 to $100,000 for each aircraft built. The escalating costs associated with product liability were reflected in rising aircraft prices. Our experts rated the price of purchasing a new aircraft as the factor having the greatest impact on the decline of general aviation. The average price of a new, single-engine piston aircraft, which is a type of aircraft commonly used for personal flying, rose from just over $25,000 in 1975 to nearly $112,000 in 1990, an increase of over 105 percent in constant 1990 dollars. The increasing cost of operating an aircraft—including higher fuel prices and maintenance expenses—also served as a deterrent to some would-be pilots, according to our panel.

Despite the increase in the price of new aircraft, the manufacturers did not offer important advances in safety features or technology, according to aviation experts. Moreover, there was a large supply of less-expensive used aircraft as a result of the thousands of single-engine piston aircraft that had been shipped each year during the 1970s and early 1980s. Considering that the useful life of these aircraft can be upwards of 30 years, consumers had little incentive to buy new ones. Amateur-built, or "kit," airplanes were another option for consumers not in a position to spend $100,000 or more on a newly manufactured unit. From 1989 to 1992, kit airplanes accounted

[3]This includes manufacturers of airframes, power plants, propellers, avionics, and other components and parts used in general aviation aircraft.

[4]Raytheon Aircraft acquired Beech Aircraft in 1995.

for more new single-engine aircraft registrations than aircraft built by the traditional manufacturing sector.

The experts that we consulted, as well as FAA and other general aviation experts, also noted that the health of the industry has traditionally been linked to the economy and that economic downturns played a role in the pre-GARA slump in general aviation manufacturing and activity indicators. Although the economy generally grew during the 1980s and early 1990s, there was a deep recession from 1981 through 1982, and there were two briefer recessions in 1980 and late 1990 through early 1991. Industry experts also said that other economic factors contributed to the decline in general aviation sales. For example, the investment tax credit, which had made aircraft ownership more affordable for businesses, was repealed.

Finally, our experts noted that changes in lifestyle seem to have discouraged interest in general aviation flying. These experts state that many personal or recreational flyers had stopped flying out of concern that they had not flown sufficient hours to maintain their flying skills. Our experts also said that consumers who might have been candidates for general aviation activities have increasingly turned to other recreational pursuits, such as boating, skiing, or driving sports cars, which have the advantage of considerably lower licensing and training requirements and can have lower operating costs. Previous government research on general aviation manufacturing also noted that less expensive forms of entertainment may be attracting individuals who might otherwise take flying lessons.

Post-GARA Trends in Manufacturing and Flying Activity Are Attributed to Mix of Reduced Liability Concerns, Continued High Prices, and Other Factors

Since the enactment of GARA, product liability concerns have fallen, and general aviation manufacturing indicators have surged. New manufacturers have entered the market, and manufacturers have put more resources into research and development for new technologies. General aviation activity indicators, such as hours flown and number of active pilots, have also increased since GARA, although less sharply. These positive trends have been attributed to a number of factors in addition to GARA, including a type of aircraft ownership called fractional ownership that allows businesses to share aircraft, and the strong economy. On the other hand, one expert has attributed the slowness of the rise in flying activity indicators and the continued high price of aircraft to the same lifestyle changes that contributed to the pre-GARA slump.

Trends Suggest That Since GARA, Product Liability Costs Have Fallen and Aircraft Manufacturing Has Rebounded

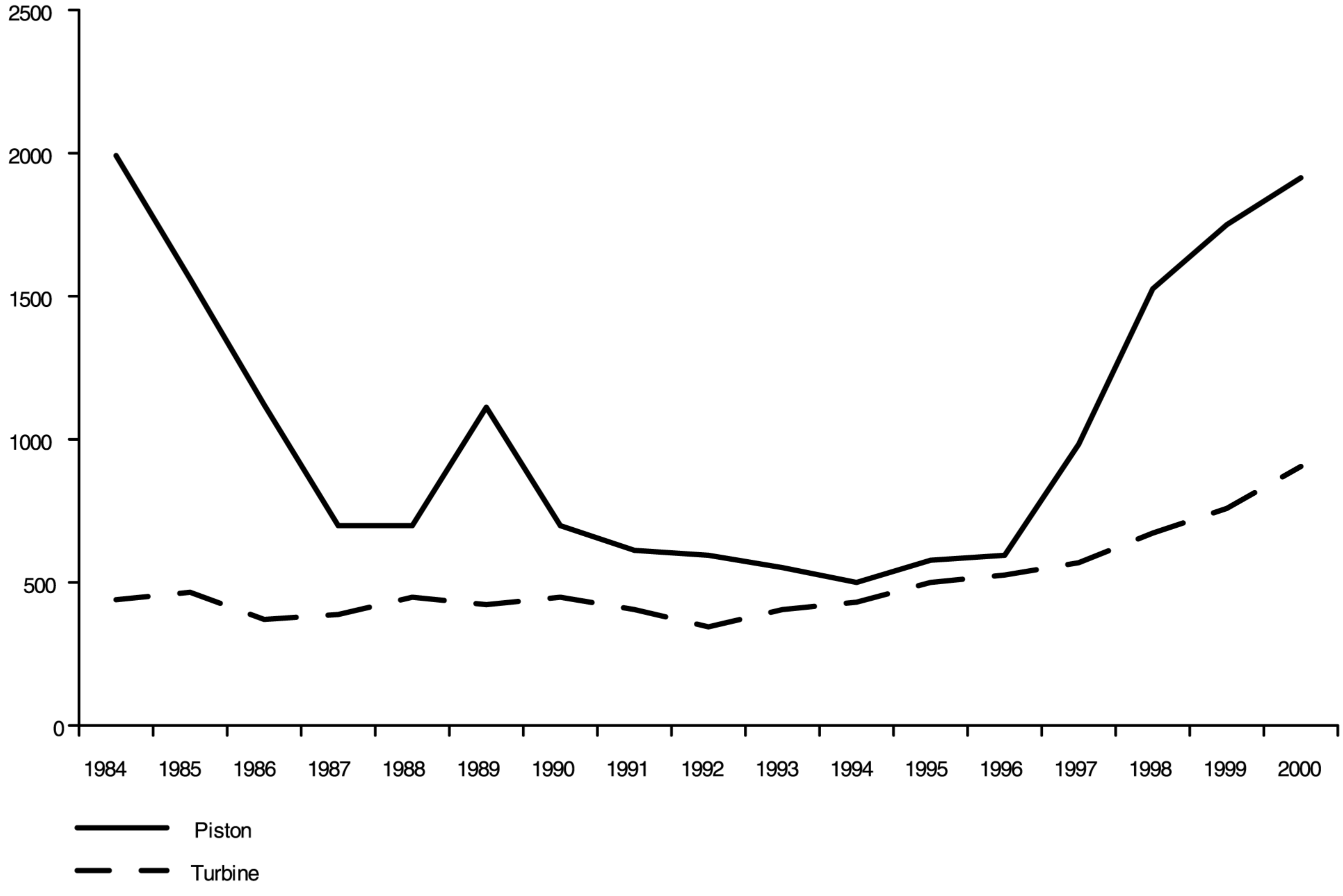
The Congress passed GARA in 1994 in an attempt to reverse the downward trends in general aviation manufacturing by limiting the financial burden created by product liability concerns. The expected benefits of reducing liability costs included enabling manufacturers to sell aircraft at lower prices and still achieve technological advances by devoting more resources to research and development. The law, which applies to aircraft with 20 or fewer seats, established an 18-year statute of repose for lawsuits against manufacturers of general aviation aircraft, parts, and components. Under this provision, no civil actions can be brought against a manufacturer for damages for death or injury arising out of an accident more than 18 years after the aircraft is delivered to a purchaser or after a new part or component is installed. Previously, lawsuits could be brought against manufacturers regardless of the age of the aircraft. Because today's fleet of single-engine aircraft has an average life of 28 years, GARA eliminates the liability exposure for more than a third of an airplane's average life.

According to representatives of GAMA, the number of product liability lawsuits brought against general aviation aircraft and components manufacturers has decreased since the enactment of GARA. A representative of one major general aviation aircraft manufacturer told us that the number of open lawsuits this company was defending fell from a high of around 900 in the early 1980s to a present total of about 80.

Spurred in part by reduced liability concerns, general aviation manufacturing has rebounded since the 1994 enactment of GARA. GAMA reported in 1999 that more than 25,000 new manufacturing jobs had been created since 1994. Shipments of new aircraft also increased, more than tripling between 1994 and 2000, from 928 to 2,816. The change was especially marked in piston aircraft, which increased nearly fourfold during that time period. (See fig. 4 for information on the number of piston and turbine aircraft shipped.) Much of this dramatic rise in piston aircraft shipments was due to the reentry of Cessna into the single-engine piston market, as well as the stepping-up of production by other manufacturers, such as Beech, that had drastically reduced their production during the height of their product liability problems. Cessna alone has shipped 3,000 units since it reopened its single-engine piston production lines in 1996.

Additionally, GAMA also reports that since the 1994 enactment of GARA, manufacturers have increased their investment in research and development by more than 150 percent and new companies have entered the market. However, the average price of new single-engine piston aircraft—the largest segment of the new fixed-wing aircraft market—has continued to increase, even when the price is adjusted for inflation. Representatives of the general aviation manufacturing industry said that manufacturers are producing more high-end, technologically advanced aircraft than before GARA was enacted, which accounts, at least in part, for the increased average price. Industry representatives also said that this advanced technology is spurring more individuals and corporations to purchase new aircraft.

Figure 4: Number of Piston and Turbine Fixed-Wing General Aviation Aircraft Shipped, 1984-2000

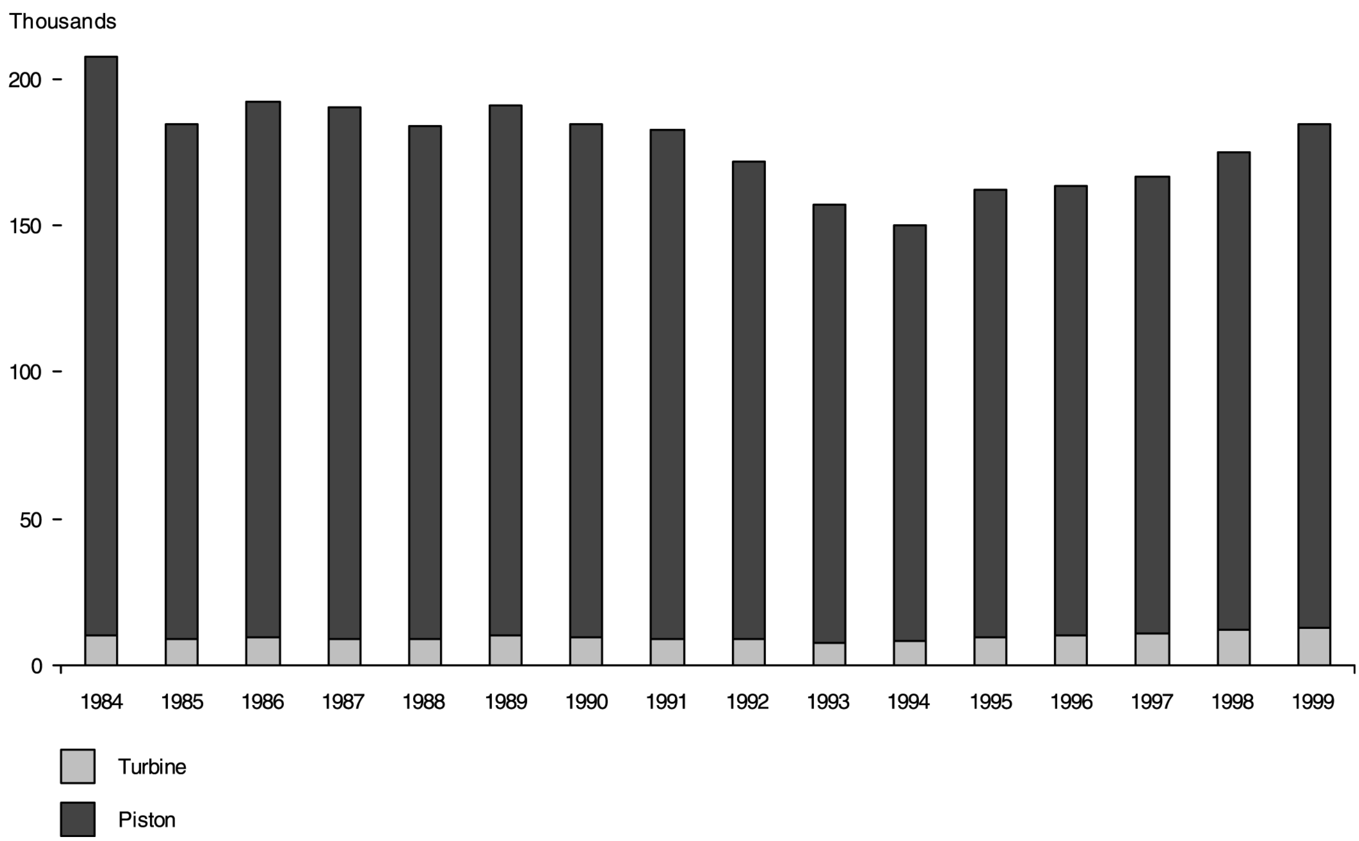


Source: GAMA.

Most Trends in General Aviation Activity Are Also Up, Although Less Sharply Than in Manufacturing

Most indicators of general aviation activity have also risen since the enactment of GARA, although not as significantly as the manufacturing-related trends. The size of the general aviation fleet has steadily increased, with increases particularly marked in turbine aircraft. The number of turbine aircraft grew 60 percent between 1994 and 1999, to almost 13,000; the number of piston aircraft grew 21 percent during the same period, to almost 172,000. Figure 5 provides details on the size of the general aviation fleet.

Figure 5: Size of General Aviation Active Fleet, 1985 Through1999



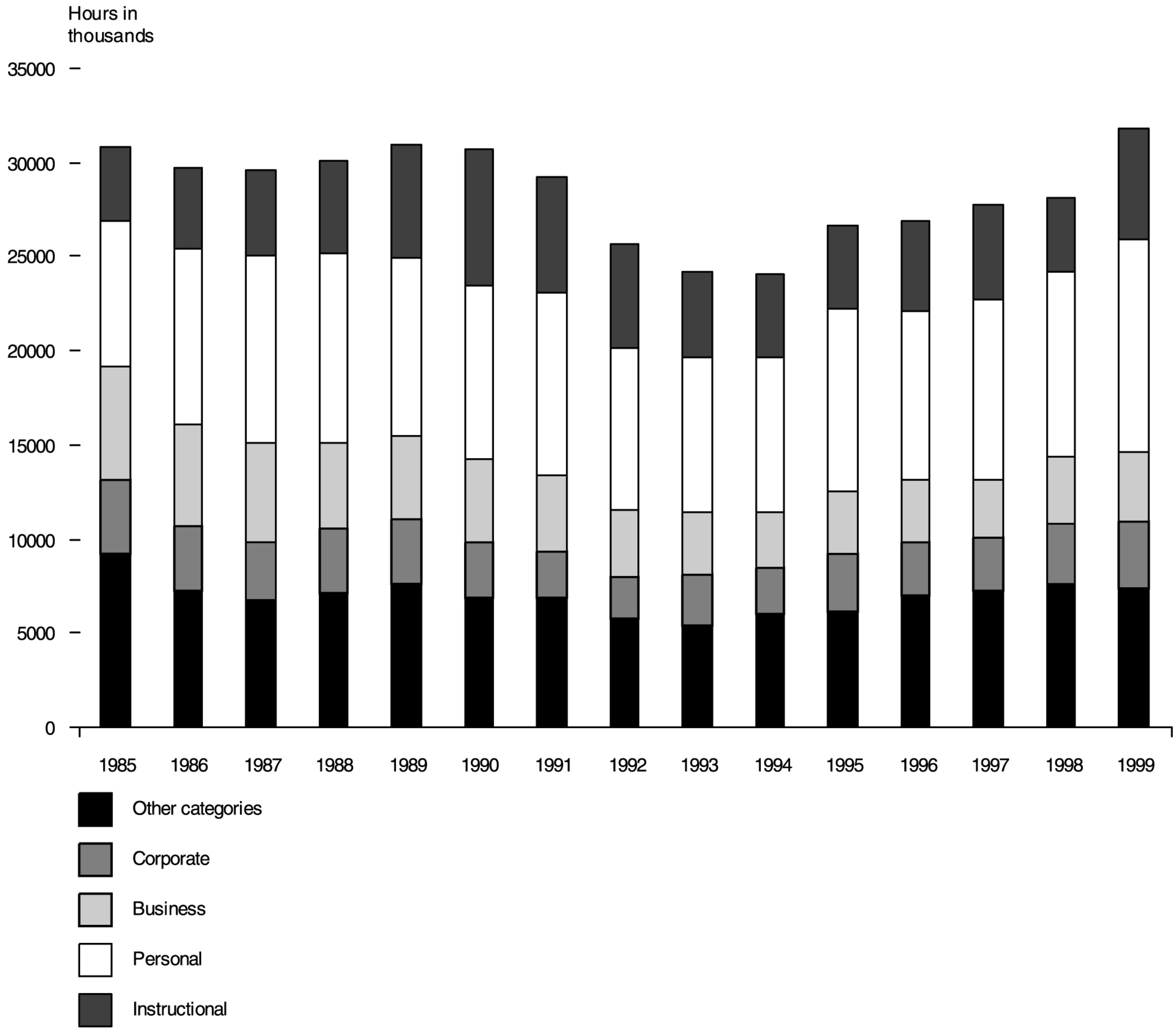
Note: Numbers are estimates based on FAA's annual survey of registered civil aircraft.

Source: FAA.

The total number of hours flown in general aviation increased 32 percent between 1994 and 1999, to almost 32 million in 1999, the most recent year for which data are available.[5] However, this total number of hours flown is only now beginning to surpass the levels of the late 1980s; for example, in 1989 the total number of hours flown was about 31 million. The four largest use categories—instructional, personal, business, and corporate—also experienced net increases between 1994 and 1999. (See fig. 6.) Corporate flying had the greatest proportional growth, increasing 45 percent during this time period.

[5]Due to changes in data collection procedures, the estimated number of general aviation hours flown prior to 1995 may not be comparable to data from 1995 and beyond.

Figure 6: Number of General Aviation Hours Flown by Use Category, 1985 Through 1999



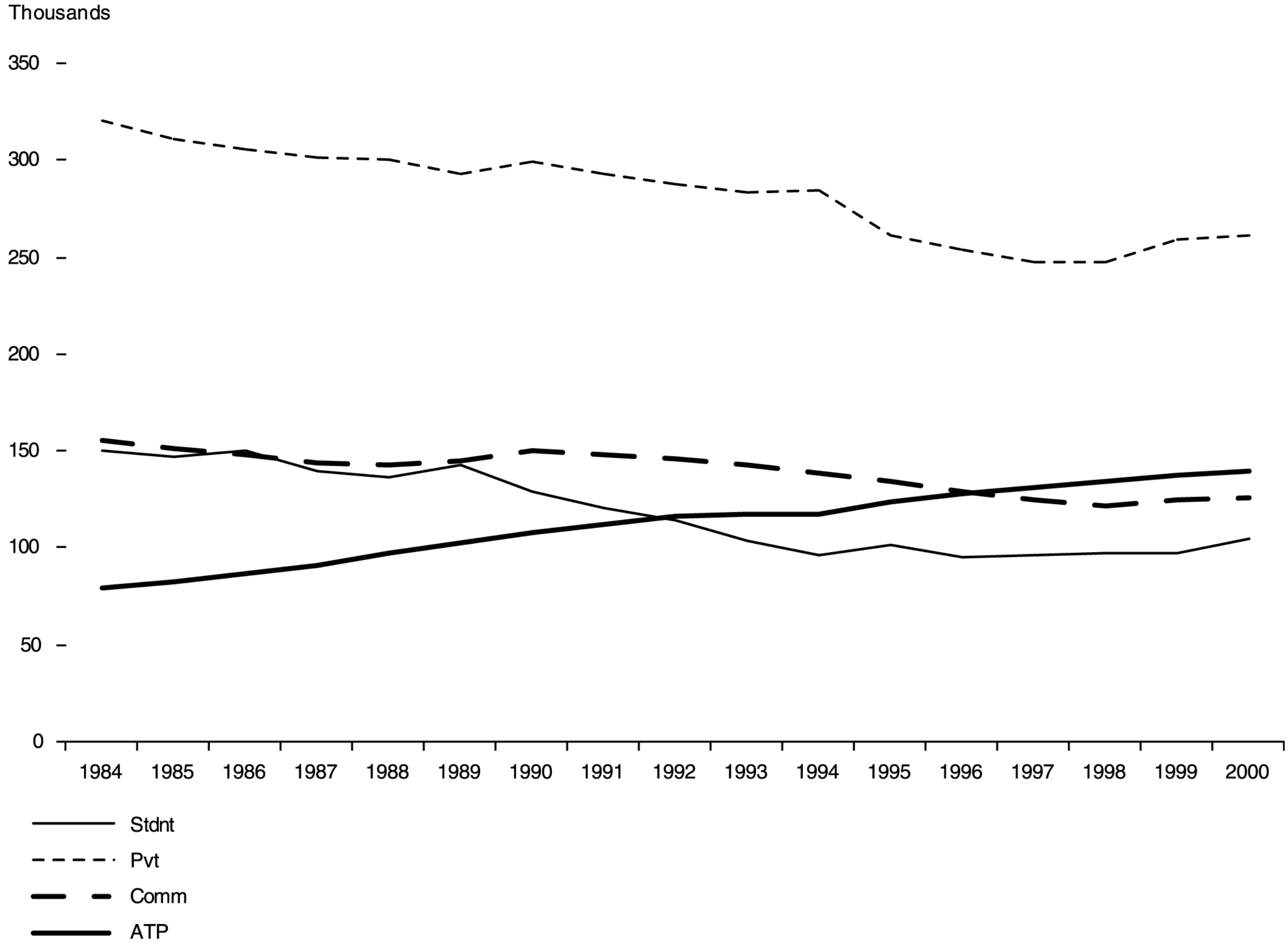
Note: Numbers are estimates based on FAA's annual survey of registered civil aircraft. Categories included in "Other" change from year to year due to changes in how FAA categorizes flight operations. The category "Other" in this figure includes the following operations every year except where noted: aerial application, aerial observation, external load (1993-1999 only), other work, sightseeing (1993-1999 only), air taxi, air tours (1995-1999 only), medical use (1999 only), public use (1996-1999 only), rental (1985 only), aerial other (1999 only) and other (all years except 1999). The estimated number of general aviation hours flown prior to 1995 may not be comparable to data from 1995 and on due to changes in data collection procedures.

Source: FAA.

The number of active private pilots—the largest single pilot category—continued to decline for several years following the enactment of GARA, falling 13 percent between 1994 and 1998, while the number of student pilots increased marginally—1.5 percent—during this same time period. More recently, however, the number of pilots has shown signs of greater growth, with private pilots increasing about 5 percent and student pilots more than 6 percent between 1998 and 2000. (See fig. 7.) Some of this growth may be due to industry efforts to attract new pilots to general aviation, such as the "Be a Pilot" program, which provides low-cost initial flight lessons to those interested in becoming pilots. Another positive indicator of pilot growth is the proportion of private pilots with instrument ratings, which has increased from 17 percent in 1990 to 22 percent in 1998.[6] An instrument rating indicates that a pilot is able to fly without seeing the horizon or other visual landmarks; and industry association experts said that having an instrument rating may indicate that pilots have a serious, long-term interest in flying.

[6]This figure includes pilots holding private certificates for airplanes, gliders, helicopters, or any combination thereof.

Figure 7: Number of Active Pilots, by Certificate Type, 1984 Through 2000



Note: Numbers are estimates based on FAA's annual study of detailed airmen statistics. Holders of student and private certificates may fly only in general aviation activities. Holders of commercial and airline transport pilot certificates may fly in general aviation activities and in commercial aviation activities.

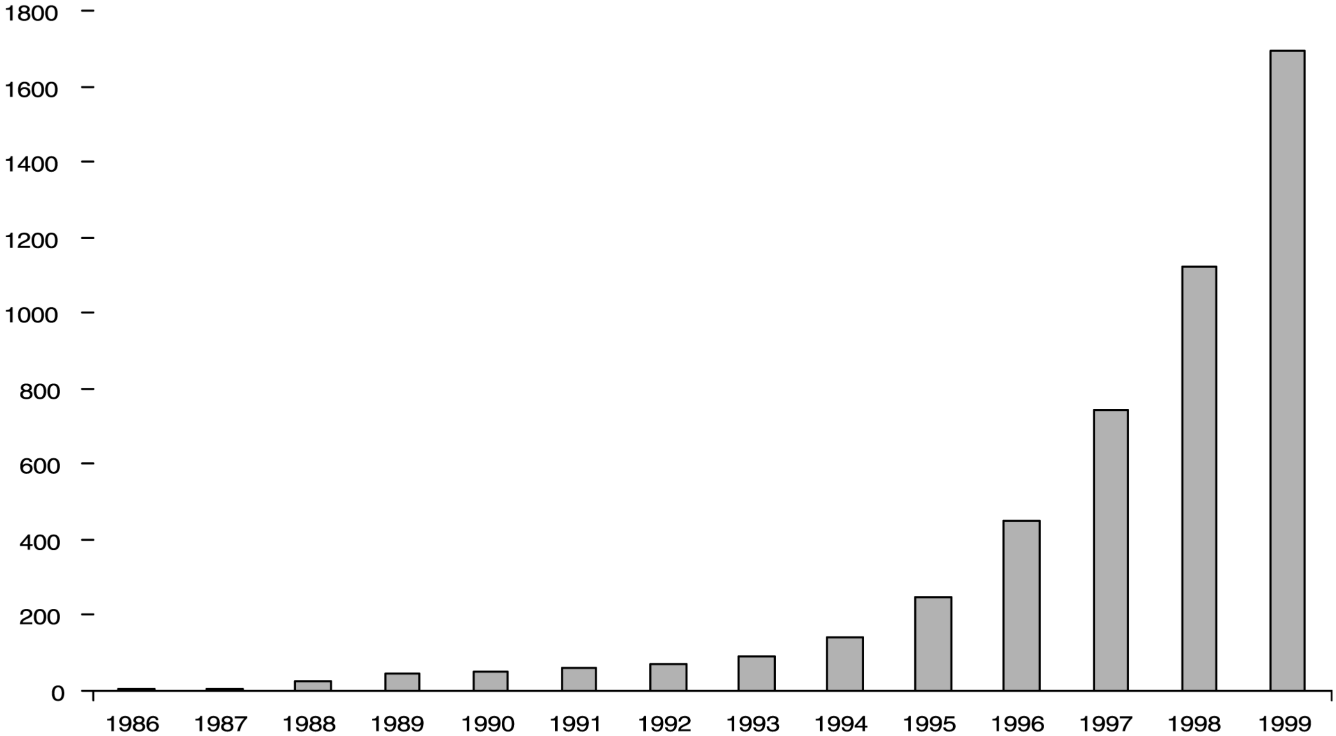
Source: FAA.

Rising Indicators Also Attributed to Fractional Ownership and Strong Economy

The experts we consulted said that a new system for aircraft ownership—fractional ownership—has had the highest impact on the recent growth in general aviation. FAA also said that fractional ownership has had a significant impact on general aviation activity. Under this system, individuals or companies purchase a share in an aircraft—usually a business jet—for their occasional use. Unlike traditional time-share programs, in which several buyers purchase a single aircraft together and must coordinate schedules, fractional owners have full access to their aircraft, or a comparable one, with as little as 4 hours notice. Using a business aircraft under a fractional arrangement instead of a commercial airline allows a traveler to bypass major airports and to take advantage of the thousands of general aviation airports, which are less congested and more dispersed.

Fractional ownership has grown steadily since its introduction in the mid-1980s. According to FAA, its growth is accelerating. In 1999, the number of individual and corporate fractional shareowners grew from 1,215 to 1,693, a 39-percent increase, and the number of aircraft—primarily jets—in fractional programs grew from 253 to 370, a 46-percent increase. (See fig. 8.) The parent corporation of one major airline, United Airlines, has announced its intention to operate a fractionally owned fleet of 200 business jets.

Figure 8: Number of Participants in Fractional Ownership Programs, 1986 Through 1999



Source: National Business Aviation Association.

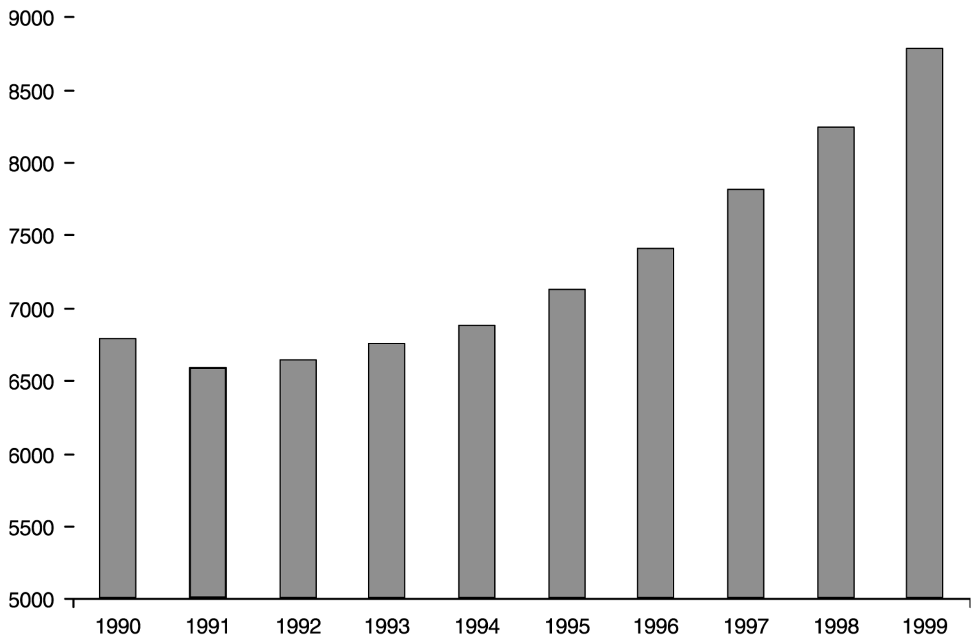
Historically, most fractional ownership programs have operated under Part 91, which regulates general aviation business activities. However, some programs operate under Part 135, which regulates on-demand and scheduled air transportation and has more stringent requirements. In response to the rapid growth of this sector, FAA initiated a review of fractional programs to determine if they are operating within the appropriate regulatory structure. The agency established an advisory rulemaking committee consisting of representatives of aircraft manufacturers, fractional owners and managers, and trade associations, among others. The committee reviewed current Federal Aviation Regulations regarding fractional ownership activity and developed a draft proposal that would require fractional ownership aircraft to operate under a new subpart of Part 91. This subpart would hold fractional ownership operators to higher standards of safety and accountability. FAA issued these changes in a Notice of Proposed Rulemaking on July 18, 2001, and expects to publish the final regulation sometime in 2002.

The experts we consulted, as well as an FAA official, said that the flourishing economy of the mid- and late-1990s was instrumental in the renewal of general aviation. According to FAA, the expanding U.S. economy and increased consumer confidence in the years since 1992 appear to have stabilized or pushed utilization rates up.[7] One member of our group of experts said that the favorable economic conditions made businesses more willing to invest in productivity tools, such as business jets. A representative of a major general aviation aircraft manufacturer said that while GARA undoubtedly provided a boost to general aviation manufacturing, economic growth was also instrumental to the rebound.

The increase in new aircraft sales can also be attributed to an increase in the number of corporations with flight departments, according to FAA. The National Business Aviation Association reports that the number of businesses in the United States that have flight departments grew 28 percent between 1994 and 1999. (See fig. 9.)

[7]Utilization rates refer to the average number of hours flown per aircraft in the active fleet.

Figure 9: U.S. Flight Departments Operating Fixed-Wing Aircraft, 1990 Through 1999



Source: National Business Aviation Association.

More Restrained Growth in Other Activity Indicators Attributed to Cost and Lifestyle Factors

With regard to the reasons that general aviation flying activity indicators did not increase at the same rate as the manufacturing indicators, one of our group of experts noted that the increased prices of aircraft may still be dampening general aviation activity. In addition, the lifestyle and choice issues contributing to the earlier decline in the industry were not directly addressed by liability reform or even an improved economy. Another expert noted that changes in lifestyle and attitudes have continued to reduce public interest in taking up general aviation flying.

FAA Forecasts Continued Growth in General Aviation

Each year, FAA convenes panels of experts in aviation and develops forecasts for future activity in all areas of aviation, including general aviation. FAA's most recent forecast predicts continued growth in all of the aspects of general aviation activity that it analyzes. FAA expects the general aviation aircraft fleet to increase at an average annual rate of 0.9 percent during the 13-year forecast period, with the number of active aircraft increasing from 219,464 in 1999 to 245,965 in 2012.[8] The fleet of turbine aircraft is expected to increase at a greater rate than the fleet of piston aircraft; as a result, the number of piston aircraft, while continuing to increase, is expected to represent a smaller percentage of the total general aviation fleet. FAA attributes this shift toward turbine aircraft to the success of fractional ownership, the introduction of new types of turbine aircraft that have piqued buyer interest, strong U.S. and global economies, and a transition from commercial air travel to corporate/business air travel by many business travelers and corporations.

FAA forecasts that the number of hours flown will increase 2.1 percent annually, with the growth concentrated in the turbojet segment, which FAA predicts to increase at an annual rate of 7 percent. FAA also predicts that the pilot population will continue to increase at an annual rate of 2 percent for the 13-year forecast period.[9] FAA attributes the projected increase to U.S. economic growth as well as to industrywide programs designed to recruit new pilots to general aviation. The number of student pilots is expected to increase 2.7 percent annually—the highest rate of the general aviation pilot categories. Private pilots are projected to increase 1.4 percent annually.

[8]FAA's aviation forecast is based on several assumptions, including continuous moderate economic growth in the United States and worldwide, no changes in the regulations affecting general aviation, no new user fees or changes in access to airports and airspace, improved flight school infrastructure, increased effectiveness on the part of the industry in keeping consumers interested in aviation, success of new products entering the market, and continued expansion of fractional ownership.

[9]This figure includes all pilot categories: student, recreational, glider, private, commercial, helicopter, and airline transport.

Airport Infrastructure

The amount of federal funding available for capital development at general aviation airports has consistently been below what has been requested by airport officials to support their airports' planned projects. In order to allocate available funding, FAA prioritizes the types of projects that it considers most important. The fiscal year 2001 Department of Transportation Appropriations Act increased funding for general aviation airports in general and for particular types of projects, but funding will still be short of what is requested for eligible projects. Experts with whom we spoke had differing opinions on the adequacy of current facilities at general aviation airports and the future development needs of these airports.

Federal Funding for Capital Development at General Aviation Airports Falls Short of Requests for Eligible Projects

General aviation airports receive funding for capital development from multiple sources, including state governments and the sale of bonds. The largest single source of funding is grants from the federal government. However, there is not enough federal money available to fund all planned projects; the annual capital development that has been planned for these airports and that is eligible for federal funding would cost at least $884 million more than the federal funding provided in 2000. Recognizing that not all projects will receive funding, FAA's funding system gives priority to certain kinds of projects, such as repairing runways and removing obstructions from landing areas.

AIP Funding Is Insufficient to Cover Eligible Projects

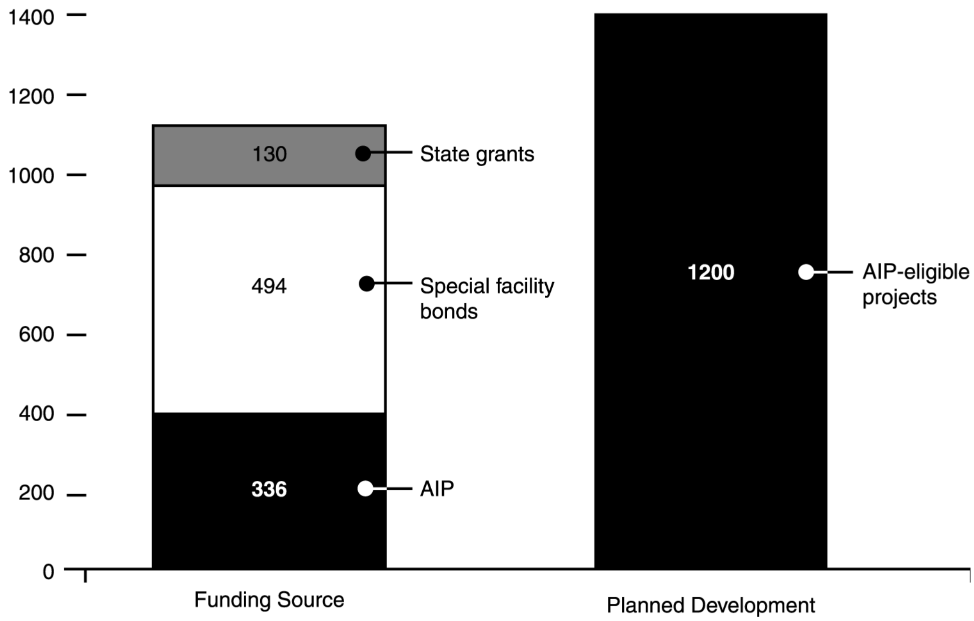
During the past few years, we have reported and testified on future funding shortfalls for the nation's airports.[1] The planned capital development for general aviation airports that is eligible for federal funding is estimated to be about $1.2 billion per year, or more than $884 million per year more than airports received in federal Airport Improvement Program (AIP) funds in 2000.[2] Additional support received from the airports' sale of bonds and from state grants still leaves airports with a funding shortfall. (See fig. 10.)

[1]See *General Aviation Airports: Oversight and Funding* (GAO/T-RCED-99-214, June 1999); and *Airport Financing: Funding Sources for Airport Development* (GAO/RCED-98-71, Mar. 1998).

[2]AIP grants are made available from the Airport and Airway Trust Fund, which is financed by taxes on domestic and international airline travel, domestic cargo transported by air, and aviation fuel. FAA allocates most AIP grants on the basis of (1) a legislated apportionment formula and (2) discretionary spending approved by FAA based on project priority and other selection criteria. Discretionary spending is also subject to set-asides and other spending criteria.

Moreover, many airports have other projects planned that are not eligible for AIP funding and therefore are not reflected in figure 10. In fiscal year 2000, for example (the most recent year for which these data are available), general aviation airports had an additional $494 million in planned projects that were not eligible for federal funding, such as the construction of hangars and maintenance buildings.

Figure 10: 2000 Funding Compared With Annual Planned Development Costs for General Aviation Airports, 1997 Through 2001



Source: GAO's analysis of data from FAA and Thompson Financial.

Estimates Do Not Fully Represent Future Funding Costs

While estimates of future capital development costs are useful indicators of possible future development activity, the actual level and types of development that occur are likely to be different for a number of reasons. Estimates of development created by FAA and others are based on airports' master plans, the accuracy of which diminishes beyond 3 to 5 years into the future, and these projections tend to underestimate actual construction costs. In addition, the development anticipated by airports' master plans may not reflect the concurrence of local communities. The availability of funds also affects actual capital spending. For example, because general aviation airports especially rely on AIP grants, they are sensitive to changes in their availability. Finally, airports' master plans may not anticipate all future costs, such as meeting new regulatory requirements or responding to unanticipated changes in demand for air travel.

FAA's Priority System Allocates Resources According to Established Priorities and Qualitative Judgments

To receive federal funding, airports must submit their plans for future development to FAA. Each airport's plan describes the development projects for the next 5 years and links the development to the current use and condition of the airport as well as forecasted aviation activity. In preparing their plans, airports also may take into consideration their state's airport system plan, which identifies the location and scale of development that is considered necessary to satisfy the state's need for air transportation. FAA reviews airports' plans and enters eligible projects into a national database that FAA uses to make decisions about the allocation of discretionary funds.

Figure 11: Vehicle Maintenance Facility at Queen City Municipal Airport, Allentown, Pennsylvania

Source: Aircraft Owners and Pilots Association.

Figure 12: Facilities at Richards-Gebaur Memorial Airport, Kansas City, Missouri

Source: Aircraft Owners and Pilots Association.

To help determine which projects will receive funding, FAA uses a system that categorizes airport development in accordance with the agency's goals and objectives. In assigning priority, the system takes into consideration the type of airport, the purpose of the work,[3] the physical component of the work (e.g., a runway, building, apron, and so forth), and the type of work (that is, the specific project being done, such as construction, purchasing a fire-fighting vehicle, or making security improvements). The system favors projects that address the safety and security requirements found in federal regulations and guidance. These requirements apply to relatively few general aviation airports, however. Projects that have been given statutory emphasis receive the second-highest degree of emphasis. This category consists of airport development items included in federal law, such as runway grooving, friction treatment, and taxiway lighting.[4] Again, few of

[3]The purpose categories are safety and security, statutory emphasis, reconstruction and rehabilitation, environment, planning, capacity, standards, and other.

[4]U.S.C. 49 Sec. 47101(f)

these requirements tend to apply to general aviation airports. The priority rating is intended to be used in conjunction with qualitative factors to select airport development projects. Qualitative factors that FAA considers include state and local priorities, environmental issues, the impact on safety and performance, and airport growth.

Increased Federal Funding Will Benefit General Aviation Airports

FAA's 5-year authorization increases the level of federal assistance for capital development projects at general aviation airports. The fiscal year 2001 Department of Transportation Appropriations Act gave significantly greater funding to airport projects in general; and provisions of the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century (AIR 21, P.L. 106-181), passed by the Congress in April 2000, provided more of these monies specifically to general aviation airport projects. Several of these changes affect the Airport Improvement Program, including an increase in the authorized level of AIP funding, automatic funding to all airports with project requests if appropriations reach a certain level, and the possibility of an increase in funding from federal money redirected from large commercial airports.

AIR 21 will increase AIP funding from $2.47 billion in fiscal year 2000 to $3.4 billion in fiscal year 2003.[5] Additionally, certain funding provisions take effect when total AIP funding for a given year is $3.2 billion or more.[6] One of these provisions allocates funding to all nonprimary airports—a category that includes general aviation airports—based on the lesser of 20 percent of the cost of development they have planned for a 5-year period as published in the NPIAS, an annual entitlement of $150,000.[7] Another provision allocates additional funding to general aviation airports that are designated relievers for congested commercial airports.[8]

[5]U.S.C. 49 Sec. 48103

[6]The amount of AIP funding authorized in 2001 was reduced from $3.2 billion to $3.19 billion. However, the $3.2 billion minimum requirement for certain funding provisions to take effect was suspended for fiscal year 2001, allowing the provisions to take effect.

[7]U.S.C. 49 Sec. 47114(d)

[8]U.S.C. 49 Sec. 47117(e)(1); see *Airport Improvement Program: Reliever Airport Set-Aside Funds Could Be Redirected* (GAO/RCED-94-226, June 1994) for additional information on the relationship between reliever airports and congestion at commercial airports.

Other changes to AIP include additional aid in the form of federal support turned back by large and medium hub airports.[9] AIR 21 allows large and medium hub airports to increase their passenger facility charges, but if they do, they must return a larger portion of their AIP entitlement funds to FAA, which could redistribute the funds among other airports. FAA officials estimate that under this provision, the amount of AIP money available for general aviation airports could increase as much as $50 million to $90 million per year.

The additional federal aid available under AIR 21 will make up part of the shortfall between planned development and available funding. However, even with the approximately $628 million in AIP awards for general aviation airports proposed for fiscal year 2001 (an increase of $286 million from fiscal 2000 funding), a 54-percent gap will still exist between funding and the full cost of AIP-eligible capital development projects. This indicates that about half of these projects will have to be funded by other means, postponed, or abandoned. While updated figures for state funding and bond proceeds are not similarly available, it is likely that a substantial difference remains between the amount of available funding and the projects proposed.

Experts Cite Several Issues Related to General Aviation Airport Infrastructure

The group of general aviation experts we spoke with brought up several issues related to general aviation infrastructure. Several were concerned with airport closings; one industry association recommended longer runways, and a different expert recommended that airports include development related to accommodating aircraft with new technologies.

According to some of the organizations we interviewed as well as some of our experts, attention needs to be focused on maintaining the existing network of airports. For example, several of the groups and experts we spoke with expressed concern about community pressure to close general aviation airports. The Aircraft Owners and Pilots Association (AOPA), an organization representing general aviation users, has been involved in efforts to keep general aviation airports open and to prevent incompatible zoning and land use around existing airports. AOPA—through its Airport Support Network—is monitoring a number of general aviation airports at which local opposition has led to efforts or plans for closure or operating

[9] U.S.C. 49 Secs. 40117(b) and 47114(f).

restrictions, including Meigs Field in Chicago, San Carlos Airport in California, and Lantana Airport in Florida.

Officials of the National Business Aviation Association (NBAA) and the National Association of State Aviation Officials (NASAO) also said that they are interested in the issue of airport closures.[10] They said they have been seeing a greater resistance to airports by the public, including efforts to close airports—particularly privately owned airports—as a way of reducing noise in residential areas and obtaining large parcels of open land for revenue-generating development. As we previously reported, some airport authorities and localities have converted portions of their airports to nonairport use, often in violation of the terms of FAA's grants to the airports.[11]

Some experts also said that potential changes in the composition of the fleet of general aviation aircraft may require alterations to airports. For example, one industry association expressed an opinion that, in order to accommodate the expected continued growth in the number of business jets, general aviation airports would need to build more long runways and install precision navigation equipment to enable all-weather landings and takeoffs. Representatives of the National Air Transportation Association, an organization representing airport service providers, said that such improvements are necessary for communities that want to take advantage of the economic opportunities and benefits that come with being able to accommodate business aviation operations. Several members of our panel agreed that there will be a need for longer runways at more airports if growth continues in the business jet segment. In addition, one member said improvements would be needed to handle the technologically advanced aircraft that he believes will become an increasingly large part of the general aviation fleet. One example he cited was NASA's Small Aircraft Transportation System, which would rely on technological improvements to make greater use of small aircraft for personal and business transportation between smaller airports. To accommodate this system, airports would need to be equipped to enable approaches using global positioning systems (GPS).

[10]NASAO represents state government officials charged with administering aviation programs, and NBAA represents organizations that own or operate aircraft in the conduct of their business.

[11]See *General Aviation Airports: Unauthorized Land Use Highlights Need for Improved Oversight and Enforcement* (GAO/RCED-99-109, May 7, 1999).

General Aviation Safety

The safety of general aviation, for which FAA has oversight responsibility, has been improving. However, the accident rate for general aviation remains about 24 times higher than for scheduled commercial aviation. The accident rate for general aviation varies by segment. For some segments, it rivals that of scheduled commercial aviation; for other segments, it is considerably higher. More than two-thirds of general aviation accidents, both fatal and nonfatal, are caused by pilot error, including mistakes related to procedure, skill, and judgment. FAA works independently and with other federal agencies and industry organizations to improve the safety of general aviation through training, technology, and procedures. Many of its current efforts involve research whose findings FAA considers for developing regulations and other guidance that enhance safety.

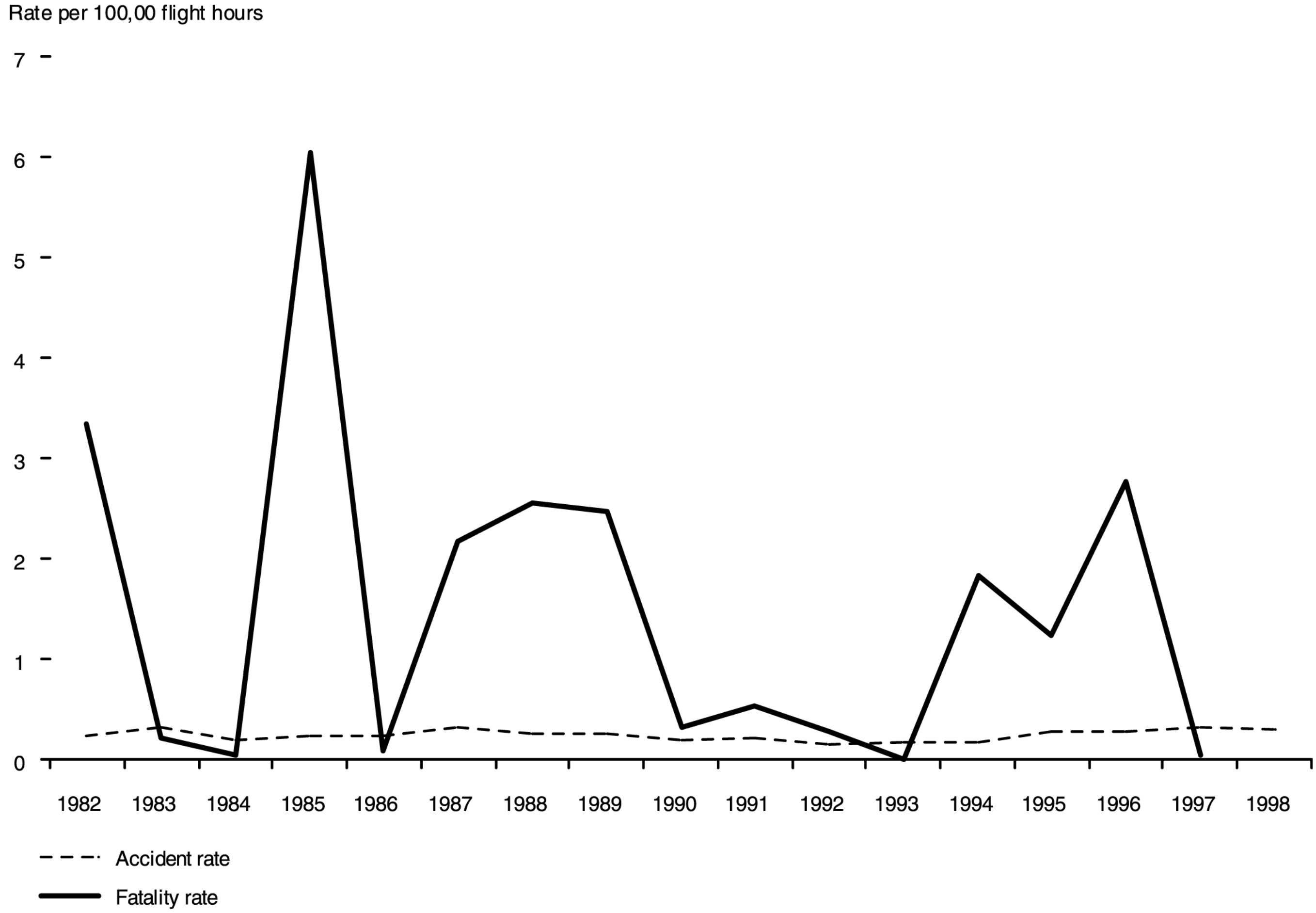
Accident Rate for General Aviation Is Improving but Is Still Higher Than for Scheduled Commercial Aviation

Safety has improved more in general aviation than in scheduled commercial aviation. Although the safety record of scheduled commercial airlines remains better than that for general aviation, the accident rate for general aviation has been declining more rapidly than that of scheduled commercial airlines. Furthermore, accident rates vary among segments of general aviation. The accident rate for the corporate segment, which is close to the accident rate for scheduled commercial aviation, is the lowest, while the accident rate for the personal segment is the highest. Because of this variance in accident rates among segments of general aviation, the safety trend for general aviation as a whole may be affected by differences in the growth rate of different segments. Experts cite multiple reasons for disparities in accident rates. These reasons include differences in pilot training and experience, in the use of technology, and in flying patterns.

Safety of General Aviation Has Improved More Rapidly Than Safety of Scheduled Commercial Aviation

In 1998, the accident rate for general aviation—the number of accidents per 100,000 flight hours—was about 24 times higher that for scheduled commercial airlines, accounting for 97 percent of the accidents and 99 percent of the deaths. However, general aviation's fatal accident rate has been dropping more quickly than commercial aviation's. From 1982 through 1998, the commercial accident rate remained stable at about 0.20 accidents per 100,000 flight hours, as shown in figure 11. (The number of fatalities fluctuated sharply because of variations in the number of deaths associated with individual airline crashes.)

Figure 13: Accident and Fatality Rates per 100,000 Flight Hours for Scheduled Commercial Aviation, 1982 Through 1998

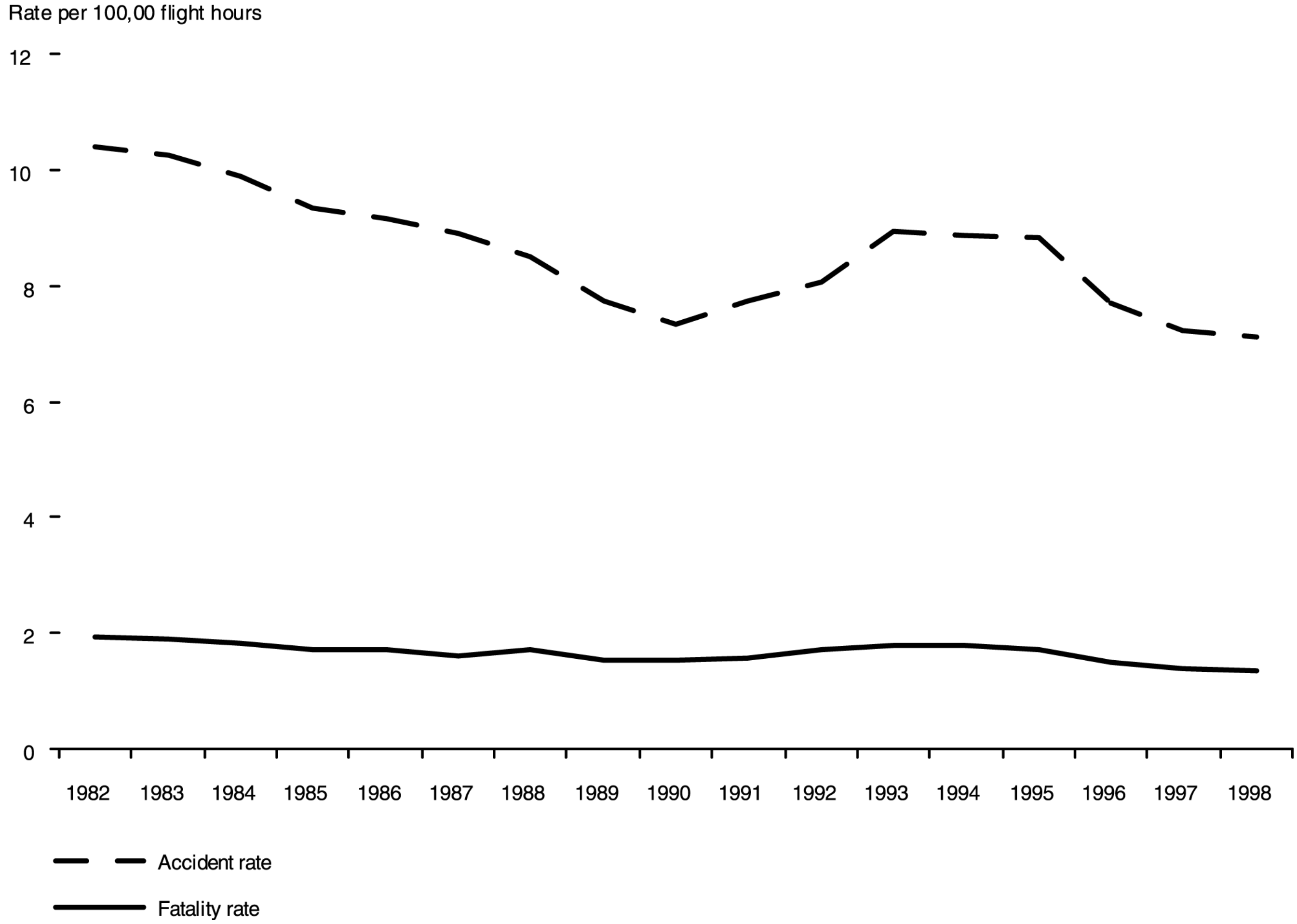


Source: GAO analysis of NTSB data.

During the same period, the total accident rate for general aviation declined from 10.4 per 100,000 flight hours in 1982 to 7.1 per 100,000 flight hours in 1998 (see fig. 12).[1]

[1]The slope of the trend line for the scheduled commercial aviation accident rate is .00 versus -.12 for general aviation for the period 1982 through 1999.

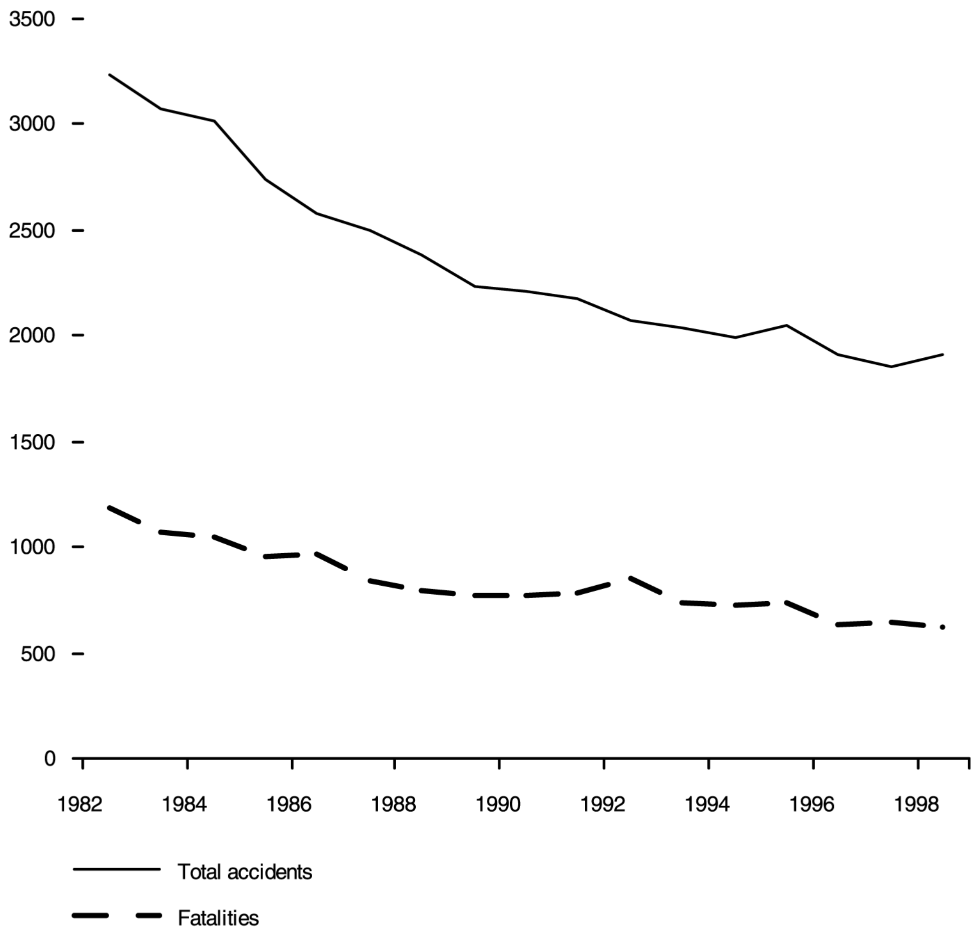
Figure 14: Accident and Fatality Rates per 100,000 Flight Hours for General Aviation, 1982 Through 1998



Source: GAO analysis of NTSB data.

In 1999, there were 312 general aviation accidents, which resulted in 559 fatalities, 15 of which occurred to bystanders on the ground, not passengers in an airplane (see fig. 13).

Figure 15: Number of Accidents, Fatal and Fatalities in General Aviation, 1982 Through 1998

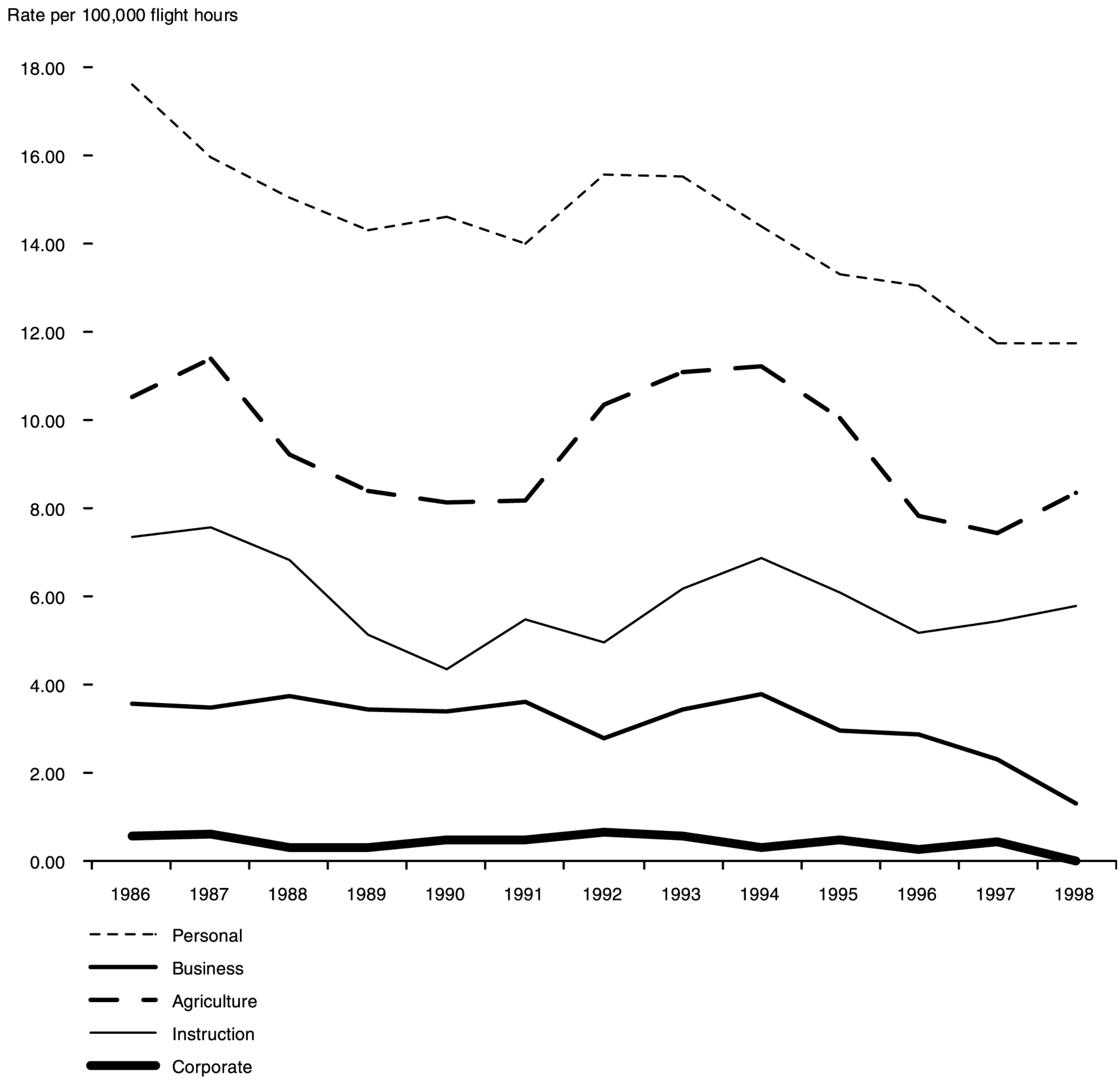


Source: GAO analysis of NTSB data.

Accident Rates Vary Among Segments of General Aviation

Some types of general aviation flying are riskier than others (see fig. 14). Personal flying, which is defined as flying for pleasure or personal transportation and not for business purposes, accounted for only about one-third of total general aviation hours flown in 1998 but accounted for almost three-quarters of fatal accidents. Corporate flying, which involves the use of aircraft owned by a corporate firm and flown by professional pilots, accounted for about 10 percent of total general aviation hours but accounted for no fatal accidents. Business flying, in which pilots use aircraft in connection with their occupation or private business, accounted for 14 percent of total general aviation hours but accounted for only 5 percent of fatal accidents. Because accident rates vary so significantly by segment, the safety trend for general aviation may be affected by differences in the growth rate of different segments. Growth is projected to occur much faster in the turbine aircraft fleet, used almost exclusively for corporate flying, than in single-engine piston aircraft, used mostly for personal and recreational flying (see ch. 2). If this projection is correct, the safety record of general aviation may improve because of the lower accident rates associated with corporate flying.

Figure 16: Figure 14: Accident Rates per 100,000 Flight Hours for General Aviation, by Segment, 1986 Through 1998



Source: GAO analysis of NTSB data.

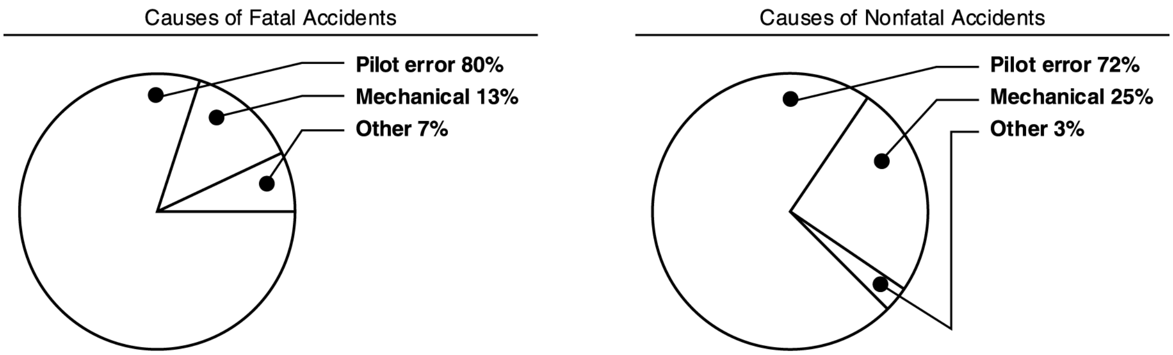
Experts Cite Multiple Reasons for Disparities in Accident Rates

Experts attribute the differences between the accident rates for commercial and general aviation, and among those for the different segments of general aviation, to a number of factors, including training, experience, technology, and procedures. An analysis of these factors shows that the corporate segment of general aviation is more closely aligned to scheduled commercial aviation than to the recreational segment of general aviation. Scheduled commercial aviation pilots and general aviation pilots who fly in the corporate segment are highly trained, tend to fly on nearly every day, and may be required to take ongoing training to maintain and improve their skills. FAA data show general aviation pilots flying for personal or recreational purposes, on the other hand, average only 30 hours of flight time per year and are subject to few recurrent training requirements. In addition to differences in pilots' skills, differences in aircraft, according to one expert, affect accident rates. The aircraft flown by commercial and corporate pilots generally have more cockpit resources to compensate for events that may threaten safety. According to experts, most flying in commercial aviation and the corporate segment of general aviation involves cruising at high altitudes, a phase of flight during which few accidents occur. Some general aviation flying may be inherently riskier than other general aviation flying; agricultural spraying, for example, involves flying low to the ground and maneuvering at slow speeds, actions that have been shown to be involved in a high proportion of accidents. Overall, FAA subjects scheduled commercial aviation to more oversight and regulation than general aviation because of its need to ensure the safety of consumers who cannot ensure their own safety. For example, while FAA regulations restrict the use of drugs and alcohol for all pilots, the agency regulates the number of consecutive hours flown and the pilot's age for airline pilots. Additionally, airlines monitor pilots' behavior to ensure compliance with both FAA regulations and their own safety rules. There are no such controls for the majority of general aviation pilots.

Pilot Error Is Involved in Most General Aviation Accidents

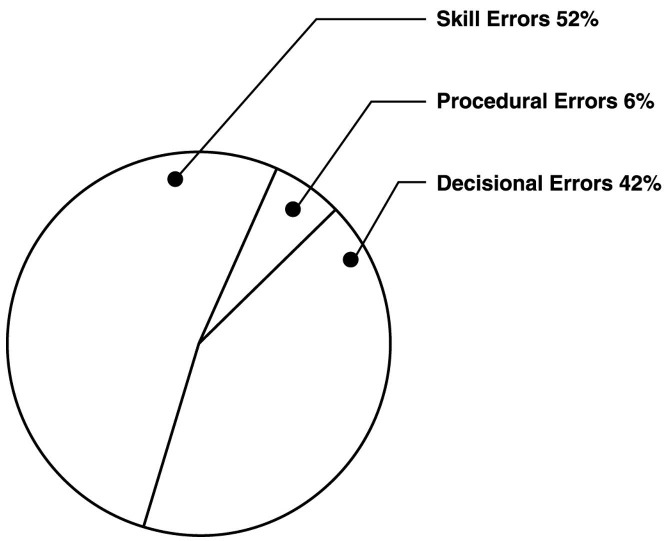
According to our analysis of National Transportation Safety Board (NTSB) accident data, 80 percent of the fatal accidents and 72 percent of the nonfatal accidents that occurred between 1994 and 1998 involved pilot error. Experts estimate that between 60 and 80 percent of general aviation accidents are associated with pilot error. Alternatively, mechanical failures were involved in 13 percent of the fatal accidents and 25 percent of the nonfatal accidents. The remaining accidents were due to other factors, such as mistakes by air traffic control. Figures 15 and 16 provide the distribution of common errors contributing to fatal and nonfatal accidents.

Figure 17: Causes of Fatal Accidents



Source: GAO analysis of NTSB data.

Figure 18: Causes of Nonfatal Accidents



Source: GAO analysis of NTSB data.

The mistakes that pilots make involve errors in following procedures, using skills correctly, or in judgment. Overall, skill-related errors resulted in 52 percent of the fatal accidents (see fig. 17). Skill-related errors, which cause most accidents, include such problems as failing to maintain flying speed; misjudging distance, altitude, or clearance; or failing to maintain control of the aircraft (see table 3).

Table 3: Percentage of Fatal and Nonfatal Accidents Caused by Selected Types of Pilot Error

Error	Description	Fatal	Nonfatal
Procedural errors			
Running out of fuel or failing to clear blocked fuel line	An airplane's engine stops due to lack of fuel, either because all available fuel on board the airplane has been depleted or because the fuel supply has been interrupted.	Not significant	10.4
Skill errors			
Failure to maintain flying speed	The aircraft slows so much that it can no longer maintain lift. Also commonly known as a stall.	16.0	Not significant
Misjudged distance, altitude, or clearance	These can result in controlled flight into terrain, which is when an airworthy aircraft is flown into terrain or another obstacle without the pilot's being aware of the impending collision.	13.8	13.7
Failure to maintain directional control	Accidents resulting from situations in which the pilot should have maintained or regained control of the aircraft but did not.	9.6	14.8
Judgment errors			
Continued flight into low-visibility conditions without proper training or equipment	Many of these accidents occurred when pilots who did not have an instrument rating attempted to fly into conditions with greatly reduced visibility, such as fog or clouds, otherwise known as instrument-meteorological conditions (IMC).	11.4	Not significant
Inadequate preflight planning	Preflight planning includes a number of activities, such as ensuring the airplane's load is within proper weight limits and is properly distributed, determining that the runway length is adequate, calculating how much fuel will be needed for the flight, and checking weather briefings.	Not significant	12.6

Source: GAO analysis of NTSB data.

To Reduce Pilot Error and Improve Safety, FAA Works With Others to Improve Training, Technology, and Procedures

FAA works to improve the safety of general aviation in a variety of initiatives with other federal agencies and industry organizations. One broad initiative, Safer Skies, was developed with the general aviation industry to improve the safety record of commercial and general aviation. FAA and the other groups involved research ways to reduce pilot error and the common types of accidents and make recommendations to improve safety. FAA must decide whether to implement these recommendations through voluntary programs, official guidance, or regulations. Most initiatives and recommendations seek to enhance safety through improvements in three areas: training, technology, and the procedures that are designed to govern operations such as takeoffs, landings, and flight patterns.

FAA Works With Other Agencies and Industry Associations on Safety Initiatives

FAA works with a number of federal agencies and industry-related organizations on research initiatives designed to identify changes to current standards for training, technology, or procedures that would improve the safety of general aviation. The federal agencies include the National Transportation Safety Board (NTSB), which investigates air crashes and recommends regulatory changes based on the results of its investigations; and the National Aeronautical and Space Administration (NASA), which has researched and developed technological advances to make aircraft more desirable and safer. Industry associations involved in safety efforts with FAA include the Airline Owners and Pilots' Association (AOPA), the Experimental Aircraft Association (EAA), the National Business Aviation Association (NBAA), and the General Aviation Manufacturer's Association (GAMA). FAA has the responsibility of implementing the conclusions and recommendations from research-oriented efforts through voluntary programs, official guidance, or regulations.

One of the recent initiatives FAA has developed with other federal agencies and industry, Safer Skies, has the mission of reducing the accident rates in both commercial and general aviation. Regarding general aviation, FAA's goal in Safer Skies is to decrease the number of fatal general aviation accidents by 20 percent in 2007. As we previously reported, this 20-percent goal represents 350 fatal accidents in 2007, only 4 fewer than the 354 that took place in 1999.[2] (Using FAA's forecasted flight hours for 2007 of 30,500,000, this goal represents a fatal accident rate of 1.15 per 100,000.) In our previous report, we noted that this goal may not challenge the general aviation community enough to continue the kinds of safety improvements that have led to previous reductions in accidents.

To achieve this reduction in general aviation fatal accidents, experts involved in the initiative are to jointly analyze U.S. and global data to identify the most serous threats to aviation safety and to find the root causes of accidents. The experts will then determine the best actions to reduce accidents and direct resources to those actions. Because the primary cause of accidents is pilot error, many of FAA's efforts to improve the general aviation industry's safety record focus on ways to prevent or mitigate those errors. For example, additional training can address deficiencies in training and experience; technological innovations can reduce the need for pilots to take certain difficult or risky actions; and procedural measures can help coordinate and manage the various takeoff, flying, and landing patterns that may threaten safety.

As a result of the ongoing work of Safer Skies, FAA, NTSB, NASA, and industry associations have also formed a General Aviation Data Improvement Team (GADIT) to gather better data on general aviation accidents. This initiative was formed to address complaints about a lack of data on the causes of general aviation accidents and incidents, especially those involving human error. In addition, this team will develop strategies for (1) improving the quality and timeliness of estimates of general aviation activity and (2) measuring the effectiveness of the various Safer Skies interventions.

FAA and Other Groups Work to Improve Safety Through Better Training

FAA first oversees the safety of general aviation through the requirements of the pilot certification process described in chapter 1. Beyond these initial requirements for pilot certification, FAA has only one ongoing training requirement for maintaining this certification—the biennial flight review. The biennial flight review is designed to assess a pilot's knowledge and skills over time and is required of all general aviation pilots. During this review, a certified flight instructor accompanies a pilot on a flight and provides assistance or guidance if any weaknesses in the pilot's abilities are

[2] *Aviation Safety: Safer Skies Initiative Has Taken Initial Steps to Reduce Accident Rates by 2007* (GAO/RCED-00-111, June 28, 2000).

identified. There is no curriculum for the flight review, such as requirements for what types of skills are to be assessed. However, FAA's guidance does state that, at a minimum, the following factors should be considered: the type of equipment flown by the pilot, the nature of the flight operations, and the amount and recency of the pilot's flight experience.[3] After the review, the person who gave the review must endorse the pilot's logbook to certify that the pilot has satisfactorily completed the flight review.

FAA also develops continuing education programs through its Aviation Safety Program and encourages pilots to take advantage of them. These programs are voluntary, and pilots may participate in as many or as few as they choose. One such option is the Back to Basics program, which provides written and video materials on takeoffs, landings, and other critical flight maneuvers. FAA also offers safety seminars, administered by its Flight Standards district offices. Experienced pilots and certified flight instructors cover a range of topics, such as global positioning system devices, flight psychology, the use of over-the-counter medication, runway incursions, mountain flying, and winter flying. AOPA's Flight Safety Foundation also conducts seminars and courses throughout the United States on a variety of safety topics.

FAA also influences safety through its certification procedures for flight instructors. For example, in 1998, FAA initiated a program in Orlando, FL, to reduce training accidents and incidents involving flight instructors by providing more direct FAA involvement in flight training. This program increased surveillance at some flight schools, reexamined flight instructors who failed to meet their instructional responsibilities, and assigned FAA inspectors to conduct all initial tests for the certification of flight instructors. Over 2 years, this program was associated with a 60-percent reduction in accidents and incidents during training of pilots. The program has a national influence because instructors who participate in it teach throughout the country.

Although FAA's and AOPA's safety seminars cover a number of issues that contribute to general aviation accidents, they are voluntary, and many pilots may never choose to receive this additional training. An FAA evaluation of the agency's safety seminars indicated that approximately

[3]FAA's guidance is described in Advisory Circular 61-89A, "Currency and Additional Qualification Requirements for Certificated Pilots."

one-third of pilots surveyed had not attended a seminar during the previous year and that only half regularly attend the seminars. In part, as a result of these findings, FAA is developing additional means of providing continuing education to pilots such as developing computer-based training courses and providing safety information on the Internet.

In addition to establishing training requirements and offering continuing education opportunities, FAA works to research training improvements that might eventually be integrated into required or recommended training. For example, some experts believe that current training methods do not sufficiently emphasize the ability to integrate information quickly, an ability that is crucial in emergency situations. According to one FAA official, many accidents might have been avoided if the pilot had recognized which skills were called for by the unfolding situation.

FAA and other experts have conducted studies on this issue that suggest that the use of personal computer-based aviation training devices (PCATD) that resemble an aircraft's cockpit can help pilots learn to integrate information quickly. These computer-based devices permit instructors to preselect emergency situations that require the rapid recognition of a problem and integration of skills needed to solve it. Exposing students to many of these situations would be too dangerous to do in aircraft but could easily be done with PCATDs. Training pilots to react to emergency situations in simulators is the training approach used by the commercial airlines. Moreover, there is some evidence that the use of PCATDs can decrease the time needed to acquire particular skills. As we reported, as a result of these studies, FAA approved the limited use of PCATD for private license certification.[4]

In March 2000, the Weather Joint Safety Implementation Team of Safer Skies released implementation plans for reducing weather-related accidents in general aviation through changes in the training curriculum for both initial and ongoing training. The intent of the plan is to place emphasis during training on the use of knowledge in realistic and dynamic aviation settings. The curriculum changes are based on scenario training and assessment that will test not only how much a pilot knows about current weather products but also how well the pilot applies that knowledge. A similar Safer Skies training effort will target accidents

[4]*Aviation Safety: Research Supports Limited Use of Personal Computer Aviation Training Devices for Pilots* (GAO/RCED-99-143, July 12, 1999).

caused by controlled flight into terrain, which occurs when a pilot flies an airworthy aircraft into terrain or another obstacle without being aware of the impending collision. Table 4 shows key recommendations that have recently been developed by groups working on improving safety through improving training procedures.

Table 4: Selected New or Modified Safety Recommendations Related to Training

Source	Selected recommendations
Safer Skies	Enhance the biennial flight review and/or instrument competency check. Improve pilot training (i.e., weather briefing, equipment, decision-making, wire and tower avoidance, and human factors). Develop and distribute mountain flying technique advisory material
AOPA	Enhance requirements for initial training to include instruction in flying in marginal weather conditions and topics relating to weather awareness. Enhance requirements for the biennial flight review to include competence in (1) reading and interpreting aviation weather reports and forecasts, (2) obtaining in-flight weather information, and (3) explaining various adverse weather conditions and strategies for avoiding them.
NTSB	Establish a cooperative program that encourages the training of pilots who are transitioning from one type of airplane to an unfamiliar type.

Source: GAO analysis.

FAA and Others Also Seek to Improve Safety Through Researching and Developing Technology

In 1994, NASA created through the Advanced General Aviation Transport Experiment (AGATE), a consortium of industry, higher education, and government entities, including FAA, to develop advanced technologies for general aviation. Some of AGATE's efforts have focused on increasing both the accessibility and development of technological innovations that can counter causes of accident and increase safety. For example, advanced cockpit displays permit pilots to visually fly predetermined courses without depending on instruments to maintain direction and orientation. Similarly, graphical displays allow pilots to determine the location and severity of weather hazards and make easily accessible the information needed to control the aircraft. These innovations should help pilots avoid several types of accidents, including controlled flight into terrain and accidents that are weather-related and/or involve loss of control of the aircraft.

This initiative also works to develop equipment that will lower the risk of injury or death in the event of an accident. Some manufacturers have already begun using these advanced technologies in their aircraft. The Cirrus S-20 aircraft, for example, has an attached parachute that can be deployed to enhance passenger survivability in the event of a stall and equipment malfunction.

Figure 19: Cirrus S-20 Airplane With Deployed Parachute

Source: Cirrus Design.

Safer Skies has also developed recommendations geared toward improving safety through changes in the development and use of technology. These recommendations include promoting the development and use of a low-cost terrain clearance and/or look-ahead device; developing new mountain and low-altitude airspace communications, navigation, and surveillance (CNS) infrastructure; adapting global positioning satellites for general aviation navigation; and removing regulatory impediments, such as certification processes for new equipment, that slow the integration of new technologies into aircraft.

While technological advances have the potential to dramatically reduce some types of accidents, there is often a significant lag time between the research phase and the time when technological advances reduce the overall accident rate. First, the technology must be developed. Then, after the technology is available for use in aircraft, the current fleet of aviation aircraft must be retrofitted with the technology. Without regulations requiring that aircraft be retrofitted, the cost of retrofitting equipment in the current fleet or replacing older aircraft may also delay the deployment of these new technologies. Additionally, once new technology is widely available, pilots will require additional training in its use.

Recent Efforts Also Seek to Improve Safety Through Procedural Measures

Finally, Safer Skies also developed recommendations to enhance the safety of general aviation through improvements in procedures governing flight patterns, including landings and takeoffs. These recommendations include standardizing and expanding the use of markings for towers and wires; using high-visibility paint and other visibility-enhancing features on obstructions; providing better information to pilots on the location and severity of weather hazard areas; and developing new procedures for airspace communications, navigation, and surveillance.

Economic Contributions to Local Communities and the Nation Are Difficult to Measure

General aviation plays an important role in U.S. civilian aviation. For instance, 96 percent of the U.S. civilian aircraft fleet is general aviation, while the remainder is commercial. Also, three out of four takeoffs each day are general aviation flights. General aviation makes important economic and social contributions to local communities in which the airports are located and to the nation at large. The total economic contribution of general aviation services consists of both the *economic impacts* and the *transportation benefits* of general aviation activities. Economic impacts refer to the economic contribution of general aviation as an industry. Transportation benefits, on the other hand, accrue primarily to the users of general aviation services. There are important limitations in measuring both types of economic contributions. It is difficult to accurately measure the economic impacts that are generated through general aviation activities, and it is difficult to assign accurate monetary values to many transportation benefits. Measurement limitations make state-by-state comparisons of general aviation benefits tenuous and impractical. However, while it is difficult to accurately measure the economic impacts and the transportation benefits generated by general aviation activities, the economic contributions are nonetheless considerable, and in some rural areas critical to the surrounding communities.

Economic Impact of General Aviation

The economic impact of general aviation is measured by considering the contributions of the general aviation industry to the economy. One methodology for measuring economic impact was developed by the Federal Aviation Administration.[1] This methodology estimates three related measures of the economic impact of general aviation on the nation and on regional communities—economic activity (or output), employment (or jobs), and income (or earnings).[2]

[1]FAA (1986), *Measuring the Regional Economic Significance of Airports*, U.S. Department of Transportation, Federal Aviation Administration, Washington, D.C., Report No. DOT/FAA/PP/87-1.

[2]The total economic impact of general aviation is an aggregation of three impacts: direct, indirect, and induced impacts. Direct impacts are those financial transactions that occur as a result of providing general aviation services that include the provision of aircraft and airport-related services. Indirect impacts occur as results of the use of general aviation services, which include expenditures by visitors patronizing hotels and restaurants in the area. Induced impacts are the “multiplier” effects of the direct and indirect impacts; the multiplier effects result from successive rounds of spending that originate with the direct and indirect impacts.

A recent study prepared for FAA estimates that in 1998, at the national level, general aviation generated about $64.5 billion in total economic output, about $19.9 billion in earnings, and about 638,000 jobs.[3] Table 5 is a break down of general aviation's estimated total economic output for 1998.

Table 5: General Aviation's 1998 Estimated Total Economic Output

Dollars in billions

	Annual economic activity	Annual earnings	Jobs
Providing aviation service	$30.8	$8.9	298,000
Using aviation service	11.4	4.4	163,000
Manufacturing	22.3	6.6	177,000
Total	**$64.5**	**$19.9**	**638,000**

Source: The Economic Impact of Civil Aviation on the U.S. Economy – 2000, p.2.

The economic activity category includes the dollar value of all general aviation and general aviation-related services plus the sum of intermediate goods and services needed to produce general aviation services. The earnings category includes the total wages and salaries paid to all persons who directly or indirectly owe their jobs to general aviation. The jobs category includes the number of people employed in the general aviation industry and in sectors that support general aviation or general aviation use.

In addition to the nationwide study prepared for FAA, many states have conducted studies on the statewide economic impacts of general aviation. Results of the 14 state studies on this topic that we reviewed in detail are presented in tables 6 through 8.[4] We selected studies that included statewide coverage of the public-use general aviation airports and for

[3]*The Economic Impact of Civil Aviation on the U.S. Economy – 2000*, prepared for the Federal Aviation Administration and MCA Research Corporation by Wilbur Smith Associates with Applied Management Solutions, Inc., March 2000. Similar reports were done in 1988 (using 1987 data), in 1990 (using 1989 data), in 1993 (using 1991 data), and in 1995 (using 1993 data).

[4]Economic impact studies for 32 states were reviewed.

which information was available on the year(s) used in the studies and state-level comparable economic data. The results in tables 6 through 8 indicate that the estimated economic impacts of general aviation on the states' economies are generally less than 1 percent. However, according to these estimates, general aviation still makes important contributions to the states' economies in terms of jobs, earnings, and economic output that are generated.

Table 6 presents estimates of jobs created by general aviation. While the numbers of jobs created may seem small relative to total state employment, the earnings generated can be substantial. Table 7 illustrates the range of estimated earnings—for example, in 1997, Minnesota had estimated earnings of $7.5 million while Arizona had estimated earnings of $476.4 million. Table 8 presents the estimated impact on total economic output. Again, while each states' general aviation output share is less than 1 percent of the gross state product, the total economic benefits are substantial, ranging from $24.4 million to about $1.5 billion.

Table 6: General Aviation Economic Impacts in Selected States - Jobs

State	Year	General aviation jobs	State jobs	General aviation jobs' share (percent)
Arizona[b]	1997	22,239	1,977,502	1.13
Colorado	1996	8,155	1,873,585	0.44
Georgia[c]	1992-93	5168	3,001,808	0.17
Idaho	1997	3,157	509,528	0.62
Kansas[d]	1997	5,070	1,243,093	0.41
Kentucky	1996	1,374	1,617,063	0.08
Maryland	1995	3,757	2,145,317	0.18
Minnesota	1997	361	2,423,593	0.01
Mississippi	1997	1,563	1,068,747	0.15
New Jersey	1994	16,000	3,463,345	0.46
North Carolina	1995	2,700	3,431,839	0.08
Oregon	1995	5,472	1,411,916	0.39
Pennsylvania	1994	5,317	5,054,453	0.11
Virginia	1995	3,269	3,011,704	0.11

[a]Ratio of general aviation jobs to state jobs.

[b]Data for the state based on only 1997 due to data limitations, although the study period was 1997 and 1998.

[c]Data for the state are an average of the 2 years.
[d]General aviation economic impact estimates were for 1997, based on 1996 survey data.

Source: GAO's analysis based on economic impact studies by various states and *Employment and Wages*, Bureau of Labor Statistics, U.S. Department of Labor.

Table 7: General Aviation Economic Impacts in Selected States - Earnings

Dollars in millions

State	Year	General aviation earnings	State earnings	General aviation share of total earnings[a] (percent)
Arizona[b]	1997	$476.4	$54,685	0.87
Colorado	1996	$171.8	$53,433	0.32
Georgia[c]	1992-93	$103.8	$73,925	0.14
Idaho	1997	$60.8	$12,255	0.50
Kansas[d]	1997	$103.0	$31,954	0.32
Kentucky	1996	$35.9	$39,557	0.09
Maryland	1995	$102.8	$62,498	0.16
Minnesota	1997	$7.5	$73,323	0.01
Mississippi	1997	$32.4	$24,793	0.13
New Jersey	1994	$450.9	$115,809	0.39
North Carolina	1995	$55.0	$83,742	0.07
Oregon	1995	$95.9	$36,473	0.26
Pennsylvania	1994	$119.8	$136,216	0.09
Virginia	1995	$57.3	$80,997	0.07

[a]Ratio of general aviation earnings to state earnings.
[b]Data for the state based on only 1997 due to data limitations, although the study period was 1997 and 1998.
[c]Data for the state are an average of the 2 years.
[d]General aviation economic impact estimates were for 1997, based on 1996 survey data.

Source: GAO's analysis from the economic impact studies by various States and *Employment and Wages, Annual Averages*, Bureau of Labor Statistics, U.S. Department of Labor.

Table 8: General Aviation Economic Impacts in Selected States - Economic Output

Dollars in millions

State	Year	General aviation output	Gross state output	General avition output share (percent)
Arizona[b]	1997	$1,466.0	$121,200	0.60
Colorado	1996	$555.5	$116,200	0.22
Georgia[c]	1992-93	$333.6	$165,000	0.10
Idaho	1997	$159.6	$29,100	0.32
Kansas[d]	1997	$296.0	$71,700	0.22
Kentucky	1996	$124.5	$94,500	0.06
Maryland	1995	$348.3	$138,100	0.11
Minnesota	1997	$24.4	$149,400	0.01
Mississippi	1997	$102.5	$58,300	0.08
New Jersey	1994	$1,300.0	$255,800	0.27
North Carolina	1995	$153.0	$193,600	0.04
Oregon	1995	$422.4	$80,700	0.18
Pennsylvania	1994	$389.7	$296,800	0.06
Virginia	1995	$175.1	$188,000	0.05

[a]Ratio of adjusted general aviation output to the gross state output. The adjusted general aviation output is based on the assumption that general aviation earnings are about 66% of general aviation output, which is the typical share of gross domestic product represented by earnings (wages and salaries, other labor income, and proprietor's income) for the whole nation. Thus, the adjusted general aviation output equals general aviation earnings divided by 0.66. The adjustment is warranted because to compare general aviation's output impact to gross state output, the impact measure must include only the value-added components. The earnings impact measure includes only value-added but the general aviation output does not. See *The Economic Impact of Civil Aviation on the U.S. Economy – 2000*, p. 6.
[b]Data for the state based on only 1997 due to data limitations, although the study period was 1997 and 1998.
[c]Data for the state are an average of the 2 years.
[d]General aviation economic impact estimates were for 1997, based on 1996 survey data.

Source: GAO's analysis based on information from economic impact studies by various States and *Current Regional Studies*, Bureau of Economic Analysis, U.S. Department of Commerce.

Transportation Benefits of General Aviation

General aviation airports improve air transportation services in local communities and in the nation. The improvements in transportation services can be classified broadly as commercial, community, and other benefits. These benefits help to increase the efficiency and productivity of businesses, and they enhance the well-being of individuals in the community and the nation at large.[5]

Commercial Benefits

General aviation saves time and reduces costs to business travelers who use general aviation airports instead of transportation alternatives, such as driving, or using a more distant airport or a congested commercial airport. By using general aviation airports, many businesses are able to increase their productivity as well as the flexibility of the schedules of their top business executives. For example, the headquarters for a noted drugstore chain is located in the middle of the Northeast United States and a logistical hike from almost everywhere else. This company operates over 4,000 neighborhood drug stores in 30 states. The company uses a helicopter to enable its senior managers to move rapidly from door to door. The company estimated that it probably saves from 1 to 1.5 staff-hours per passenger for every hour it flies.

General aviation also facilitates commercial activities, including agricultural applications (such as aerial seeding and spraying), monitoring pipelines and utility lines, and providing express or just-in-time cargo and package delivery services. Mississippi, among other states, uses aerial seeding and insect spraying to enhance agricultural yields and improve crop quality. Minnesota is among the states that use aerial inspections of utilities to enable businesses to monitor their infrastructure and quickly locate problems.

Community Benefits

General aviation provides public health services. General aviation is a critical component of a community's public health network, used for regular or emergency transportation of persons, medical equipment and supplies. In Arkansas, helicopters are used in emergency situations to transfer critically injured patients for treatment. Air response can save

[5]See, for example. FAA (1992), *Estimating the Regional Economic Significance of Airports*, U.S. Department of Transportation, Federal Aviation Administration, Washington, D.C., Report DOT/FAA/PP-92-6.

valuable time in delivering treatment that can mean the difference between life and death. Aviation is also used to transfer patients between hospitals for specialist care, transfer organs for transplant, and to transport health care specialists to rural areas for patient care.

General aviation activities also assist state and federal governments in addressing challenges to public safety by facilitating both routine and emergency services, including monitoring floods, forest fires and storms, and providing relief to victims of natural disasters. General aviation airports serve as vital civil defense facilities, providing key staging grounds for responding to natural disasters, local police and surveillance work, and Civil Air Patrol and National Guard activities.

General aviation provides recreational facilities for individuals who use general aviation airports for leisure activities, including skydiving, personal pleasure flying, flying home-built aircraft, local sightseeing, and tourism. For example, 436,000 tourists annually choose to visit Pennsylvania via private or corporate aircraft. These tourists spend over $28.4 million annually for hotels, food, retail, and other items.

General aviation assists in aerial photography that is used for a variety of purposes, including mapping, surveying, and in managing environmental and wildlife matters. In Maryland, as elsewhere, aerial photography has become an indispensable tool for local developers, planners, and others who depend on the aerial surveys for their business operations.

General aviation helps to aid economic development by attracting businesses to small-and medium-sized communities. The availability of a general aviation airport is one of the factors that businesses consider when they are contemplating relocation or expansion.[6] An April 2000 National Air Transportation Association (NATA) telephone survey indicated that between 44 and 60 percent of survey respondents believed that recruitment of new business and industry and retention of current business was very important or one of the most important benefits provided by local general aviation airports. An identical percentage of respondents believed that the airports had a positive impact on local businesses and the local economy.

[6] See, for example, *Economic Impact of New Jersey's General Aviation Airports*, prepared for the New Jersey Division of Aeronautics, by the Airport Technology and Planning Group, Inc. (May 1996). Other factors include available labor supply, convenient highway access, tax incentives, and academic and cultural centers.

Other Benefits

General aviation airports relieve congestion by freeing operating slots at nearby busy commercial service airports. This service benefits commercial-air travelers by allowing the commercial airports to support higher passenger and cargo volumes. Between 29 and 47 percent of the respondents to the NATA survey believed that serving as an alternative airport for private aircraft to reduce air traffic at large commercial airports was a very important or one of the most important benefits of general aviation airports.

General aviation airports provide flight instruction facilities for training new pilots in the aviation industry. Apart from the direct benefits to the new pilots, using public-use general aviation airports rather than commercial airports for flight training also reduces crowding at commercial airports. A majority of respondents to the NATA survey, between 51 and 63 percent, believed that general aviation airports' role in providing training services and facilities for pilots was very important or one of the most important benefits.

General aviation provides the fastest means of accessing the national airspace system, especially for many small and medium towns and cities, which, in turn, provides access to other regions of the nation and the world at large.

Limitations of Measuring Economic Impacts and Transportation Benefits of General Aviation

General aviation can have a significant economic impact on the local economies of communities served by the airports, of the states, and of the nation, as estimated in various studies. However, the estimated values reported in these studies may not reflect the true or actual economic impact of general aviation for many reasons. The limitations of the studies on the economic impact of general aviation include the following major issues.

Opportunity Cost of General Aviation Activities

The studies of the economic impact of general aviation do not account for the economic impact of using the funds for the general aviation activities in alternative projects. The economic impact methodology, therefore, assumes implicitly that general aviation activities do not replace other economic activities. But this assumption is not necessarily true. Ideally, the economic impact studies should measure only those activities that exist only because of general aviation airports. This would involve developing a base-case (or counterfactual) scenario that depicts a community without the general aviation airport. Furthermore, from a local perspective, the local community benefits from the direct and indirect economic impacts resulting from the construction and operation of a general aviation airport. However, from a national or regional perspective, these impacts may simply be a redistribution of benefits from one local area to another rather than a net gain.

Measurement of the Induced or Multiplier Economic Impacts

One of the categories of the total economic impact of general aviation is the induced (or multiplier) effect from the direct and indirect impacts of general aviation activities. The estimated multipliers generally tend to be less reliable for small areas of the national economy because there are no readily reliable data to use in computing them. Also, the value of the multiplier in local communities depends on how the region affected by the economic impact is defined. Another important problem is that different economic models are used in different studies to determine the induced effects, and different methodologies exist within each model, making comparisons of the estimates from different studies difficult.[7]

Double-Counting of Economic Transactions Under the Benefit-Cost Methodology

There is the potential for double counting of benefits under the benefit-cost methodology for evaluating general aviation airports. For instance, there is double-counting of benefits when both the timesaving benefits realized by airport users and the fees that they pay to airport operators are counted because the former is reflected in the latter.

While it is generally agreed that general aviation activities can provide benefits from improvements in air transportation services, there are significant practical problems in identifying and measuring the

[7]Types of models include economic base models, econometric models, and input-output models. See, for example, Michael W. Babcock, "The Economic Significance of General Aviation Airports in Rural Areas," *Journal of the Transportation Research Forum*, vo1. 39, no. 3, Summer 2000, pp. 141-156. The most popular model used is the input-output. However, different input-output multiplier systems have been employed. For instance, there is the AIMS (Automated Input-Ouptput Multiplier system), the IMPLAN (Impact Analysis for Planning) system, and the RIMS (Regional Input-Output Modeling System).

transportation benefits.[8] For instance, it is difficult to estimate the dollar value of travel time savings to individuals whose time has different opportunity costs, or the value of general aviation services to an individual who uses the airport for leisure or recreation. Furthermore, the discussion and estimation of transportation benefits of general aviation services tend to ignore some important external costs and benefits, such as the costs of pollution and noise from aircraft, and the benefits from relieving congestion at nearby commercial service airports.

General Aviation Enjoys Community Support

As noted above, communities realize considerable benefits from general aviation airports, and general aviation receives community support in return. Such support was recently demonstrated in a telephone survey conducted by the National Air Transportation Association (NATA). Among other things, questions were included on perceived benefits of general aviation airports. Between 44 and 60 percent of survey respondents said general aviation airports had a positive impact on local businesses and the local economy. An identical percentage of respondents thought recruitment of new business and industry and the retention of current business was very important or one of the most important benefits provided by local general aviation airports. An even higher percentage of respondents, 51 to 63 percent, believed it was very important that the general aviation airports provided training services and facilities for pilots. Favorable reactions were also offered for general aviation airports serving as an alternative for private aircraft to reduce air traffic at large commercial airports and as a source of jobs.

[8]See, for example, Harry P. Wolfe, "Quantifying the Benefits of a New General Aviation Airport: A Return on Investment Approach," *Transportation Research Circular*, Transportation Research Board, National Academy of Sciences, Washington, D.C., No. 259, July 1983, pp. 33-38.

GAO Contacts and Staff Acknowledgment

GAO Contacts

Gerald L. Dillingham (202) 512-2834
Christopher A. Keisling (404) 679-1917

Staff Acknowledgments

Jonathan Bachman, Janet Barbee, Carolyn Boyce, Jay Cherlow, Elizabeth Eisenstadt, Dana Greenberg, Heather Halliwell, Art James, John Karikari, Paul Lacey, Bert Japikse, Richard Scott, and Alwynne Wilbur made key contributions to this report.

Ordering Information

The first copy of each GAO report is free. Additional copies of reports are $2 each. A check or money order should be made out to the Superintendent of Documents. VISA and MasterCard credit cards are accepted, also.

Orders for 100 or more copies to be mailed to a single address are discounted 25 percent.

Orders by mail:
U.S. General Accounting Office
P.O. Box 37050
Washington, DC 20013

Orders by visiting:
Room 1100
700 4th St. NW (corner of 4th and G Sts. NW)
U.S. General Accounting Office
Washington, DC

Orders by phone:
(202) 512-6000
fax: (202) 512-6061
TDD (202) 512-2537

Each day, GAO issues a list of newly available reports and testimony. To receive facsimile copies of the daily list or any list from the past 30 days, please call (202) 512-6000 using a touchtone phone. A recorded menu will provide information on how to obtain these lists.

Orders by Internet:
For information on how to access GAO reports on the Internet, send an e-mail message with "info" in the body to:

info@www.gao.gov

or visit GAO's World Wide Web home page at:

http://www.gao.gov

To Report Fraud, Waste, or Abuse in Federal Programs

Contact one:

- Web site: http://www.gao.gov/fraudnet/fraudnet.htm
- e-mail: fraudnet@gao.gov
- 1-800-424-5454 (automated answering system)

PRINTED ON RECYCLED PAPER

United States
General Accounting Office
Washington, D.C. 20548-0001

Official Business
Penalty for Private Use $300

Address Correction Requested

Presorted Standard
Postage & Fees Paid
GAO
Permit No. GI00

[redacted]