Chapter 12 GENERAL AVIATION

General aviation is defined as all civil aviation other than flying done by scheduled air carriers and government agencies. It is the largest segment of the aerospace industry. Very few people realize the size and importance of this branch of aerospace. There were over 190,000 civil aircraft in the United States in the late nineties. Of that number, nearly 10,000 civil aircraft were used as licensed air carriers.

There are over 633,000 certified pilots in the United States today. The aircraft they fly are categorized as: (1) instructional, (2) personal, (3) sport, (4) business and (5) commercial aviation.

Objectives

Define general aviation.
Name the five groups into which general aviation is separated.
Describe the typical instructional aircraft.
Discuss two basic trainer aircraft.
Describe the process of getting a private pilot certificate.
Describe the typical personal aircraft.
Define sport aviation.
List and describe the purposes of the seven divisions of sport aviation.

Instructional Aviation

The first category of general aviation, deals with aircraft used specifically to teach someone to fly. Whether a pilot is flying a Boeing 747, or just a small single-engine personal aircraft, entry-level flight training is a requirement.

A pilot usually learns to fly in general aviation or in the military. Instructional flying accounts for about 13 percent of all the hours flown in general aviation. In the late nineties, there were approximately 14,000 aircraft being used in flight training and a total of 4,500,000 hours were logged.

Ninety percent of all instructional aircraft are small single-engine airplanes. At most flight schools, you will currently find either Cessna 152s or 172s being used. Other company models, such as those built by Piper and Beechcraft, are used, but their current production is primarily focused on higher performance pleasure and business airplanes.

There are also opportunities for pilots who seek training in other aircraft types. These include multi engine reciprocating, turbopropeller-powered, turbojet-powered, helicopters, gliders, and hot air balloons.

Pilot Certification

An individual who wants to learn to fly will usually go to a certified flight instructor (CFI). The

student's flight training includes both ground school (classroom work on various aspects of flying) and flight instruction (actually flying the aircraft). Prior to flying alone (solo), the student must acquire an FAA student pilot certificate by passing a standard FAA Class III Medical Examination, which is given by an FAA-designated medical doctor. This student certificate must be endorsed by the flight instructor prior to the first solo flight and again prior to the first solo cross-country flight. At some point in the training, the student must be certified by an instructor as being prepared to take the FAA written examination. This is the goal of ground school preparation. After passing the written examination and completing all flight requirements, the flight instructor recommends the student for a flight test, which is administered by a FAA-certified examiner. Successful completion of this flight test earns the coveted private pilot certificate. The pilot may then fly unsupervised and carry passengers—but not for hire.

A person interested in becoming a pilot has several options available. After completing the private pilot license, or certificate, there are several higher levels of training available. These include the commercial, the ATP (Air Transport Pilot), and flight instructor's certificate. Also, there are ratings that can be added to these certificates. For example, there is an instrument rating, a multi-engine rating, a rotorcraft rating, a glider rating, an airship rating, and a free balloon rating.

The majority of pilots have received their basic instruction in either Cessna or Piper aircraft. They are small, two-seat aircraft with small engines. They have a low cruising speed and are very easy to fly. These characteristics help develop confidence in the beginning student. The fact that they are also inexpensive to buy, operate, and maintain makes them attractive to flight schools.

One of the greatest training planes of all time, the Piper J-3 *(EAA)*

Cessna 152

This is the successful Cessna 152. Thousands of pilots have received their entry-level flight training in this aircraft.

This basic trainer went into production in 1978 to replace the well-established Cessna 150. It is 24 feet long, has a 33-foot wingspan and a maximum gross weight of 1,670 pounds. It is powered by a 110-horsepower Lycoming four-cylinder engine. At 8,000 feet and using 75 percent power, the Cessna 152 will cruise at 100 mph for about 650 miles. The fuel economy factor is 28 miles per gallon of fuel, which is excellent for an airplane.

Since World War II, a number of training aircraft have come and gone. Thousands of pilots received their licenses in airplanes like the Piper Cherokee 140, the Beechcraft Skipper, and Luscombe Silvaire. They were great little airplanes but for one reason or another, they were discontinued from the offerings of their companies.

During the 1970s and 1980s, threats of lawsuits plagued America's general aviation "entry level" flight training and many manufacturers considered two-place training airplanes to be too great a risk. However, the Cessna 150s, 152s, Piper Cherokee 140s, Piper Tomahawks, Beech Skippers and others are still being used by many flight schools despite their age. Can you imagine taking driver's education in a 1966 Chevy? In the world of general aviation flight training, however, that is exactly the case and these old airplanes just keep on flying and doing their job well!

If an individual wants to fly a multi-engine aircraft, he or she must get a multi-engine rating. This rating allows the pilot to fly only the type of multi-engine aircraft in which the instruction is received. To fly another type of multi-engine aircraft, the pilot must have that type aircraft added to his or her pilot certificate by taking additional instruction in that type aircraft.

Personal Aviation

Most people are surprised to learn that personal flying accounts for only 24 percent of all hours flown by general aviation aircraft. Generally, people think of all general aviation aircraft as small "puddle jumpers" being flown by an individual for fun or for personal transportation. The news media generally refers to private airplanes as all non-air carrier and non-military aircraft. This category of general aviation is the largest both in terms of the number of hours flown and the number of aircraft.

Personal aviation is the use of an aircraft for other than business or commercial use. It is often called private aviation, although this term is often misused by the news media. The private plane is used in the same way and for the same purposes as a private car. It may be used to carry the family on a vacation, to take friends to a football game, or just for the fun and relaxation of flying. The thing to remember is that you cannot tell a personal aircraft from any other type of general aviation aircraft just by looking at it. The only difference is in its use.

From the early 1920s until the beginning of the 1980s, names like Cessna, Beechcraft and Piper were synonymous with general aviation. The vast majority of all the general aviation aircraft flying anywhere in the world were manufactured in the United States. Most of them were built by Cessna, Piper and Beech Aircraft, and were built before 1980.

The Air Force Academy T-41

Beech Aircraft Company

Beech produced six aircraft models that fit into our definition of the typical personal aircraft. All of them are all-metal, low-wing monoplanes. We will discuss three of these—the Sundowner, the Sierra, and the Bonanza F-33. Of these, only the Bonanza is still in production.

The Bonanza F-33 is a descendant of one of the most recognizable of all aircraft, the V-tail Bonanza. The Bonanza F-33 has a 285-horsepower Continental engine and a constant-speed propeller. The tricycle gear is retractable. It has a large 1,300-pound payload and is fast (150 to 200 mph). It also has a long range (800 to 1,000-miles). The Bonanza is a very reliable airplane and can be equipped with many options including an autopilot. Many consider it the finest single-engine, fixed-wing aircraft built today.

Beechcraft are prestigious aircraft and, like prestigious automobiles, have a great deal of standard equipment.

The Beechcraft Bonanza *(EAA)*

Cessna Aircraft Company

The Cessna Aircraft Company produced eight different models of the four-place personal aircraft. All of them are high-wing monoplanes and are among the most successful airplanes in the aviation industry.

They are the only all-metal, high-wing aircraft manufactured in the United States. Their "home base" is Wichita, Kansas, which is sometimes referred to as the "Air Capital of the World."

Cessna has been building aircraft since 1927 and is the world's largest manufacturer of general aviation airplanes. It has produced a total of 179,000 aircraft. However, production of all entry-level aircraft ceased in 1986. In the 90's, Cessna once again started manufacturing the 172 Skyhawk and 182 Skylane aircraft.

The Cessna 172 Skyhawk has a 160-horsepower Lycoming engine and a fixed-pitch propeller. It also has fixed (non-retractable) landing gear. The Skyhawk has a payload of

Cessna 172 Skyhawk

950 pounds, a cruising speed of 116 to 135 mph and a maximum cruising range of 695 miles. This was the best selling of all Cessna aircraft and the one most often purchased as a "first" aircraft.

The Cutlass RG was the least expensive retractable-landing-gear aircraft offered by Cessna. The retractable landing gear reduces drag, thus increasing performance. The Cutlass has a 1,120-pound payload and the 180-horsepower Lycoming engine provides a cruising speed of 139 to 161 mph. The maximum cruising range is 967 miles.

The Cessna 185 Skywagon is a "tail dragger." You will notice in the figure that the Skywagon has its main landing gear set more forward than the other aircraft. Also, in place of the nosewheel the Skywagon has a tailwheel. This arrangement causes the Skywagon to sit on the runway with its nose high, whereas tricycle-gear aircraft sit level. This nose-high attitude makes it more difficult to see straight ahead while taxiing the aircraft; however, taildraggers have other advantages. The Skywagon has a 300-horsepower Continental engine which gives it a cruising speed of 130 to 170 mph and a maximum range of 750 miles.

Cessna's venerable Skywagon

The 210 Centurion was a "top of the line" in Cessna personal aircraft. The Centurion is powered by a 300-horsepower Continental engine, which drives a three-bladed, constant-speed propeller. It has a 1,650-pound payload and a maximum range of 1,250 miles. The Centurion cruises at 175 to 193 mph. For those who can afford it, the Centurion is probably the roomiest and most comfortable four-place aircraft built in the United States.

Mooney Aircraft Company

The Mooney 201 is an all-metal, low-wing aircraft with a retractable tricycle landing gear. It has a payload of about 1,000 pounds and a 1,100-mile range. The Mooney 201 is powered by a 200-horsepower Avco Lycoming engine, which gives it a cruising speed of 160 to 190 mph. There's an interesting bit of trivia about Mooney. At one point in their manufacturing history, they produced an airplane that had a Porsche engine in it!

The Mooney 201

Piper Aircraft Company

Piper Aircraft Company has been building airplanes since 1929; although prior to 1937, it was known as the Taylor (Brothers) Aircraft Company. Throughout the years, Piper has had a reputation for reliability and simplicity. Piper is one of the "big three" of general aviation. At one time, Piper manufactured nine models of personal aircraft. They were all-metal, low-wing monoplanes. Today, it produces six piston-engine aircraft under the name of the New Piper Airplane Company.

One of Piper's most popular aircraft is the Arrow. It has a 200-horsepower Lycoming engine and a cruising speed of 142 to 165 mph. The payload for the Arrow IV is 1,125 pounds and the maximum range is 850 miles.

The exotic Piper Malibu is a six-place aircraft that was introduced in 1983. The Malibu holds several single-engine speed records including Oakland, California, to Honolulu, Hawaii, with an average speed of 200.2 mph. The Malibu is powered by a 310-horsepower Continental turbocharged engine and is pressurized to fly at altitudes up to 25,000 feet. Its cruising speed at optimum altitude is 250 mph, and has a range of up to 1,700 miles.

Piper PA-18 Super Cub was first offered in 1949. This makes it a record holder for the longest continuously produced airplane in American aviation history. There have been over 40,000 Super Cubs produced since it was introduced, and Piper still builds the Super Cub, but only on special order. The Super Cub is the only high-wing aircraft manufactured by Piper and is also the only fabric covered one. The latest Super Cubs are equipped with 150-horsepower Lycoming engines. The first model was powered by a 90-horsepower Continental. It is a small, two-place airplane that cruises at 105 to 115 mph and has a 460-mile range.

The New Piper Archer III

Sport Aviation

Sport aviation is often called "flying for fun." It is basically flying for some purpose other than transportation or business. Some people do it as a hobby, some for relaxation, some for competition (racing) and some for the thrill of it (aerobatics). Whatever their motive, sport aviators comprise a small but enthusiastic segment of aviation.

Sport aviation is generally broken down into the following divisions: (1) homebuilts, (2) ballooning, (3) soaring and gliding, (4) antique aviation, (5) racing, (6) aerobatics (stunt flying) and (7) ultralights. With the exception of ultralights, all other forms of sport aviation require the pilot to have at least a private pilot certificate.

KANDLA
AHMADABAD
DAHOD
Vadodara
NDB
VADODARA
NDB
PORBANDAR
BHAVNAGAR
VOR-NDB
VAR49B
3666
VAR44
JALGAON
5140
VAR39
AURANGABAD
20°
SOLAPUR
VOR-NDB
BELGAUM
2°W
NR2101
N51BE

Homebuilts

This phase of sport aviation combines the love of flying with the hands-on hobbies of woodworking, fabrics, welding, metal working and composite construction. In this endeavor, the pilot actually builds the airplane either from a kit or from a set of plans. For many, the incentive is that they can become an airplane owner by building their own aircraft much more cheaply than by buying one. They can also build an airplane that is sportier looking than a factory-built airplane, or they can even build a replica of a famous "warbird." The prices vary from only a few hundred dollars for the plans to complete kits costing well over $100,000. A variety of engines are available from two-stroke to modified automotive 4s, V-6s,V-8s and custom built V-12s.

The FFP Classic

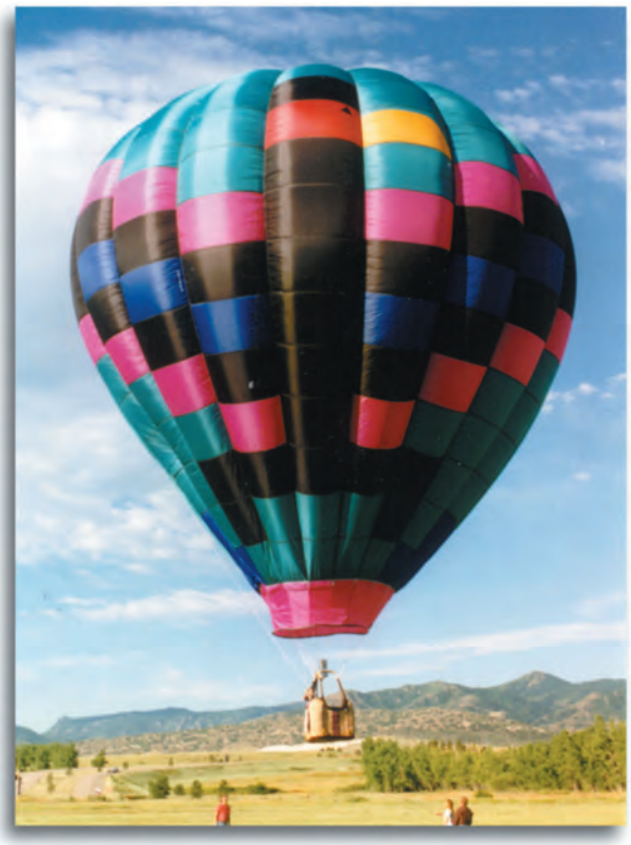
This homebuilt airplane was constructed by a group of advanced aeronautics students at Littleton High School, Littleton, Colorado.

A homebuilt aircraft must pass FAA inspections, and it is certificated in a special category as an experimental aircraft. In order to qualify for the special certificate, 51 percent or more of the fabrication must be done by the homebuilder. One major consideration of homebuilding is the commitment of time. It is not uncommon for an airplane to take 5 years to complete. Too often, many projects are abandoned because of the time involved.

Ballooning

In the past few years, many sport aviators have turned to hot-air ballooning for recreation. These aircraft include the large envelope (gasbag), which is usually made of polyester and a basket suspended under the envelope. The basket carries the passengers, flight instruments, propane gas and the burners that keep the envelope inflated.

The envelope is inflated first by using a large fan to blow air into the round opening at the bottom of the envelope. After the envelope has air in it, the burner is lighted and the hot propane flame heats the air inside. To make the balloon rise, the air is heated more. To make the balloon descend, the burner is shut off allowing the air inside to cool down. For more rapid descents, there is a vent shaped like a parachute, in the top of the envelope. This allows a large volume of hot air to escape.



A hot air balloon takes off from the Montgolfier Balloon Port near Denver, Colorado.

The balloons are equipped with an altimeter, rate-of-climb indicator, envelope temperature gauge and compass. They also have a two-way radio for communications with the ground.

Balloon enthusiasts believe this is the ultimate in aviation sport. Balloons are carried along by the wind, and the pilot controls the direction by finding winds blowing in different directions at various altitudes.

Soaring and Gliding

There is a group of aviators who fly unpowered sailplanes. Their sport is often called soaring or gliding, but there is a big difference between the two. Gliding is the controlled descent of an unpowered aircraft while soaring is flying without engine power and without loss of altitude. If a sailplane is towed up to altitude and after release it descends to a landing, that is gliding. Similarly, if a person with a hang glider jumps from a high place and descends to a landing, that is gliding. Soaring, on the other hand, involves finding and riding air currents so that the aircraft remains aloft or even gains altitude.

Soaring is a well-organized and competitive sport. There are soaring meets with prizes given for highest altitude, longest-duration and longest-distance flights. This aspect of sport aviation is much more popular and much larger in number of pilots soaring in Europe than in the United States.

Sailplanes are necessarily very lightweight. They must produce a great deal of lift at relatively low speeds in order to remain airborne. For lightness, most competitive sailplanes are constructed of aluminum tubing or wood, covered with fabric or fiberglass over a foam-sandwich material.

The TG-4A sailplane is the aircraft used to train Air Force Academy cadets.

For many years, the best competitive sailplanes came from Europe, but now the United States is manufacturing a few which match the best of the Europeans. Schweizer Aircraft Corporation is the leading US manufacturer. They build training sailplanes, family sailplanes, and medium- to high-performance competitive sailplanes. Two examples are the SGS 2-33A and the SGS 1-35. The SGS 2-33A is a two-place training and family sailplane. This 600-pound aircraft is only 26 feet long and has a 51-foot wingspan. Its fuselage is fabric with a fiberglass nose, and it has an all-aluminum wing.

There are about five other sailplane manufacturers in the United States. They produce quality sailplanes both in kit form and as factory-produced aircraft.

Antique Aviation

This segment of sport aviation involves either finding and restoring a vintage aircraft or building replicas of old airplanes from original plans. This phase of sport aviation attracts the same type of people who collect antique automobiles, furniture and other items. They want to preserve these pieces of the past because they are irreplaceable.

In order to qualify as an antique, an aircraft must be at least 20 years old. This area of sport aviation is very expensive and generally attracts people from the higher-income levels. When restoring an old aircraft, it is often impossible to obtain the parts you need, so they have to be handmade. For example,

Antique Airplane *(EAA)*

One of the great warbird trainers, the Consoldated Vultee BT-13 *(EAA)*

to restore a Piper J-3 Cub may cost $20,000 in addition to the $3,000 to $5,000 purchase price. Some of the very rare aircraft can easily cost over $100,000.

The warbirds aviation buffs collect, restore, and fly aircraft that served during times of conflict. These include World War I, World War II, Korea, Vietnam and Desert Storm.

Some of the most popular are the P-40, P-51 Mustang, P-47 Thunderbolt, AT-6 Harvard, Supermarine Spitfire, Hawker Hurricane, Messerschmitt Bf l09 and Mitsubishi A6M Zero. This phase of antique aviation is fast becoming the most expensive of all. In 1961, a person could buy a P-51 for about $1,500. Today, the cost can easily exceed one million dollars. They are becoming scarce, their parts are hard to find and labor costs to work on them are skyrocketing.

Racing

Each year the National Championship Air Races are held in Reno, Nevada. This is a pylon race where the airplanes race around markers (pylons), with the racers flying about 50 to 200 feet above the ground. The low altitude and high speeds put a great strain on the aircraft and the pilots.

The racing aircraft are classified according to size and power. The unlimited class is made up of World War II fighter aircraft, and they will race at speeds in excess of 400 mph. The other categories include the AT-C (which is limited to AT-6 aircraft only) and the Formula One category. The Formula One racers are small single-place (20-foot wingspan, weighing about 850 pounds) aircraft, powered by small 100-horsepower engines. They reach speeds of over 200 mph when racing.

Aerobatics

The most familiar aspect of sport aviation is the air show with all its special flying events. The main event in these air shows is aerobatics, which used to be called stunt flying. This activity is too precise to be called stunting now, especially when a team performs the aerobatic maneuvers. More truthfully, it should be called precision flying.

Aerobatic flying requires aircraft that can withstand tremendous forces and that can fly upside down, right side up, and everything in between. It also requires a particularly skillful pilot. The pilot must have very good vision and distance judgment, and must be able to think and react calmly while under a great deal of pressure. Many of the best aerobatic pilots in the world are women.

Aerobatic Biplane

Some of the maneuvers seen during a typical aerobatic performance are loops, the hammerhead stall, rolls, Cuban 8s, the Immelmann, spins and the splits.

Some of the aerobatic aircraft used by pilots in the United States are the Bellanca Citabria and the Cessna 150 Aerobat, both production-models. Also, many US pilots use several smaller biplanes, like the Pitts Special.

Ultralights

These small, lightweight aircraft began as powered hang gliders. Ultralight pilots feel that this is the only area of powered flight with the freedom to fly whenever and wherever one desires. Ultralight aircraft do not require FAA certification and pilots do not need a license or medical examination.

In the 1970s, ultralights were all "foot-launched." This meant that the aircraft was picked up and launched by running along the runway with it until flying speed was attained. These early ultralights had no landing gear, but today many have wheels.

Power plants for ultralights must be small and lightweight because of the weight restrictions involved. Ultralights are relatively inexpensive ($5,000 to $20,000) and are available either assembled or in kit form.

In this chapter, we have discussed three areas of general aviation—instructional, personal and sport. These three areas involve learning to fly and the fun activities in aviation. In the next chapter, we will talk about general aviation, which is directly or indirectly related to business.

Ultralight Aircraft

Fisher Flying Product FP202 Ultralight

Key Terms and Concepts

- general aviation
- Aircraft Owners and Pilots Association (AOPA)
- instructional aviation
- personal aviation
- sport aviation
- business aviation
- commercial aviation
- antique aviation
- aerobatics
- ultralights

? Test Your Knowledge ?

SELECT THE CORRECT ANSWER

1. **(Ultralights/Antique aircraft)** *are relatively inexpensive, ranging from $5,000 to $20,000.*
2. **(Beech/ Cessna/ Piper)** *is the largest manufacturer of general aviation aircraft in the world.*
3. *Homebuilt aircraft must pass* **(FAA inspections/AOPA inspections)** *and then it is certified as a/ an* **(homebuilt aircraft/experimental aircraft)**.

FILL IN THE BLANKS

4. _____ *is defined as all civil aviation other than flying done by the scheduled air carriers and government agencies.*
5. *Just over 20 percent of general aviation is* _____ *while almost 80 percent is either directly or indirectly* _____.
6. *Ninety percent of the instructional aircraft are* _____ .
7. *The two companies with the most name recognition in personal and trainer aircraft are* _____ *and* _____.

8. *Fill in the blanks with the names of the divisions of sport aviation:*
   _____*Use small, light weight aircraft requiring no license*
   _____*Involves finding and riding air currents to remain aloft*
   _____*Aircraft includes the gasbag, basket, instrument, burner, propane*
   _____*Contest where planes fly around pylons*
   _____*Involves the controlled descent of unpowered aircraft*
   _____*Should really be called precision demonstration flying*
   _____*The pilot actually constructs their own aircraft*
   _____*Involves restoring vintage airplanes or building replicas of them*

TRUE OR FALSE

9. *Flight training is a highly competitive business and manufacturers provide considerable assistance.*
10. *One of the incentives of homebuilts is that you can become an aircraft owner for substantially less money.*
11. *Racing aircraft are classified according to size and power.*
12. *Soaring is more popular in the US than in Europe.*
13. *The lift for balloons is provided by heating helium.*

SHORT ANSWER

14. *List the five groups of general aviation*
15. *Describe the typical instructional aircraft.*
16. *Describe the typical personal aircraft.*
17. *What are some of the reasons given to enjoy sport aviation?*