

# LEARN TO FLY

***Become a pilot.***

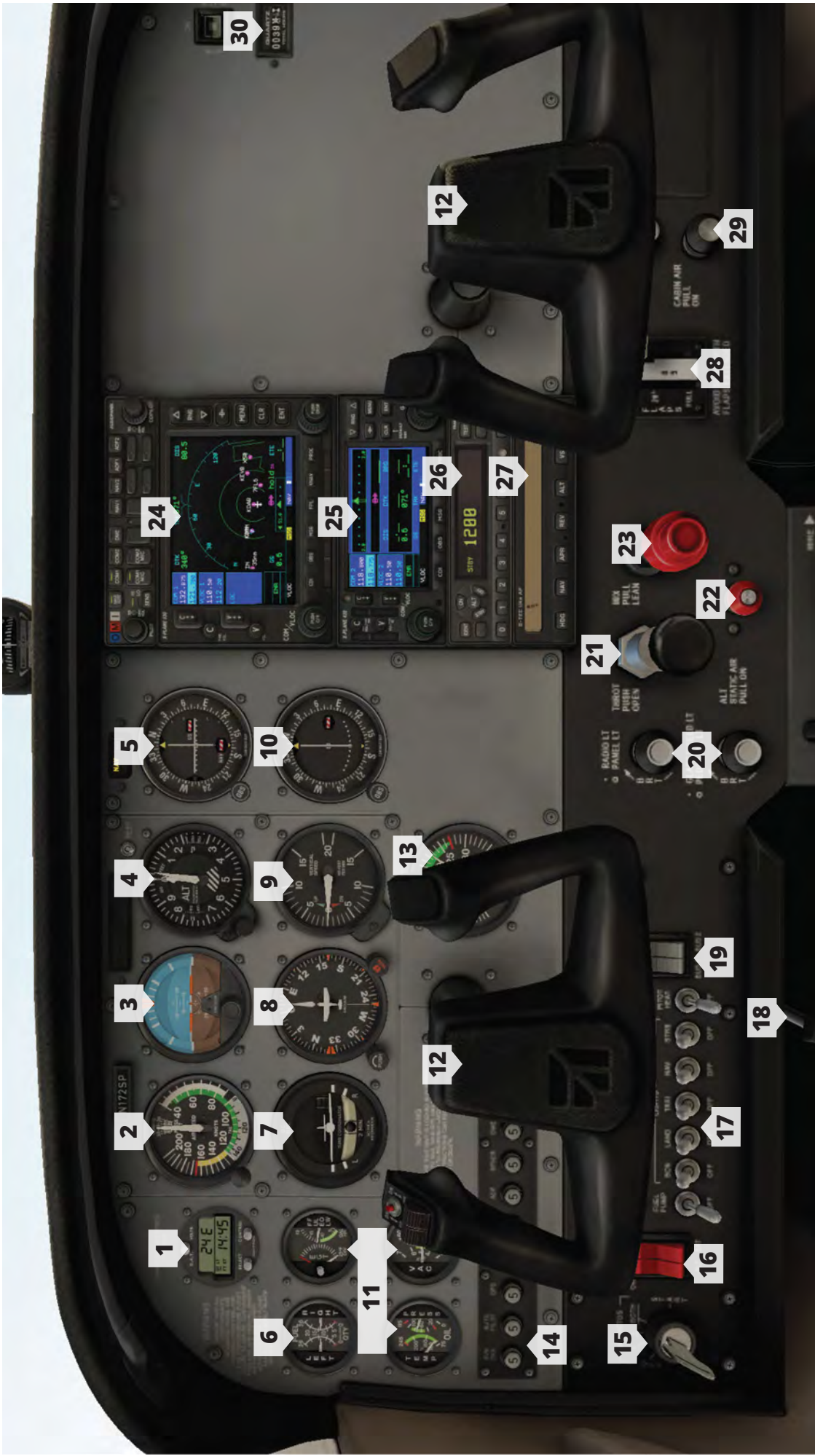


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*Irvin N. Gleim || Garrett W. Gleim*





- |                             |  |                             |                         |
|-----------------------------|--|-----------------------------|-------------------------|
| 1. Clock                    | 10. NAV 2                                | 18. Parking Brake           | 25. GPS                 |
| 2. Airspeed Indicator       | 11. Engine Instruments                   | 19. Avionics Switch         | 26. Transponder         |
| 3. Attitude Indicator       | 12. Control Yoke                         | 20. Interior Panel Lights   | 27. Autopilot           |
| 4. Altimeter                | 13. Tachometer                           | 21. Throttle                | 28. Flap Control        |
| 5. NAV 1                    | 14. Circuit Breaker Panel                | 22. Alternate Static Source | 29. Temperature Control |
| 6. Fuel Quantity            | 15. Magneto Switch                       | 23. (Fuel) Mixture Control  | 30. Hobbs Meter         |
| 7. Turn Coordinator         | 16. Master Switch (Alternator & Battery) | 24. Avionics                |                         |
| 8. Heading Indicator        | 17. Engine Switches                      |                             |                         |
| 9. Vertical Speed Indicator |  |                             |                         |

**GLEIM**<sup>®</sup> | Aviation  
Training Aviators Since 1980

# LEARN TO FLY

***BECOME A PILOT***

by  
Irvin N. Gleim, Ph.D., CFII  
and  
Garrett W. Gleim, CFII

We are glad you are interested in learning to fly. This *Learn to Fly* booklet has helped millions of aspiring aviators of all ages determine the steps required to become a pilot and pursue their aviation dreams.

At Gleim Aviation, our goal is to provide valuable, user-friendly self-study materials that are highly effective in training you to become a skilled and safe aviator. Just as a great teacher can lead a class that helps you learn, our carefully-designed Online Ground School courses, FAA Test Prep, Audio Review, and reference books will make it easy for you to learn and understand aviation.

Deciding whether you want to become a pilot is a big step, but as you prepare for each aviation milestone, we are here to help! We convert the FAA test prep process from a memorization marathon into a learning opportunity and rewarding experience. You will get higher test scores in less study time. Our products are designed to save you time, effort, frustration, and money.



Irvin N. Gleim, Ph.D., CFII



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# LEARNING TO FLY

## Taking Off

The thrill of flying comes with unparalleled freedom and makes the achievement of becoming a pilot even more rewarding. Flying an airplane and becoming a pilot is fun! You may want to become a pilot for the privilege of flying yourself to airports in thousands of destinations or seeing beautiful sights from the flight deck. If your goal is to become a career pilot, the opportunities you will discover also bring an alluring responsibility.

On a commercial flight, passengers rarely see how pilots use the controls, which makes it hard to imagine flying an airplane yourself. The next time you see an airplane, picture yourself flying as the pilot. You're sitting on the flight deck, feeling confident and ready to take to the skies. In addition to controlling the left and right turns of the airplane, you are controlling altitude – up and down movement.

The complexity and freedom of three-dimensional movement makes flying far more exhilarating than driving, and you also get to enjoy greater speeds and spectacular panoramas. Flying an airplane is more complex than driving a car, but with practice you'll gain lifelong satisfaction and pride. Flying can change how you approach many facets of life.

Many people consider learning to fly beyond their capability or budget, but it is not as difficult, time consuming, or expensive as is generally believed. Earning a pilot certificate requires specific flight experience, a knowledge test, and a practical (flight) test. With help from Gleim, you can complete your training quickly and affordably – while having fun!

Use this booklet to learn more about airplanes, careers in aviation, and how to prepare for your flight training.

Don't forget to take your First Flight Certificate (found on the last page of this booklet) to the airport with you!

## Scheduling a Discovery Flight

A discovery flight (or introductory flight) is an amazing opportunity for you to experience flying. Before making any flight-training commitments, a discovery flight offers an opportunity to “try before you buy” and see how you feel about general aviation.

There are several ways to take your first flight:

- Contact a local flight school to schedule a discovery flight.\*
- Attend a Young Eagles rally and get a free airplane ride with an Experimental Aircraft Association pilot.
- Take a Cadet Orientation Flight with the Civil Air Patrol.
- Fly with a friend, family member, or colleague.

You will find that flying is not as difficult as you previously thought, **and it's a lot more fun!** We suggest that you request an early morning or late afternoon flight when it's cooler, with the objective of flying in smooth air, which will offer a better introduction into aviation. Windy or cloudy conditions will make your flight bumpy and/or obscure your view, so try to reschedule if necessary to ensure you enjoy the experience.

**Congratulations on taking your first step toward learning to fly!**

\*Read and understand this booklet (especially pages 12-27) before scheduling your discovery flight to make the most of your experience. Understanding flying before you are in the air will allow you to appreciate every aspect of the flight.





## Starting Flight Training

### Compare Flight Schools

Visit one or more flight schools at your local airport where you are considering taking flight lessons. Indicate that you are interested in taking flight lessons and make sure you feel comfortable with the instructor and the flight school. Compare prices with similar schools and make sure you understand what's included in the training.

Questions to Ask:

- What are the aircraft rental and instructor time costs?
- Does your flight school offer discounted rates for advance or lump-sum payments?
- What is the schedule of available aircraft?
- Do you offer any training on flight simulators?
- Do you offer discovery flights for a nominal fee?  
May I take it with no further obligation?
- Where do you recommend I take my FAA knowledge and practical tests,  
and what are the costs?



## Choosing Between Part 61 and Part 141 Training

Students often ask about the differences between Part 61 and Part 141 training. These refer to the sections in the Federal Aviation Regulations that define minimum pilot training requirements and certification of flight schools: 14 CFR Part 61 and Part 141.

When deciding between Part 61 and Part 141, it is important to consider how you learn, what your goals are as a pilot, and your availability to attend lessons. Consider the following factors:

### Part 61 Training

- Flexible training schedule
- Part-time training options
- Choose from any Certificated Flight Instructor (CFI) or flight school (potentially in more convenient locations)
- Requires more flight training hours:
  - Private Pilot:** 40+
  - Commercial Pilot:** 250+
- No minimum required ground training hours

### Part 141 Training

- Best if you want to be a professional pilot
- Fast-paced training
- More rigid structure
- Must meet minimum pass rates for pilot certification; overseen by the FAA
- Requires fewer flight training hours:
  - Private Pilot:** 35+
  - Commercial Pilot:** 190+
- Requires 35+ ground training hours

#### Flight Training Tip

Keep in mind, most students do not earn their Private Pilot certificates at the FAA minimums, and many pilots take 55-75 hours to complete their training. However, if your goal is becoming a professional pilot, Part 141 training for commercial pilots can offer significant savings in both time and money.

#### Ground Training Tip

Students who spend more time studying and learning during ground school typically finish their flight training faster.

If you are still not sure, you should visit both types of schools. Tour the facilities, interview the staff and instructors, and discuss your aviation goals to find out for yourself which one you prefer.

Regardless of which type of school you attend, you will need to gain the same aeronautical knowledge and meet the same performance standards when you take your FAA knowledge and practical tests.

## Scheduling a Visit to Your Local Airport

Now that you have an understanding of the different types of flight schools, let's set up a visit!

### Step 1

Find a local flight school or instructor using the Gleim search tools available at [GleimAviation.com/findacfi](https://www.gleimaviation.com/findacfi).

### Step 2

Contact the school or instructor to set up a time to visit. Explain that you are interested in learning more about aviation and flight training and would like a tour.

### Step 3

Arrive at the airport on time and take your tour. Answer any security questions, then follow your escort's instructions as you move outside to take a tour. Be sure to ask questions about what is going on at the airport.

### Step 4

Thank your escort for his or her time and assistance and ask if there is a place you can sit to observe air traffic. Enjoy the view!

### Step 5

Find another local airport and repeat the process. You may find that you are more excited than ever to get involved in aviation. The more airports you visit, the better understanding you will have of how general aviation works and how to become a part of the excitement.

## Your Introductory Flight

When you meet your instructor or pilot for your introductory flight, he or she will likely give a short briefing on what to expect before taking you to the airplane. The pilot will do a preflight inspection and answer your questions. When you start training, your instructor will teach you what to inspect. **Remember, safety is paramount!**

Once in the plane, your instructor will help you adjust your seat and seat belt. If the cockpit looks daunting, just think about what you read in this booklet to better understand the flight controls and instruments. Notice how your instructor uses the checklist. You might even get to read some of the items to ensure every step is done and the airplane is safe to fly.

After the pilot starts the engine, you may get to taxi the airplane, which you steer with your feet by pressing the rudder pedals. Your airplane will have two complete sets of controls so the instructor can help. After all the checks are done, the airplane is ready for takeoff. Your pilot will taxi onto the runway, line up with the centerline, and advance the throttle to full power. The instructor may have you keep a hand on the control yoke and both feet on the pedals. Follow your instructor's movements as they fly the airplane.

Once aloft, your instructor will take their hands off the controls and guide you through the basic fundamentals of flight. Don't worry, your instructor is there to help. When it's time to return to the airport, the instructor will take over and land the plane. Reflect on your newfound freedom as you taxi back to parking.

Flying a plane can be a magical experience! As with anything new, it will take time to learn, practice, and perfect your new skills. Remember that at one time, your flight instructor, airline pilots, and even astronauts were sitting right where you are now. Stay committed to the learning process and you'll enjoy every moment of your training!



## Find a Flight Instructor

Find a local Certificated Flight Instructor (CFI) by visiting [GleimAviation.com/findacfi](http://GleimAviation.com/findacfi) (our CFI Directory) or browse the Internet to compare instructors and read reviews. Before making your final decision, speak to several potential flight instructors and ask the following questions to gain insight into their teaching style.

Questions to Ask:

- What is your schedule and availability for training?
- Can I use my Gleim Pilot Training Syllabus?  
Download the Gleim *Private Pilot Syllabus* at [GleimAviation.com/syllabus](http://GleimAviation.com/syllabus)
- How long does your average student take to solo?
- How many total hours of solo and dual flight do your students typically require for the pilot certificate?
- Do you use a flight simulator?



## Plan Your Training

Once you have chosen your flight instructor, you need to sit down with them and map out a plan for your training timeline. Once you begin your pilot training, purchase a local sectional chart, a Chart Supplement, and a copy of your airplane's *Pilot Operating Handbook* (POH) or *Airplane Flight Manual* (AFM). You can also talk to your instructor about using electronic charts.

Questions to Ask:

- When and how often will I fly?
- When will I take the FAA pilot knowledge test?
- When should I plan to take my FAA practical test?
- Where do you recommend that I take my medical examination?
- When and how should payments be made for instruction?



Photo courtesy of Women in Aviation International

## Helpful Aviation Organizations

GLEIM supports all aspects of the flight training industry, particularly organizations that focus on aviation recruitment, flight training, and advocacy. If you are interested in joining an aviation organization to meet other aviation enthusiasts, apply for training scholarships, or see firsthand what the aviation industry looks like, check these out.

### Aircraft Owners and Pilots Association

[aopa.org](http://aopa.org)

The Aircraft Owners and Pilots Association (AOPA) has a You Can Fly program designed to support flying clubs, encourage best practices in flight training, and help high school students learn more about careers in aviation. You Can Fly is working to make flying more accessible and affordable!

### Experimental Aircraft Association

[YoungEagles.org](http://YoungEagles.org)

The Experimental Aircraft Association's (EAA) Young Eagles program has provided free introductory flights to more than 2 million young people ages 8 to 17. This program provides insight into how an airplane flies and what it takes to become a pilot.

### Women in Aviation International

[wai.org](http://wai.org)

Women in Aviation International (WAI) members get access to job search and scholarship opportunities, access to mentors in their industry, and much more. WAI provides resources to assist women in aviation and encourage young women to consider aviation as a career. Each year, Girls in Aviation Day is celebrated with hundreds of events worldwide for girls ages 8 to 17.

### Society of Aviation and Flight Educators

[SafePilots.org](http://SafePilots.org)

SAFE is a member-driven professional organization open to all aviation educators and provides members with mentoring, support, and professional accreditation.



Photo courtesy of Civil Air Patrol

To find out about aviation scholarships, visit [GleimAviation.com/Scholarships](https://gleimaviation.com/Scholarships).

## Organization of Black Aerospace Professionals (OBAP)

[obap.org](https://obap.org)

OBAP is a nonprofit organization dedicated to the inclusion and advancement of minorities in all aviation and aerospace careers. OBAP encourages diversity in the industry by supporting aspiring aviation professionals through Project Aerospace, a series of virtual and in-person youth programs, scholarships, mentoring, and a flight school offering a range of training opportunities.

## National Association of Flight Instructors

[nafinet.org](https://nafinet.org)

Founded in 1967, the National Association of Flight Instructors (NAFI) is dedicated exclusively to raising and maintaining the professional standing of flight instructors in the aviation community.

## The Ninety-Nines

[ninety-nines.org](https://ninety-nines.org)

The Ninety-Nines is an international organization of women pilots from 44 countries, with thousands of members throughout the world. Virtually all women of achievement in aviation have been or are members of The Ninety-Nines. The organization sponsors hundreds of scholarship and educational programs, including aerospace workshops for teachers, airport tours for students, fear-of-flying clinics for airline passengers, and more.

## Civil Air Patrol

[gocivilairpatrol.com](https://gocivilairpatrol.com)

The Civil Air Patrol (CAP) offers a cadet orientation flight program designed to introduce new cadets to flying and stimulate their interest in aviation. Each orientation flight is always free to cadets thanks to volunteer pilots.

# UNDERSTANDING AIRPLANES

## Types of Aircraft



### Airplanes

- Single-engine land
- Multi-engine land
- Single-engine sea
- Multi-engine sea



### Rotorcraft

- Gyroplane
- Helicopter



### Lighter-than-air

- Airship
- Gas balloon
- Hot air balloon



### Gliders



### Powered lift



### Powered parachute



### Weight-shift-control

# On the Flight Deck

## Flight Instruments

When you are sitting in an airplane for the first time, you will probably notice six flight instruments in front of you. The typical arrangement of these instruments is shown below.

The **airspeed indicator** (ASI) displays the speed at which the airplane is moving through the air. The ASI in the figure is indicating an airspeed of 84 knots.

The **attitude indicator** (AI) displays the attitude of the airplane (nose up, nose down, wings banked) in relation to the horizon. The AI in the figure is indicating a climbing right turn.

The **altimeter** (ALT) displays the altitude of the airplane above mean sea level (MSL) when properly adjusted to the current pressure setting. The ALT in the figure is indicating an altitude of 4,900 ft. MSL.

The **turn coordinator** (TC) displays the rate at which a turn is being made. The miniature airplane banks in the direction of the turn. At the bottom of the instrument is a ball in a glass tube called an inclinometer. The inclinometer indicates whether the airplane is in coordinated flight (ball centered) or uncoordinated flight. The TC in the figure is indicating a right turn and uncoordinated flight.

The **heading indicator** (HI) displays the heading (direction) the airplane is flying. The HI in the figure is indicating a heading of 250°.

The **vertical speed indicator** (VSI) displays whether the airplane is in level flight, climbing, or descending. The rate of climb or descent is indicated in hundreds of feet per minute. The VSI in the figure indicates a climb at 700 feet per minute.



### Sport Pilots:

You may not have all six flight instruments.

At a minimum, you will have:

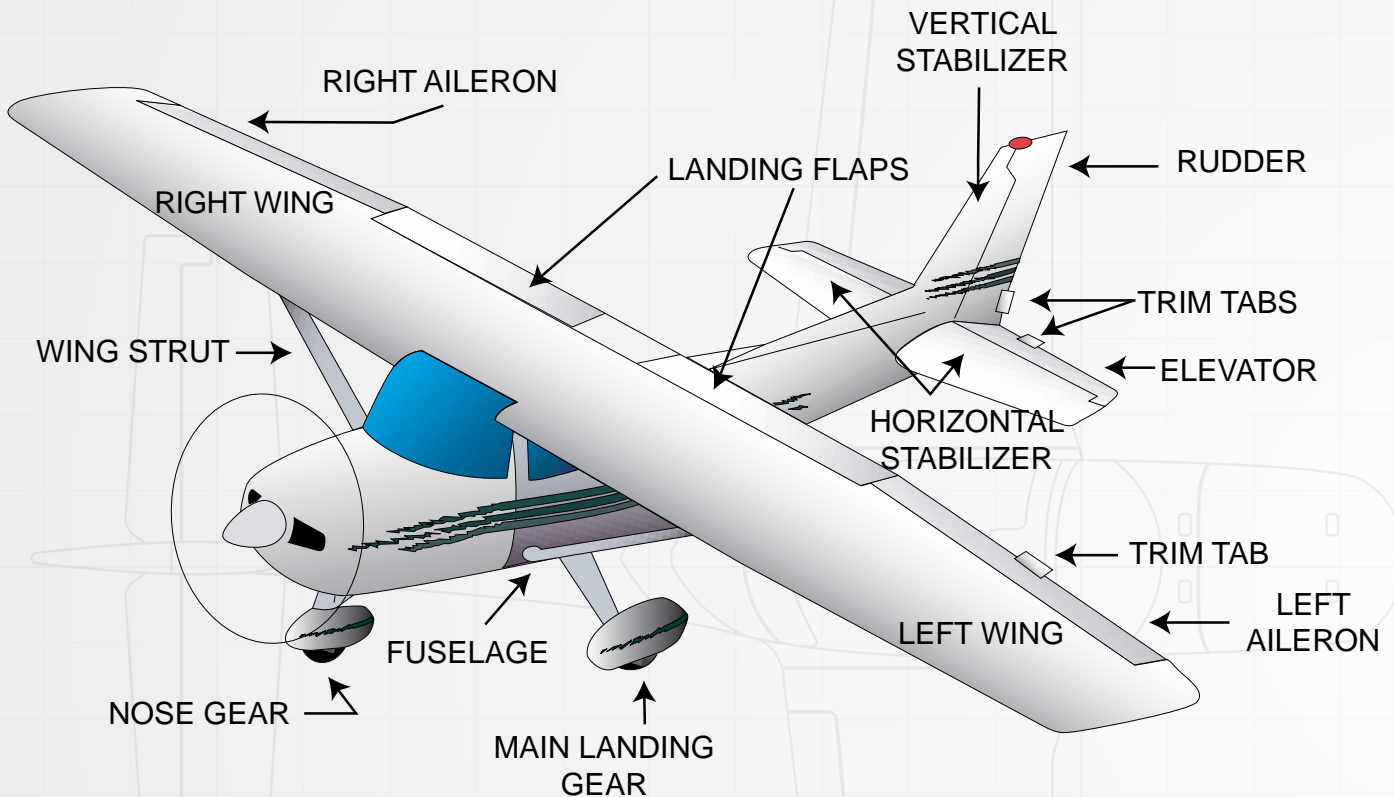
1. Airspeed indicator
2. Altimeter
3. Compass to determine direction in lieu of a heading indicator

A **glass cockpit** – seen inside the back cover – is a system of electronic flight displays (EFDs) and associated components that display information like aircraft flight attitude and direction, GPS location, and pertinent engine information. These systems are designed to decrease pilot workload, enhance situational awareness, and increase the safety margin. Many major aircraft manufacturers now have a full glass cockpit as standard or optional equipment.

# Parts of the Airplane

The purpose of this section is to introduce you to the parts of the airplane and to aerodynamics, i.e., the forces acting on the airplane in flight. Remember, this is technical material that will make more sense as you begin your flight lessons.

The figure below is of a high-wing aircraft, such as a Cessna 172. On low-wing airplanes, such as the Piper Cherokee, the wings are affixed to the bottom rather than the top of the fuselage.



## Fuselage

The main component of the airplane. Its function is to act as a carrier for the wings and tail section. It also is designed to produce some lift.

## Wing

The primary producer of lift on the airplane. The shape of the wing is called an airfoil. This shape provides lift by creating a low-pressure area on the top of the wing and a high-pressure area on the bottom. The air on top of the wing moves faster than the air flowing under the wing, which results in less pressure on top than on the bottom of the wing. This differential pressure causes a lifting force. At the same time, the bottom of the wing deflects air downward, which also produces lift.

## Nose gear

This component is designed to steer the airplane on the ground. It is not designed for excessive impacts or loads. However, it is designed to carry the weight of the forward portion of the airplane.

## Main landing gear

The component of the airplane that touches the runway first during a normal landing. It is designed to absorb large loads and impacts.



## Horizontal stabilizer

This structure, located in the rear of the airplane, is designed to provide continuous longitudinal (from front to rear) stability. It prevents uncontrolled up and down movements of the nose (pitching).

## Elevator

A movable part on the rear of the horizontal stabilizer. It is used to move the airplane about the lateral axis. It provides the pitch input and helps control altitude. The axes of rotation are discussed and illustrated on page 18.

## Vertical stabilizer

This surface provides directional (right or left) stability. It acts like a weathervane to prevent uncontrolled left or right movements of the nose (yawing).

## Rudder

This surface, which is connected to the vertical stabilizer, moves the airplane around its vertical axis and is used to yaw (move the tail to the left or right) the airplane.

## Elevator trim tabs

These small, movable surfaces decrease control pressures and help to establish hands-off flight (i.e., when the airplane will almost fly by itself). All airplanes have elevator trim tabs controlled from the cockpit.

## Right and left ailerons

These surfaces, located on the outside trailing edges of the wings, control the airplane around its longitudinal axis [i.e., the degree of bank (roll)] or whether one wing is higher or lower than the other wing.

## Aileron trim tab

This small, movable section of one or both ailerons permits adjustment so the wings remain level (i.e., you can compensate for more weight on either side of the airplane). Not all airplanes have aileron trim tabs.

## Flaps

These surfaces are located on the inside trailing edges of the wings. They can be extended to modify the shape of the wing at slower speeds. This provides more lift and drag and allows an airplane to land, take off, or fly at slower speeds.

## Nosewheel (tricycle) vs. tailwheel (conventional)

Nosewheel airplanes have the third wheel in front of the main landing gear (i.e., under the nose), as pictured to the left. Nosewheel airplanes have much better handling (because there is less airplane behind the pivot point) and visibility characteristics while taxiing. Almost all new airplanes are nosewheel design. Tailwheel airplanes have the third wheel under the tail. Tailwheel airplanes can land on much rougher terrain and, consequently, are favored by bush pilots. In a tailwheel airplane, this gear supports the weight of the rear portion of the airplane.

## Retractable landing gear

Landing gear normally retract into the wing or fuselage through an opening, which may be covered by doors after the gear is retracted. This reduces drag and increases airspeed without the need for additional power. A smooth door provides for the unrestricted flow of air across the opening that houses the gear. The retraction or extension of the landing gear is accomplished either electronically or hydraulically by use of landing gear controls within the cockpit. Warning indicators are usually provided in the cockpit to indicate whether the wheels are extended and locked or retracted. In nearly all airplanes equipped with retractable landing gear, a system is provided for emergency gear extension in the event landing gear mechanisms fail to lower the gear.

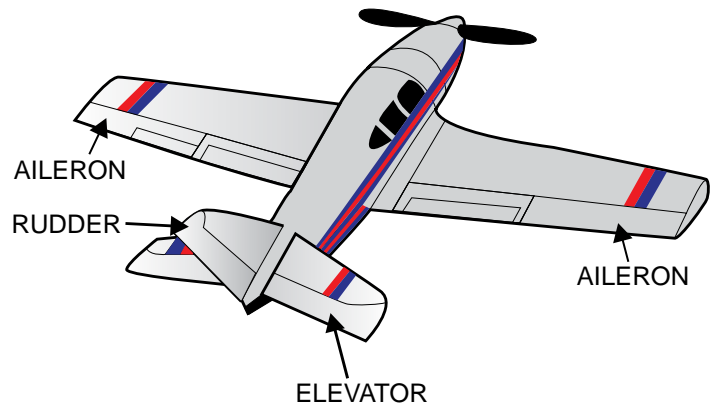
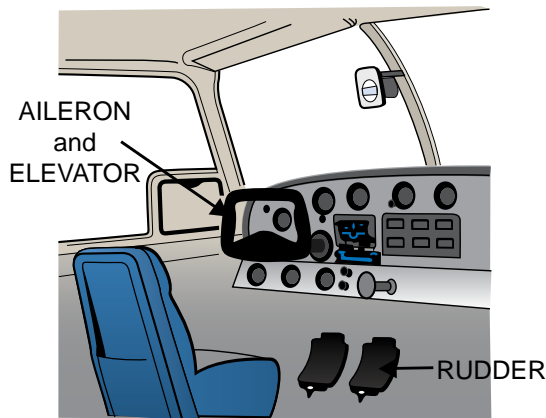
# Flight Controls

## Primary Flight Controls

The airplane is controlled by deflection of flight control surfaces. The pilot moves the flight control surfaces by moving the control yoke and rudder pedals.

The control yoke is similar to the steering wheel of a car. However, you can push and pull it in addition to turning it. The push/pull movement controls the third dimension in which airplanes move (up and down). Remember, a car can only go straight or turn (move in two dimensions), but an airplane can go straight, turn, and move up or down.

Each flight control plays a role in changing the airplane's attitude (whether the airplane is pointing up or down) during takeoff, flight maneuvering, and landing. These flight controls are detailed below.



The **ailerons** are the outboard movable portions of each wing. The term “aileron” means “little wing” in French. Ailerons are located on the trailing (rear) edge of each wing near the outer tips. When deflected up or down, they change the wing’s camber (curvature) and its angle of attack. This changes the wing’s lift and drag characteristics.

- Their primary use is to bank (roll) the airplane around its longitudinal axis. The banking of the wings results in the airplane turning in the direction of the bank (i.e., toward the direction of the low wing).
- They are interconnected in the control system to operate simultaneously in opposite directions of each other. As the aileron on one wing is deflected downward, the aileron on the opposite wing is deflected upward.
- They are controlled by turning the control yoke.

The **elevator** is attached to the horizontal stabilizer. The elevator provides the pilot with control of the pitch attitude about the airplane’s lateral axis. The elevators are controlled by pushing or pulling the control yoke.

The **rudder** is attached to the vertical stabilizer. Controlled by the rudder pedals, the rudder is used by the pilot to control the direction (left or right) of yaw about the airplane’s vertical axis for minor adjustments. It is not used to make the airplane turn, as is often erroneously believed. Banking the airplane makes it turn.



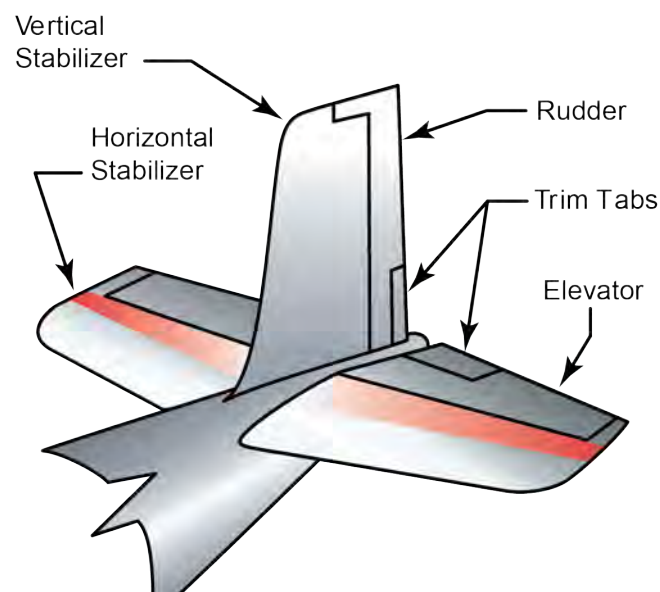
## Secondary Flight Controls

In addition to primary flight controls, most airplanes have another group called secondary flight controls. These include trim devices of various types and wing flaps.

**Trim tabs** are commonly used to relieve the pilot from maintaining continuous pressure on the primary controls when correcting for an unbalanced flight condition caused by changes in aerodynamic forces or weight.

**Wing flaps** are installed on the wings of most airplanes. Flaps increase both lift and drag and have three important functions:

- They permit a slower landing speed, which decreases the required landing distance.
- They permit a comparatively steep angle of descent without an increase in speed. This makes it possible to safely clear obstacles when making a landing approach to a small field.
- They shorten the required takeoff distance and allow a steeper climb path.



# How Airplanes Fly

## Basic Flight Maneuvers

At the beginning of each flight lesson, your instructor will sit down with you to go over what you will do during the lesson. This is called a preflight briefing. It is a discussion between you and your CFI that should answer all of your questions. Your home study before the lesson will reduce the time spent on the preflight briefing and provide you with quality flight training time – all of which keeps costs down.

In this section, we will provide you with more detailed information on the basic flight maneuvers (straight-and-level, turns, climbs, and descents). Read through each maneuver to understand the basic concepts. Write down questions to ask your instructor. They can help you grasp each concept clearly.

Objectives:

1. Learn the proper use of flight controls for maneuvering the airplane.
2. Attain the proper attitude in relation to the horizon by use of visual and instrument references.
3. Emphasize the importance of dividing your attention and constantly checking all reference points while looking for other traffic.

## Airplane Control

Airplane control entails three components: pitch control, bank control, and power control.

**Pitch control** is the control of the airplane about its lateral axis (i.e., wingtip to wingtip) by applying elevator pressure to raise or lower the nose, usually in relation to the horizon.

**Bank control** is the control of the airplane about its longitudinal axis (i.e., nose to tail) by use of the ailerons to attain the desired angle of bank in relation to the horizon.

**Power control** is the control of power or thrust by use of the throttle to establish or maintain a desired airspeed, climb rate, or descent rate in coordination with pitch attitude changes.

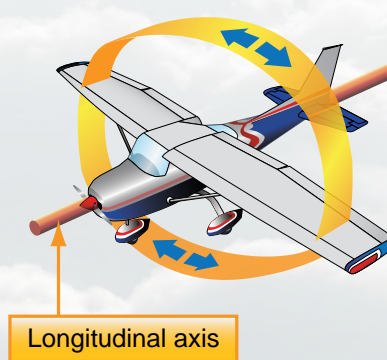
## Axes of Rotation

The airplane has three axes of rotation around which it moves, as seen in the illustration below.

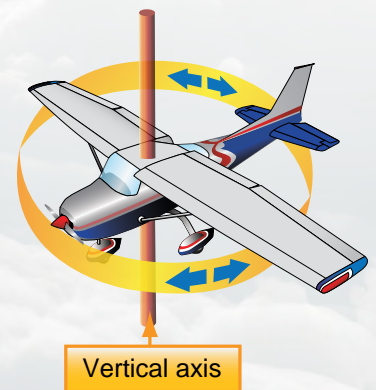
### PITCHING



### ROLLING



### YAWING



The airplane can rotate around one, two, or all three axes simultaneously. Think of these axes as imaginary axes around which the airplane turns, much as a wheel would turn around axes positioned in these same three directions.

## Straight-and-Level Flight

Straight-and-level flight means that a constant heading and altitude are maintained. It is accomplished by making corrections for deviations in direction and altitude from unintentional turns, descents, and climbs.

The pitch attitude for level flight (i.e., constant altitude) is obtained by selecting some portion of the airplane's nose or instrument glare shield as a reference point and then keeping that point in a fixed position relative to the horizon. That position should be cross-checked occasionally against the altimeter to determine whether or not the pitch attitude is correct for the power setting being used. If altitude is being lost or gained, the pitch attitude should be adjusted in relation to the horizon. The application of forward or back elevator pressure is used to control this attitude. After adjustment, the altimeter should be checked to determine whether altitude is being maintained.

The pitch information obtained from the attitude indicator (AI) also shows the position of the nose and wings relative to the horizon. To achieve straight flight (i.e., constant heading), you should select two or more outside visual reference points directly ahead of the airplane (e.g., roads, section lines, towns, lakes, etc.) to form an imaginary line and then keep the airplane headed along that line. While using these references, you should occasionally check the heading indicator (HI) to determine that the airplane is maintaining a constant heading.

Both wingtips should be equidistant above or below the horizon (depending on whether your airplane is a high-wing or low-wing type). Any necessary adjustment should be made with the ailerons to return to a wings-level flight attitude. The attitude indicator should be checked for small bank angles, and the heading indicator should be checked to note deviations from the desired direction.

Straight-and-level flight requires almost no application of control pressure if the airplane is properly trimmed and the air is smooth. Trim the airplane so it will fly straight and level without constant assistance. This is called "hands-off flight." Improper trim technique usually results in flying that is physically tiring, particularly in prolonged straight-and-level flight. The airplane should be trimmed by first applying control pressure to establish the desired attitude and then adjusting the trim so that the airplane will maintain that attitude without control pressure.

The airspeed will remain constant in straight-and-level flight with a constant power setting. Significant changes in airspeed (e.g., power changes) will require considerable changes in pitch attitude to maintain altitude. Pronounced changes in pitch attitude will also be necessary as the flaps and landing gear (if retractable) are operated.



***Sketch an attitude indicator showing an aircraft descending to the right.***



***See example on page 27.***

## Turns

A turn is a basic flight maneuver used to change, or return to, your desired heading. This maneuver involves the coordinated use of the ailerons, rudder, and elevator.

Until a force acts on the airplane, it tends to fly straight ahead due to inertia. Inertia is the phenomenon observed when moving objects continue to move in the same direction (i.e., they tend not to turn unless acted upon by an outside force). The lift produced by an airplane's wings is used to turn the airplane. When banked, the horizontal component of lift turns the airplane.

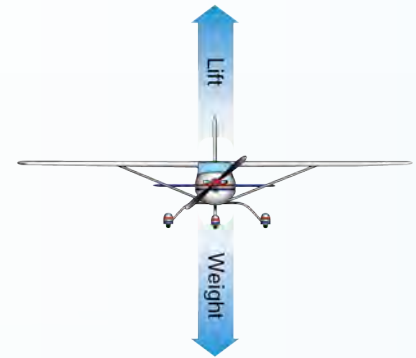
To enter a turn, you should simultaneously turn the control wheel (i.e., apply aileron control pressure) and apply rudder pressure in the desired direction. The speed (or rate) at which your airplane rolls into a bank depends on the rate and amount of control pressure you apply. The amount of bank depends on how long you keep the ailerons deflected. When the airplane begins to turn, centrifugal force pulls the airplane away from the turn (i.e., tends to make it fly straight ahead). The horizontal component of lift (in a bank) counteracts the centrifugal force. Therefore, the greater the bank, the sharper the turn or the greater the rate of turn because more of the total lift goes into the horizontal component.

The rudder does not turn the airplane. It controls the yaw about the vertical axis. This permits the "coordination" of the rudder and ailerons. Coordinated flight is when the airplane goes "straight ahead" through the relative wind. Rudder pressure must be enough to keep the ball of the inclinometer (part of the turn coordinator) centered. If the ball is not centered, "step on the ball" to recenter it. For example, if the ball is to the right, apply right rudder pressure (i.e., step on the ball) to recenter it.

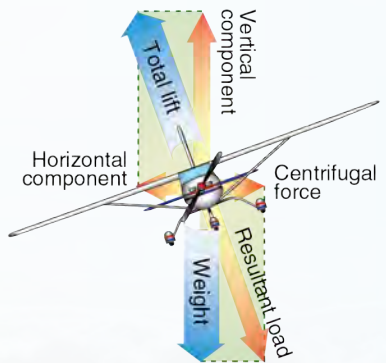
The best outside reference for establishing the degree of bank is the angle made by the top of the engine cowling or the instrument panel with respect to the horizon. Because most light airplanes have a fairly flat engine cowling, its angle relative to the horizon will give some indication of the approximate degree of bank.

Information obtained from the attitude indicator will show the angle of the wings in relation to the horizon. Referring to this information will help you learn to judge the degree of bank based on outside references. To maintain a constant altitude, you will need to apply enough back elevator pressure (i.e., raise the nose of the airplane in order to increase the angle of attack) to prevent a descent. As the desired angle of bank is established, aileron and rudder pressures should be released. The bank will not continue to increase because the aileron control surfaces are neutral in their streamlined position.

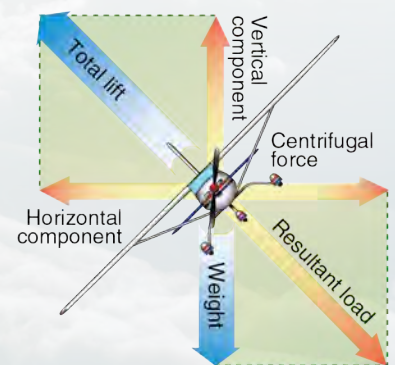
### Level flight



### Medium banked turn



### Steeply banked turn



The back elevator pressure should be held constant or sometimes increased to maintain a constant altitude. Throughout the turn, you should cross-check your outside references and occasionally the altimeter to determine whether the pitch attitude is correct. If you are gaining or losing altitude, adjust the pitch attitude in relation to the horizon, and then recheck the altimeter and vertical speed indicator to determine whether altitude is now being maintained.

In a bank, the total lift is split between horizontal lift (counteracting centrifugal force) and vertical lift (counteracting weight and gravity). Therefore, given the same amount of total lift, there is less vertical lift in a bank than in straight-and-level flight. Thus, to maintain altitude in a turn, you must:

- Increase back pressure on the control yoke (for a higher angle of attack to produce more lift) and/or
- Increase power

Returning to straight flight from a turn (“roll-out”) is similar to the “roll-in” except that control pressures are used in the opposite direction. Aileron and rudder pressures are applied in the direction of the roll-out (i.e., toward the high wing).

As the angle of bank decreases, the elevator pressure should be released smoothly as necessary to maintain altitude. Remember, when the airplane is no longer banked, the vertical component of lift increases. Since the airplane will continue turning as long as there is any bank, the roll-out must be started before reaching the desired heading. The moment at which the roll-out should begin in order to lead the desired heading will depend on the rate of turn and the rate at which the roll-out will be made.

As the wings become level, control pressures should be gradually and smoothly released so that the controls are neutralized as the airplane resumes straight-and-level flight. As the roll-out is completed, attention should be given to outside visual references as well as to the attitude indicator and heading indicator to determine that the wings are leveled precisely and that the turn is stopped.

## Climbing Turns

For climbing turns, the following factors should be considered:

With a constant power setting, the same pitch attitude and airspeed cannot be maintained in a bank as in a straight climb due to the decrease in the vertical lift and airspeed during a turn. The loss of vertical lift becomes greater as the angle of bank is increased, so shallow turns may be used to maintain an efficient rate of climb.

If a medium- or steep-banked turn is used, the airplane’s rate of climb will be reduced. The airplane will have a greater tendency towards nose heaviness than in a straight climb due to the decrease of vertical lift. As in all maneuvers, attention should be divided among all references equally.

There are two ways to establish a climbing turn:

1. Establish a straight climb and then turn or
2. Establish the pitch and bank attitudes simultaneously from straight-and-level flight.

The second method is usually preferred because you can more effectively check the area for other aircraft while the climb is being established.



## Climbs

Climbs and climbing turns are basic flight maneuvers in which the pitch attitude and power setting result in a gain in altitude. In a straight climb, the airplane gains altitude while traveling straight ahead. In climbing turns, the airplane gains altitude while turning.

To enter the climb, simultaneously advance the throttle and apply back elevator pressure. As the power is increased to the climb setting, the airplane's nose will tend to rise to the climb attitude. In most trainer-type airplanes, the climb setting will be full power.

While the pitch attitude increases and airspeed decreases, progressively more right-rudder pressure must be used to compensate for torque effects and to maintain direction. Because the angle of attack is relatively high, the airspeed is relatively slow, and because the power setting is high, the airplane will have a tendency to roll and yaw to the left due to forces created by the rotating propeller. While right-rudder pressure will correct for the yaw, some aileron pressure may also be required to keep the wings level.



When the climb is established, back elevator pressure must be maintained to keep the pitch attitude constant. As the airspeed decreases, the elevators may try to return to their streamlined or neutral position, which would cause the nose to lower. Nose-up trim will therefore be required.

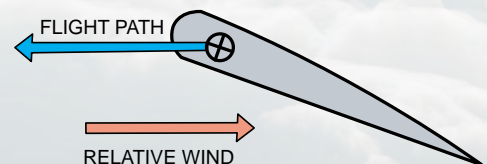
You will need to cross-check the airspeed indicator (ASI) because you want to climb at a specific airspeed, and the ASI will provide an indirect indication of the pitch attitude. If the airspeed is higher than desired, you need to raise the nose. If the airspeed is lower than desired, you need to lower the nose.

After the climbing attitude, power setting, and airspeed have been established, trim the airplane to relieve all pressures from the controls. If further adjustments are made in pitch, power, and/or airspeed, you must retrim the airplane.

If a straight climb is being performed, you need to maintain a constant heading with the wings level. If a climbing turn is being performed, maintain a constant angle of bank. To return to straight-and-level flight from a climbing attitude, you should start the level-off below the desired altitude in order to avoid climbing through it.

To level off, the nose should be lowered. The nose must be lowered gradually, however, because a loss of altitude will result if the pitch attitude is decreased too abruptly before allowing the airspeed to increase adequately. As the nose is lowered, retrim the airplane. When the airspeed reaches the desired cruise speed, reduce the throttle setting to the appropriate cruise power setting and trim the airplane.

**Angle of attack** is the angle between the chord line of the wing and the relative wind (which is parallel to the flight path). The angle of attack is always based on the flight path, not the ground.





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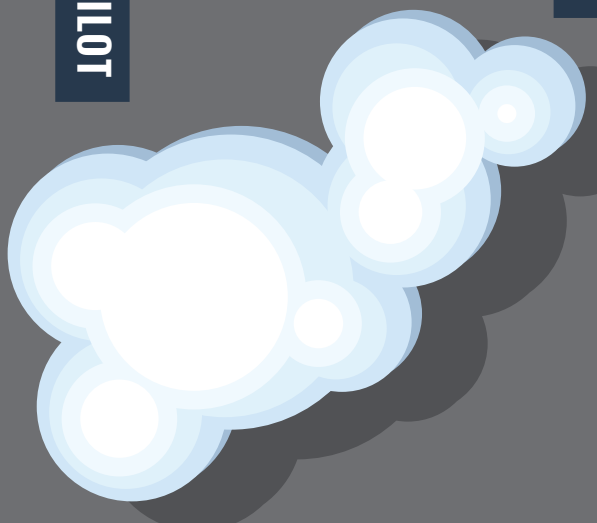
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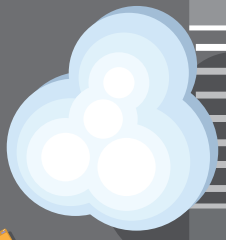
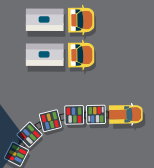
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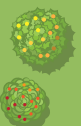
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## Descents

A descent is a basic maneuver in which the airplane loses altitude in a controlled manner. Descents can be made

- With partial power, as used during an approach to a landing
- Without power (i.e., as a glide)
- At cruise airspeeds during en route descents

To enter a descent, you should first reduce power to the desired setting or to idle and apply carburetor heat (if recommended by the manufacturer). Maintain a constant altitude by applying back elevator pressure as required until the airspeed decreases to the desired descent airspeed.

Once the descent airspeed has been reached, lower the pitch attitude to maintain that airspeed and adjust the trim. When the descent is established, cross-check the airspeed indicator to ensure that you are descending at the desired airspeed.

- If the airspeed is higher than desired, slightly raise the nose and allow the airspeed to stabilize in order to confirm the adjustment.
- If the airspeed is lower than desired, slightly lower the nose and allow the airspeed to stabilize.

Once you are descending at the desired airspeed, note the position of the airplane's nose relative to the horizon and the indications of the attitude indicator. Trim the airplane to relieve all control pressures. Maintain either straight or turning flight, as needed.

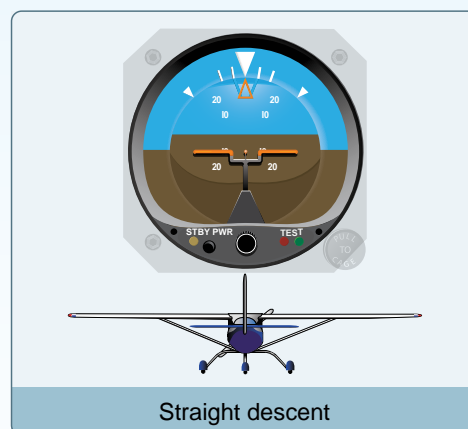
The level-off from a descent must be started before reaching the desired altitude in order to avoid descending through it. To level off, you should simultaneously raise the nose to a level attitude and increase power to the desired cruise setting. The addition of power and increase in airspeed tend to raise the nose. You will need to apply appropriate elevator control pressure and make a trim adjustment to relieve the control pressures.

## Turning Descents

As with climbing turns, you can either

- Enter the turn after the descent has been established or
- Simultaneously adjust the bank and pitch attitudes.

At the desired power setting during a descending turn, maintain airspeed with pitch as you would in a straight descent.



# BECOMING A PILOT

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Fast track becoming a pilot by passing the FAA knowledge test prior to completing your flight training. Once you have passed the FAA knowledge test, you will be well on your way to becoming a certificated pilot, and the knowledge gained will help you be a safer student pilot when you enter the cockpit! Some students take ground school and flight training simultaneously, but by focusing solely on ground school first, you can gain valuable knowledge and ensure you can focus on flying after mastering the fundamentals.

The Gleim Online Ground School courses contain study outlines, hundreds of knowledge test questions, and the actual FAA figures you'll encounter on your knowledge test. Our answer explanations are expertly written to help you understand both the correct and incorrect answers. We even guarantee our Online Ground School graduates will pass the FAA knowledge exam or we will refund their course purchase price.

### *Why use the Gleim Online Ground School?*

- It is always up to date.
- Users achieve very high knowledge test scores and a near-100% pass rate.
- Convenient 24/7 online access!
- Integrated quizzes and practice exam simulations.
- Explanations of correct and incorrect answer choices help you learn from your mistakes while reinforcing core concepts.

### **Our Online Ground School courses are available for:**

- Sport Pilot
- Private Pilot
- Instrument Pilot
- Commercial Pilot
- Fundamentals of Instructing
- Flight and Ground Instructor
- Airline Transport Pilot
- Flight Engineer
- Canadian Certificate Conversion
- Military Competency

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# Choosing between a Sport or Private Pilot Certificate

Sport Pilot		
Pros	Considerations	Testing
<ul style="list-style-type: none"> <li>• Fewer training requirements, which saves time and money</li> <li>• 20+ flight training hours, including 5+ hours of solo (i.e., by yourself) flight time</li> <li>• Typically lower-cost flight training</li> <li>• Available specifically for pilots of light-sport aircraft (LSA), a simple but capable performing-aircraft</li> <li>• LSAs may include some of the most advanced instrumentation available</li> </ul>	<ul style="list-style-type: none"> <li>• To become a professional pilot, you would need to also become a private pilot</li> <li>• May only carry one passenger</li> <li>• May only fly during day time</li> <li>• LSAs are usually smaller and slower than other light airplanes</li> </ul>	<ul style="list-style-type: none"> <li>• 40 multiple-choice question knowledge test</li> </ul>

Private Pilot		
Pros	Considerations	Testing
<ul style="list-style-type: none"> <li>• Required to further your career as a pilot</li> <li>• Greater flexibility</li> <li>• You can carry as many passengers and bags as the aircraft allows</li> <li>• Faster aircraft</li> </ul>	<ul style="list-style-type: none"> <li>• Additional training requirements  <b>Part 61:</b> 40+ flight training hours, including 10+ hours of solo flight time  <b>Part 141:</b> 35+ flight training hours, including 10+ hours of solo flight time, 35+ hours of ground training</li> </ul>	<ul style="list-style-type: none"> <li>• 60 multiple-choice question knowledge test</li> </ul>

*Note: How long students take to finish training usually depends on time spent doing a variety of non-flying tasks, such as commuting, ground training, aircraft preflight, rescheduling lessons due to bad weather, airplane maintenance, etc.*



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## Steps to Earning Your Sport or Private Pilot Certificate

- Purchase the Gleim Deluxe Pilot Kit with Online Ground School.
- Pass the FAA sport or private knowledge test with a score of 70% or higher.
- Obtain a Student Pilot Certificate (learn more on page 32).  
You must be able to read, speak, write, and understand English.
- Obtain at least a third-class FAA medical certificate for private pilot. A driver's license covers your medical requirement for sport pilot, or you can fly under BasicMed for either.
- Select a flight instructor and/or flight school.
- Complete your flight training by utilizing the syllabus and flight maneuvers books included in Gleim pilot kits.
- Meet the minimum hours of flight and/or ground training.
- Pass the FAA practical test (called a flight test).  
You must be at least 17 years of age when you take your flight test.

### Passing the Flight Test (FAA Practical Test)

At the end of your flight training, you must successfully complete a practical (flight) test, which will be given as a final exam by an FAA evaluator, usually called a designated pilot examiner (DPE). Each of the required tasks/maneuvers for the sport and private flight tests is both explained and illustrated in the Gleim Flight Maneuvers and Practical Test Prep books for each certificate.

FAA-designated pilot examiners are proficient, experienced flight instructors/pilots who are authorized by the FAA to conduct practical tests. They typically charge a fee for their services. Using the Gleim training materials will prepare you to pass your FAA practical test with confidence.



## What does it cost?

The price of instruction varies nationwide and also from flight school to flight school. Fuel, maintenance, and airplane expenses play a major role in determining airplane rental rates. Shop around to make sure you are getting what you need at a fair price. Your total cost will depend on the flight school's equipment, local cost factors, competition, etc., and the amount of training you require in excess of the minimum flight-hour requirements. Many flight schools allow payments lesson-by-lesson rather than all at once. Some flight schools offer discounts for purchasing a block of flight time.

Below is an example cost calculator for the investment to earn a sport or private pilot certificate:

Expenses		Sport Pilot Certificate	Private Pilot Certificate
Flight Training	Dual Time	15 hr. (\$100/hr. aircraft + \$40/hr. instructor) = \$2,100	30 hr. (\$120/hr. aircraft + \$45/hr. instructor) = \$4,950
	Solo Time	5 hr. (\$100/hr. aircraft) = \$500	10 hr. (\$120/hr. aircraft) = \$1,200
Ground Training		5 hr. (\$40/hr.) = \$200	10 hr. (\$45/hr.) = \$450
Books and Supplies			
Gleim Kit			
Aeronautical Sectional Chart		\$300	\$350
Chart Supplement			
Airplane Operating Manual			
Medical Exam		N/A	\$100
Knowledge Test Fee		\$160	\$160
Rental Aircraft for Practical Test		\$150	\$240
Practical Test Fee		\$400	\$400
<b>TOTAL:</b>		<b>\$3,810</b>	<b>\$7,850</b>

*Note: This is the low end of the cost range.*

For private pilot certification, many pilots require 55+ hours of flight training. Also, aircraft rental can range from below \$100 to \$200 per hour or more, depending on the airplane, the airplane's age, the equipment installed, and flight school rates. (Note that the age of the aircraft does not imply less reliability.) Private pilot training can cost between \$8,000 and \$12,000 on average. Sport pilot training can cost between \$4,000 and \$6,000 on average. The Gleim training syllabus for the certificate you're pursuing will help you and your CFI complete your training in the shortest amount of time possible.

# What Is a Student Pilot Certificate?

Getting a student pilot certificate is one of the first steps toward earning a sport or private pilot certificate. You must obtain a student pilot certificate before you are allowed to fly solo.

You will need to meet the following requirements in order to obtain a student pilot certificate:

- Be at least 16 years of age.
- Be able to read, speak, write, and understand English.

To apply, you will meet in person with a flight instructor, an FAA inspector at your local Flight Standards District Office (FSDO), a designated pilot examiner, or an airman certificate representative from an approved Part 141 flight school. You will fill out an application that will be processed and sent to the FAA and TSA for review. Upon approval, your student pilot certificate will be mailed.

# What Is a Medical Certificate?

The FAA medical examination is a routine physical exam administered by FAA-designated doctors called aviation medical examiners (AMEs) who will issue your medical certificate after the exam.

If you have a physical handicap, medical certificates can still be issued in many cases. Operating limitations may be imposed depending upon the nature of your disability.

Visit [www.faa.gov/pilots/amelocator](http://www.faa.gov/pilots/amelocator) for a list of AMEs by state and city.

## BasicMed

Pilots of small aircraft can meet the medical certification requirements with an FAA program called BasicMed if they held a third-class medical certificate after July 14, 2006. If you are new to aviation, you will need to get the third-class medical certificate once. Certain cardiovascular, neurological, or mental health conditions may also require you to obtain a one-time special issuance certificate.

### BasicMed allows pilots to fly an aircraft

- Up to 6,000 pounds
- With up to 5 passengers
- Below 18,000 feet
- Up to 250 knots
- But not for compensation or hire

FAA Rating	Medical Requirements
Sport	Driver's License
Private	3rd Class
Commercial	2nd Class
Airline Transport	1st Class

UNITED STATES OF AMERICA Department of Transportation Federal Aviation Administration <b>MEDICAL CERTIFICATE</b> <u>3rd</u> CLASS					
This certifies that (Full name and address): Smith, John Tyler 1234 W. 56 St. Gainesville, FL 32605					
Date of Birth	Ht.	Wt.	Hair	Eyes	Sex
1/23/86	5'9"	150	Brn.	Brn.	M
has met the medical standards prescribed in Part 67 Federal Aviation Regulations for this class of Medical Certificate.					
Examiner	Limitations None				
	Date of Examination 4/15/17		Examiner's Serial No. 12345-6		
Examiner	Signature <i>J. T. Taylor, D.O.</i>				
	Typed Name J. T. Taylor, D.O.				
AIRMAN'S SIGNATURE <i>John Tyler Smith</i>					

# Advanced Pilot Training

## Instrument Rating

An Instrument Rating permits you to fly “by instruments,” i.e., without visual references to the ground, horizon, or other landmarks. You will be able to fly through clouds, rain, fog, etc., all of which restrict visibility. Having an Instrument Rating is particularly useful when you fly long distances. It is frequently difficult to travel long distances without encountering weather systems that require instrument piloting skills. Similarly, if you must make a flight at a specific time, it may be possible only under Instrument Flight Rules (IFR) due to adverse weather conditions.

An Instrument Rating is added to your private or commercial pilot certificate (commercial pilot certificates are discussed beginning on page 36) upon satisfactory completion of your training program, a knowledge test, and a practical test. Your private or commercial pilot certificate will look the same, except it will have the words “Instrument Airplane” typed on the certificate under the ratings section.



## FAA Knowledge Testing

The instrument pilot knowledge test consists of 60 multiple-choice questions. Hundreds of practice questions that are representative of what you'll see on the actual FAA exam are produced in the Gleim *Instrument Pilot FAA Knowledge Test Prep* book with complete answer explanations to the right of each question.

## Flight Training Requirements

The FAA requires 20 tasks to be tested in the following categories:

- Preflight preparation and procedures
- Air traffic control clearances and procedures
- Flight by reference to instruments
- Navigation systems
- Instrument approach procedures
- Emergency operations
- Postflight procedures

To see a detailed review of each task, refer to the Gleim *Instrument Pilot Flight Maneuvers and Practical Test Prep* book.

## Steps to Earning Your Instrument Rating

- Hold at least a private pilot certificate.  
Be able to read, speak, write, and understand English.  
Hold at least a current third-class FAA medical certificate (or fly under BasicMed).
- Order the Gleim Deluxe Instrument Pilot Kit with Online Ground School from [GleimAviation.com](http://GleimAviation.com).
- Pass a 60-question FAA knowledge test with a score of 70% or higher.
- Study the *Gleim Instrument Pilot Flight Maneuvers and Practical Test Prep* book. Understand each aspect of IFR flight before you practice it in an airplane.
- Pursue a flight instruction program with a Certified Flight Instructor - Instrument (CFII). When selecting a CFII, consider the suggestions on how to select a CFI (presented on page 9 of this booklet).
- Have flight experience totaling more than 100 hours (specific requirements are outlined in the *Gleim Instrument Pilot Syllabus* book).
- Have a signed recommendation from your instrument instructor that you are a competent instrument pilot.
- Pass your practical test!

## Cost of Your Instrument Rating

If you go to a typical flight school, you will probably spend \$7,000 to \$10,000 to complete the flight training needed for the Instrument Rating, not including the time it takes to build prerequisite experience. You must have 50 hours of cross-country time as pilot in command, flying to airports more than 50 NM from the departure point.

Rental rates for IFR-certified airplanes can range from \$100 to \$200 per hour or more. Instrument instruction will cost about \$40 to \$60 per hour for your instructor (you are required to have 40 hours, but plan on at least 50 hours). You should discuss the costs with potential CFIs. After you select a specific program, develop a budget with your CFI and review your progress periodically.

## Cost Saving Tips

### *Ground Trainers and Aviation Training Devices (ATDs)*

Several IFR flight simulators and Flight Training Devices (FTDs) have been marketed widely to colleges, FBOs, etc., as well as more affordable ATDs. If you can gain access to one, use it under the supervision of a CFI who will sign off these hours in your logbook. Up to 20 of the 40 hours of required IFR experience, and 10 of the 15 hours of required instrument instruction, may be credited in a flight simulator or FTD. Up to 10 of the required 40 hours of IFR experience may be obtained in an ATD. That said, you can always fly more than the minimum to gain competency.

### *Purchase an IFR-Equipped Airplane*

Once you have your private pilot certificate, it may be in your interest to purchase an IFR-equipped airplane or gain the use of one through a flying club. You need a full panel for IFR certification, which includes an attitude indicator, a heading indicator, a turn coordinator, and IFR-certified navigation equipment. As you are building cross-country hours toward your Instrument Rating, you should work on your instrument skills. It is more effective to proceed under the supervision of a CFI than to try to do it entirely on your own.

### *Safety Pilots*

Once you have your private pilot certificate, you can practice your instrument skills by using a “hood” (a view-limiting device so you can see your instruments but not outside of the airplane). While using a hood, you must have a safety pilot next to you watching for traffic at all times. A safety pilot is a pilot who is appropriately rated to fly your airplane and is required by Federal Aviation Regulations to look primarily for other air traffic. A safety pilot also can take over the controls if you get the airplane into an unusual attitude (i.e., if it begins to get out of control).

## Commercial Pilot Certificate

Attaining the status of a commercial pilot is a huge milestone. As a commercial pilot, you will be able to fly for compensation or hire. This could include transporting people or cargo or flying in a variety of other capacities. Many commercial pilots pursue careers as flight instructors or charter pilots on their own or with corporate flight departments. The steps to complete your commercial pilot training are similar to private and instrument: study for the knowledge test, fly with an instructor, and pass your tests. If this is your goal, Gleim can help!



### Requirements to Obtain a Commercial Pilot Certificate

- Be at least 18 years of age.
- Be able to read, speak, write, and understand English.
- Hold at least a current third-class FAA medical certificate.
- Hold an Instrument Rating.
- A commercial pilot is presumed to have an Instrument Rating. If not, his or her commercial pilot certificate will be endorsed with a prohibition against carrying passengers for hire on day VFR flights beyond 50 NM or at night.
- Receive and log ground and flight training from an authorized instructor.
- Earn a score of 70% or higher on the commercial pilot knowledge test.
- Have a total of 250 hours of pilot flight time (with no more than 50 hours in a flight simulator or flight training device), or 190 hours if training under Part 141.
- Successfully complete an FAA practical test, which will be conducted as specified in the FAA's Airman Certification Standards.

### Flight Training Requirements

For the commercial pilot practical test, the maneuvers tested are similar to those tested on the private practical test, except five additional proficiency flight maneuvers are required: chandelles, eights on pylons, lazy eights, steep spirals, and a power-off precision landing. Two additional knowledge tasks are required: supplemental oxygen and pressurization.

Obtain and study the Gleim *Commercial Pilot Flight Maneuvers and Practical Test Prep* book. It contains the tasks required on the commercial pilot practical test with discussions and illustrations.

### FAA Knowledge Testing

The test consists of 100 multiple-choice questions. Sample FAA questions are reproduced with complete explanations of each question in the Gleim Commercial Online Ground School, Commercial Pilot FAA Test Prep Online, and *Commercial Pilot FAA Knowledge Test Prep* book.



## Airline Transport Pilot (ATP) Certificate

Airline transport pilots are responsible for operating large transport aircraft with advanced systems. To pilot for an airline, earning an ATP certificate is a must. ATP training will prepare you to fly according to the most demanding standards. The requirements vary depending on whether you will be flying single- or multi-engine airplanes. Airline pilots can enjoy many opportunities for a very rewarding career in aviation.



### Requirements to Obtain an Airplane Transport Pilot Certificate

- Be at least 23 years of age (at the time of the ATP practical test).
- Be able to read, speak, write, and understand English.
- Be of good moral character.
- Hold at least a commercial pilot certificate and an Instrument Rating, a restricted ATP certificate, or a foreign ATP or commercial pilot certificate.
- Hold at least a current FAA third-class medical certificate.
- Later, if your flying requires an ATP certificate, you must hold a first-class medical certificate.
- Earn a score of 70% or higher on the ATP knowledge test (there are two ratings to choose from).
- Accumulate flight experience consisting of at least 1,500 hours of total time as a pilot (detailed flight requirements can be found in 14 CFR 61.159).
- Successfully complete a practical flight test given as a final exam by an FAA inspector or designated pilot examiner and conducted as specified in the FAA's Airline Transport Pilot and Aircraft Type Rating – Practical Test Standards.

### Rating Add-ons

If you are seeking the ATP certificate with a Multi-Engine Rating, you must complete an approved ATP Certification Training Program (CTP) in order to take the FAA knowledge test. A list of Gleim partnered ATP-CTP providers can be found at [GleimAviation.com/atpctp](http://GleimAviation.com/atpctp).

The ATP Single-Engine Rating does not require completion of an ATP CTP. If you complete the ATP single-engine knowledge test (ATS) and then seek to add the Multi-Engine Rating (ATM), you will be required to complete an ATP CTP program prior to taking the ATP multi-engine airplane (ATM) knowledge test.


### FAA Knowledge Testing

The ATP single-engine airplane test (ATS) consists of 90 multiple-choice questions. ATM consists of 125 multiple-choice questions selected from the airplane-related questions in the FAA's ATP, aircraft dispatcher, and flight navigator knowledge test banks.



## Flight Instructor Certificate

A flight instructor certificate allows you to provide flight and ground training. With it, you can teach others to fly! An individual who wishes to have a career as a pilot typically earns the private, commercial, and flight instructor certificates (as well as an Instrument Rating). As a certificated flight instructor (CFI), you can work as a flight instructor and get paid to teach aviation.



Abby Welch receives her certificated flight instructor (CFI) license.

### Requirements to Become a Certificated Flight Instructor (CFI)

- Be at least 18 years of age.
- Be able to read, speak, write, and understand English.
- Hold a commercial or airline transport pilot certificate (discussed on pages 36 and 37).
- Hold an Instrument Rating if applying to be a flight instructor in an airplane.
- Hold at least a current third-class FAA medical certificate.
- Pass the 100-question FAA flight instructor airplane knowledge test.
- Pass the 50-question FAA fundamentals of instructing knowledge test.
- Obtain a logbook endorsement by an appropriately certificated and rated flight instructor who has provided you with spin entry, spin, and spin recovery training.
- There is no minimum time requirement, but you must receive training from a qualified instructor toward the category rating sought.
- Pass your FAA practical test!

### Flight Training Requirements

The flight portion of the practical test consists largely of the maneuvers tested on the private and commercial practical tests, except you must additionally explain each maneuver to the examiner as you are flying the airplane. During the practical test, you will fly the airplane from the right seat because this is where CFIs instruct (with the student in the left seat).

All of the tasks for the CFI are thoroughly explained in the Gleim *Flight Instructor Flight Maneuvers and Practical Test Prep* book, with step-by-step instructions for each flight maneuver.

### Certificated Flight Instructor – Instrument (CFII)

In order to instruct pilots working toward their Instrument Rating, you must be an instrument instructor, which requires more training, another FAA knowledge test, and another practical test. The knowledge test consists of 50 questions from the same pool of questions used for the Instrument Rating knowledge test (i.e., you essentially retake your Instrument Rating knowledge test). Thus, you need to study the Gleim Instrument Rating Online Ground School, Instrument Rating FAA Knowledge Test Prep Online, and the *Instrument Rating FAA Knowledge Test Prep* book. The practical test consists of the Instrument Rating practical test maneuvers, plus you must explain the maneuvers as you perform them in the right seat. The Gleim *Instrument Pilot Flight Maneuvers and Practical Test Prep* book is an essential text to help you prepare for your CFII practical test.





## Maximize Your Flight Training

### Fly at Home

The airplane is not always the best classroom. It's noisy, compact, and full of distractions. New students can easily become overwhelmed with task overload, so building a foundation of aeronautical knowledge before you fly allows you to get the most out of your flight instruction. Students who maximize their training time in a simulator quickly develop the skills to become safe, competent pilots, and consequently finish their flight training faster.

### Join the Club

Joining a local flying club can help you save money and connect with a community of like-minded pilots to fly and consult with. Flying clubs typically offer access to aircraft and may host events where pilots can get to know one another. The Aircraft Owners and Pilot's Association (AOPA) has an excellent Flying Club Finder tool online to search for clubs near you.

### Make a Commitment

Purchasing an airplane on your own or with a joint owner can offset the cost of renting an aircraft from a flight school. Insuring a plane, especially for a student, should not pose too much of an additional expense, especially if the airplane you insure is of the typical training variety (i.e., a simple, low-horsepower, single-engine airplane). However, it is always a good idea to contact an aviation insurance company to discuss your insurance needs prior to the purchase of an airplane.



## Get Paid to Fly Drones

The aviation industry has seen a significant shift toward the use of unmanned aircraft systems (UAS). The Part 107 small Unmanned Aircraft Systems (sUAS or “drones”) rule became effective in 2016, finalizing the first operational rules for commercial sUAS operations. According to FAA industry estimates, the rule could generate more than \$82 billion for the U.S. economy and create more than 300,000 new jobs in the next 20 years.

A pilot’s license called the remote pilot certificate is required to fly drones for commercial purposes. The training to earn this certificate can be completed quickly and affordably. Remote pilots must learn about a wide range of topics to safely integrate their operations into the National Airspace System. Operators of sUAS have job opportunities in nearly every industry. Gleim Aviation is excited to help usher in this new era of aviation with training that ensures safe and responsible flying is a top priority for all operators. To learn more about remote pilot training and opportunities, visit our drones information page online at [GleimAviation.com/drones](https://GleimAviation.com/drones).

## What Is Part 107 (the sUAS rule)?

The sUAS regulations are found in 14 CFR Part 107. It contains the operational rules for routine commercial use of small unmanned aircraft systems (UAS, UAV, or “drones”). This rule includes operational limitations, requirements for certifications, responsibilities of the remote pilot in command, and aircraft requirements, detailed in the next section.

## Part 107 Privileges and Limitations

Operating a drone for non-recreational purposes requires the pilot to adhere to a number of regulations. These rules are designed to keep the National Airspace System and the public safe and secure. The information in this booklet is a summary. Always check the FAA sUAS webpage to make sure the information you have is up-to-date: [www.faa.gov/uas](http://www.faa.gov/uas).

### Operational Limitations

Your sUAS must weigh less than 55 lb., and you should never exceed a groundspeed of 100 mph (87 knots) or an altitude of 400 feet (or remain within 400 feet of a structure). You – the pilot in command – and the person manipulating the flight controls should keep the sUAS within your visual line of sight (VLOS) at all times. Cameras or binoculars can be used to help meet this requirement, but you must always satisfy the “see-and-avoid” requirement without additional equipment.

### Where and when can you fly?

You may not operate an sUAS over people unless they are directly participating in the operation, under a covered structure, or inside a covered, non-moving vehicle. You may fly your sUAS during daylight hours or during the civil twilight (30 minutes before official sunrise to 30 minutes after official sunset, local time) with appropriate anti-collision lighting. You must have minimum weather visibility of 3 miles from the control station. Operations in controlled airspace may be allowed with the required FAA authorization. Operations in Class G or uncontrolled airspace are allowed without authorization.

Additionally, remote pilots:

- Cannot operate more than one sUAS at one time.
- Cannot operate from a moving aircraft.
- Must yield right of way to other aircraft.
- Must not have a physical or mental condition that would interfere with the safe operation of an sUAS.
- May carry non-hazardous loads by sUAS if they do not adversely affect controllability of the aircraft.
- May be compensated and hired to transport property as long as all Part 107 limitations and requirements are met and does not involve crossing state lines or travel between
  - Hawaii and another place in Hawaii through airspace outside Hawaii;
  - The District of Columbia and another place in the District of Columbia;
  - A territory or possession of the United States and another place in the same territory or possession.

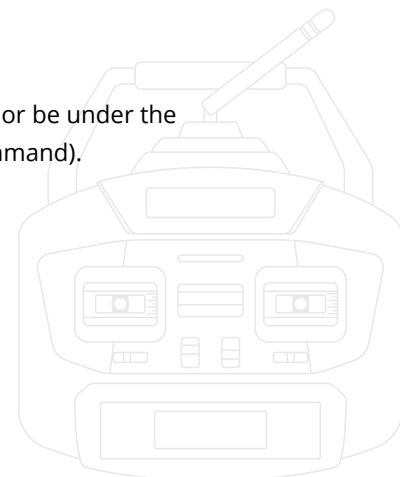
Most of the restrictions discussed above can be waived if the applicant demonstrates that his or her operation can safely be conducted under the terms of a certificate of waiver. Additionally, a remote pilot in command may deviate from the requirements in response to an in-flight emergency.

### Remote Pilot in Command Certification and Responsibilities

A person operating an sUAS must either hold a remote pilot certificate with an sUAS rating or be under the direct supervision of a person who does hold a remote pilot certificate (remote pilot in command).

A remote pilot in command must:

- Allow the FAA to inspect or test the sUAS and any associated documents/records.
- Report accidents to the FAA within 10 days that cause serious injury, loss of consciousness, or property damage of at least \$500.
- Conduct a preflight inspection, including specific aircraft and control station systems checks, to ensure the sUAS is in a condition for safe operation.
- Register their drone with the FAA.



## Remote Pilot Certificate

The remote pilot certificate is your license to fly small unmanned aircraft systems (sUAS) for hire. There are countless industries incorporating commercial operations for sUAS operators, including:



Photography and videography



Aerial inspections



Real estate and construction



Agricultural



Engineering



Disaster relief



Civil/government



Aviation training



Aerial surveys



Military

### Requirements to Obtain a Remote Pilot Certificate

If you are not already a pilot, you must first prepare for and pass the FAA knowledge test to become an FAA certificated remote pilot. The test consists of 60 multiple-choice questions. There is a 2-hour time limit to complete the test. The test must be taken at an FAA-authorized testing center, which will charge a test-taking fee.

If you are already a pilot (sport, recreational, private, commercial, ATP), a free online FAA test is required. You must have a current flight review in accordance with 14 CFR 61.56. If you do not have a current flight review, you must take the knowledge test at an authorized testing center using the same process as someone who is not a pilot.

The aeronautical knowledge subjects that will be tested for either testing method include:

- Regulations
- Airspace classifications and requirements
- Meteorology
- Aircraft performance
- Emergency operations
- Crew resource management
- Radio communication procedures
- Human factors
- Aeronautical decision-making
- Airport operations
- Maintenance
- Preflight inspections

## Helpful sUAS Organizations

### Association for Unmanned Vehicle Systems International

[auvsi.org](http://auvsi.org)

The Association for Unmanned Vehicle Systems International (AUVSI) is the world's largest organization devoted exclusively to advancing the unmanned systems and robotics industries. AUVSI members work in the defense, civil, and commercial markets, and they represent a unified voice in advocacy for policies and regulations encouraging growth and innovation.

### Academy of Model Aeronautics

[modelaircraft.org](http://modelaircraft.org)

The Academy of Model Aeronautics (AMA) is the world's largest model aviation association, representing more than 195,000 members from all walks of life, income levels, and age groups. The AMA promotes the development of model aviation as a recognized sport and recreational activity.



## Steps to Earning Your Remote Pilot Certificate

- Learn the aeronautical knowledge applicable to sUAS operations using Gleim remote pilot training resources.
- Be at least 16 years old.
- Demonstrate aeronautical knowledge by either
  - Passing the FAA Unmanned Aircraft General exam with a score of 70% or higher or
  - Possessing a Part 61 (manned aircraft) pilot certificate (other than student pilot) and completing both a flight review and the FAA sUAS online training course (ALC-451) within the previous 24 months.
- Apply for your remote pilot certificate on the FAA IACRA website, [iacra.faa.gov](https://iacra.faa.gov).

The complete steps to apply for the remote pilot certificate for both new and existing pilots are detailed at [GleimAviation.com/drones](https://GleimAviation.com/drones).

# CAREERS IN AVIATION



## Aviation Careers Abound

Many people approach aviation as a hobby – something for fun or for flexibility while traveling. Many others look to aviation as the industry where they would like to build their career and earn a living. Aviation is an exciting industry, and whatever your goals, we want to help you find your place in it. Because it's the most visible, many think the only job opportunity for aviators is becoming a commercial airline pilot. While this is certainly a prestigious career, there are many other opportunities in aviation, including:

- Aerospace Engineer
- Flight Attendant
- Air Traffic Controller
- Flight Instructor
- Maintenance Technician

Many aviation jobs do not require a college degree and provide immediate career options; however, having a college degree will help you reach the highest levels of your profession. Careers in aviation abound, and the need for talent is predicted to surge over the next two decades. Whether you desire to become a pilot, an aeronautical engineer, or work in aircraft maintenance, this booklet is a great resource to help spark an interest in aviation.

Keep reading for a few careers we have highlighted, but keep in mind there are many others available. We hope this introduction will inspire you to pursue a career in aviation.



## Commercial Airline Pilot

Being a commercial airline pilot is a rewarding career that carries a great deal of responsibility. Plus, your office will have the best view imaginable! Commercial airline pilots all start exactly where you are now, thinking about aviation and dreaming of getting into the cockpit. It all starts with this *Learn to Fly* guide. From here, you will need to obtain several certifications from the FAA and build up a wealth of flight time and experience flying different aircraft for various purposes.

Airlines like well-rounded candidates with lots of varied flight experience. The airline interview hiring process is complex and difficult, as it should be. You will have to prove your skills in a classroom setting and again in a flight simulator, where you will need to pass a check flight. Then, you will become a first officer and gain valuable experience. Once you have enough seniority, you can upgrade to captain and be a mentor to your own first officer.



## Flight Educator

Flight educators are responsible for teaching the next generation of pilots and keeping current pilots in the air. This is not necessarily limited to just being a flight instructor. A flight educator could be a senior instructor at a flight school, responsible for managing other instructors; a flight school administrator; a professor or teacher at an aviation college, high school, or academy; or any other number of positions where flight students are being educated on how to become or remain pilots. This position is vitally important to the aviation ecosystem because without flight educators, there are no pilots.



## Aviation Maintenance Technician

Aviation maintenance technicians (AMTs) keep our aircraft flying – and not just flying, but flying safely. This is another vital segment of the aviation industry that is often overlooked by people seeking to enter aviation as a career, but it is one filled with incredible opportunities. AMTs work on small general aviation aircraft, huge commercial airlines, and everything in between. Most AMTs specialize in a certain segment of aviation maintenance, like aircraft engines, sheet metal repairs, avionics (cockpit systems), rotorcraft, or any of 100+ other specialties. There are schools all over the country that train and certify AMTs. You can even get paid for your training by working as an apprentice under another certificated AMT. AMT training is intensive, and the work carries with it a huge responsibility. However, that responsibility also yields a huge reward as you watch an aircraft you maintained or repaired take off and fly to its destination.

## Maintenance Operations: Preventative Maintenance and Inspections

In aviation, we like to say that “takeoffs are optional, but maintenance is mandatory.” All aircraft must undergo regular preventive maintenance and inspections. Most aircraft must undergo an annual inspection in addition to periodic inspections for certain installed equipment. As a general rule, the more complex the aircraft, the more maintenance is required. If an airplane is used for hire (e.g., flight instruction, cargo/personal charter, etc.), more frequent maintenance is necessary.

Aviation Maintenance Technicians (AMTs) are becoming more specialized in their types of training, knowledge, and experience. The FAA offers two types of AMT certificates: one for the airframe and one for the powerplant. Each certificate requires a knowledge test and practical examination, along with hands-on experience. Below is a sample of AMT specialties with a brief description of the associated tasks.

Specialty	Description of Work
Sheet Metal Repairs	Assess damage and determine the required repair scheme from approved data. Implement the repair using various types of fasteners and hand tools.
Composite Repairs	Assess damage and determine the required repair scheme from approved data. Implement the repair using composite materials and processes.
Avionics	Install and interface line replaceable units with other equipment on the aircraft using manufacturer’s installation instructions.
Avionics Repairs	Verify, troubleshoot, and repair problems in line replaceable units using manufacturer’s maintenance documents.
Turbine and Reciprocating Engines and Propellers	Perform diagnostic tests to determine a performance problem. Perform repairs or replace components using manufacturer’s maintenance manuals.
Engine and Propeller Overhaul	Disassemble, inspect, repair, and replace parts as needed. Reassemble and test the unit to manufacturer’s specifications.

### Hazards

When visiting a maintenance facility, be careful to stand only where you are instructed. There can be a number of potentially unseen hazards in the workspace. Use caution and follow the instructions of the person escorting you. If you ever doubt whether you are in a safe location, always ask immediately.

If you are interested in becoming an AMT, you will need to meet the following FAA requirements:

- Be at least 18 years of age.
- Be able to read, speak, write, and understand English.
- Acquire 18 months of practical experience with either powerplants or airframes or 30 months of practical experience working on both at the same time.
  - Alternatively, you can graduate from an FAA-approved aviation maintenance technician school.
- Pass a written, oral, and practical test.

Gleim offers online training courses to prepare you for the written exams. To prepare for the practical exam, you can work under the supervision of an FAA-certified AMT or repair station.



# Test Your Knowledge with These Practice Questions

## 1. What is the purpose of the rudder on an airplane?

- A. To control yaw.
- B. To control overbanking tendency.
- C. To control roll.

## 2. The elevator controls movement around which axis?

- A. Longitudinal.
- B. Lateral.
- C. Vertical.

## 3. Trim systems are designed to do what?

- A. Relieve the pilot of the need to maintain constant pressure on the flight controls.
- B. Increase wing lift during approach and landing.
- C. Control roll by moving in the opposite direction from one another.

## 4. What force makes an airplane turn?

- A. The horizontal component of lift.
- B. The vertical component of lift.
- C. Centrifugal force.

## 5. What does the airspeed indicator display?

- A. The speed of the airplane over the ground.
- B. The speed of the wind at the airport.
- C. The speed of the airplane through the air.

## 6. How should you enter a climb?

- A. Advance the throttle and apply forward elevator pressure.
- B. Advance the throttle and apply back elevator pressure.
- C. Apply back elevator pressure and decrease the throttle.

## 7. What class of medical certificate must be obtained to become a private pilot?

- A. First.
- B. Second.
- C. Third.

## 8. Which is an example of a primary flight control?

- A. Flaps.
- B. Trim tabs.
- C. Ailerons.

## 9. Which operation may a remote pilot conduct without a waiver?

- A. Fly beyond visual line of sight with a good camera.
- B. Fly with a ground speed up to 100 mph.
- C. Fly over a crowd of people.

## 10. According to 14 CFR Part 107, how much does a small unmanned aircraft system weigh?

- A. Less than 55 lbs.
- B. 55 kg. or less.
- C. 55 lbs. or less.

# FIRST FLIGHT CERTIFICATE

PRESENTED TO

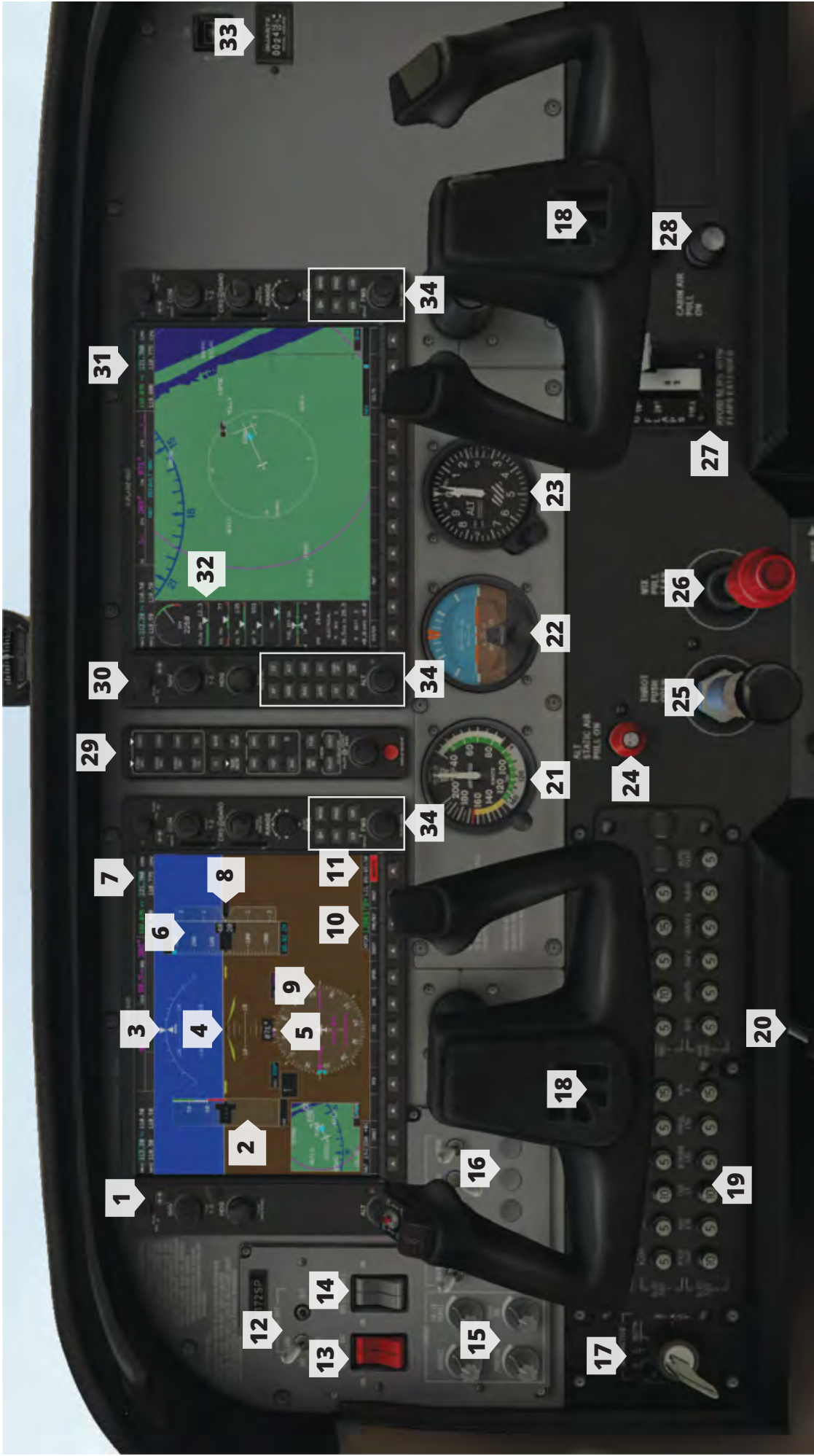
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*who on this day first experienced the joy of flying in a general aviation aircraft  
piloted by the undersigned.*

Signed this \_\_\_\_\_ day of \_\_\_\_\_ in the year \_\_\_\_\_

Pilot in Command \_\_\_\_\_





- 1. NAV1
- 2. Airspeed
- 3. Slip Skid
- 4. Altimeter
- 5. Turn Rate
- 6. Altimeter
- 7. Comm1
- 8. Vertical Speed
- 9. Horizontal Situation

- 10. Transponder
- 11. Time
- 12. Battery Backup Switch
- 13. Master Switch (Alternator & Battery)
- 14. Avionics Switch
- 15. Interior Panel Lights
- 16. Electrical Switches
- 17. Magneto Switch
- 18. Control Yoke

- 19. Circuit Breaker Panel
- 20. Parking Brake
- 21. Airspeed Indicator
- 22. Attitude Indicator
- 23. Altimeter
- 24. Alternate Static Source
- 25. Throttle
- 26. (Fuel) Mixture Control
- 27. Flap Control

- 28. Temperature Control
- 29. Radio Panel
- 30. NAV2
- 31. Comm2
- 32. Fuel & Engine Instruments
- 33. Hobbs Meter
- 34. Autopilot

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