Gold Seal

Learn to Fly

Gold Seal Online Ground School

www.GroundSchool.com

Thank you to the following people for the use of their aviation photographs: David Tscholl, Michael Ossipov, Arnaud Dachary, Woody Hatchett, Robert Dunn, David Alders, and Ron Baak.

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Introduction

Becoming a pilot is an exciting proposition. Imagine being able to hop into an airplane and soar skyward, free to go virtually anywhere you wish. See the most fantastic vistas and feel the thrill of confidence. Pilots are special people who have earned a special recognition. Many people dream about it, but few ever reach the goal. You can be one of those few and you can start your journey right now.

The path you'll take while earning your wings won't be the easiest thing you have ever tried. But it isn't terribly difficult either. It will require some diligent study and practice, but it is something that you can do. It only takes determination and a sense of adventure.

As a pilot, you will be able to fly an airplane nearly anywhere in the country. Journeys that might have taken six or seven hours in a car can be made in only three hours in an airplane. Take your friends and family on exciting trips. Fly yourself to business meetings or visit with far-flung customers. And if you're considering a career as an airline captain, the private pilot certificate is your first step.

In this book, we will show you exactly what you need to know to earn your pilot certificate as quickly and economically as possible. We will guide you through the process and point you toward the resources you will need.

This book is a primer. It does not cover everything that a pilot needs to know. But it does introduce you to all the fundamentals you will need to get started. Consider it Step #1 in your new adventure.

Russ Still, ATP, CFI/CFII, Master CFI

Section I

What Does it Take?

On any given day, there are between 50,000 and 100,000 active student pilots in the United States. Most are working to become private pilots, but some are working toward sport pilot certification or recreational pilot certification. You can become one of them and it may be easier than you think. All it takes is the desire and commitment to go for it and see it through. And you don't even need to have perfect vision.

Learning to fly is not reserved for military personnel, engineers, and thrill seekers. In fact, the average student pilot is probably just like the average American. No special education is required to get started, and you certainly don't have to be a genius. There is nothing involved in flight training that an eighth grade science student cannot grasp. Sound easy? It really is. But don't be mistaken - the material you have to learn isn't overly difficult, but there is a lot of it. There is a lot more to flying an airplane than simply steering it around and landing.

There are two types of skills you have to master to become a pilot: the physical skills involved in actually flying the airplane, and the knowledge mastery of topics that cover everything from navigation, to aerodynamics, to weather theory. Your flight instructor will help you with the first, and Gold Seal will help you with the second.

Depending on how often you fly, and how much you study on your own, it will probably take you between three and nine months to complete your private pilot training. A sport pilot certificate can be earned in less time, but also has fewer privileges. In either case, the more that you study, the more quickly you will complete the program and attain your goal of becoming a certificated pilot.

Minimum Flight Training Hrs.	Sport Pilot	Rec. Pilot	Private Pilot
Flight Time – total training hrs	20	30	40
Dual Instruction	15	15	20
Dual Cross Country	2	2	3
Solo Flight	5	3	10
Solo Cross Country	1	0	5
Instrument Training	0	0	3
Flight Test Preparation	3	3	3

The Process

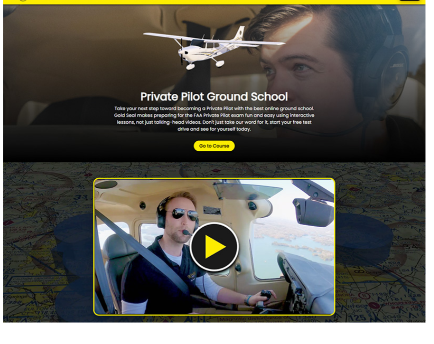
There are a lot of flight training paths available. Different people will prefer different routes. But they all lead to the ultimate goal of becoming a safe, proficient, and legal pilot. **Note that US citizens must show proof of citizenship prior to beginning flight training. Bring your passport or U.S. birth certificate to your first flight lesson. Students who are not citizens must begin the process by registering with the TSA Alien Flight Student Program.** *(For more information visit https://www.fts.tsa.dhs.gov.)*

As you progress through your training you must learn things, demonstrate proficiency to your instructor, and pass some tests required by the FAA (Federal Aviation Administration). There are a lot of ways to accomplish these things based on your schedule and your style.

There are some common misconceptions about flight training. The most typical one is that you simply take a written test then fly with an instructor for some prescribed number of hours. That is sort of how the process works, but is a gross over-simplification.

Studying for the written test (known by the FAA as the “Knowledge Test”) is necessary, but is not an end in itself. Some of the conceptual material you must learn is not covered in the written test, but you still must master it. A complete program of learning will thus prepare you for more than just the written test. Your instructor will determine whether or not you have learned this additional material, and the examiner will verbally test you on it when you take the “Practical Test” at the end of your training.

The FAA doesn’t care how you acquire the necessary knowledge. You can take a formal ground school where an instructor lectures to the group. Or, you can study on your own using books, CDs, DVDs, and computerized tools. All that matters is that you learn the material.



The Gold Seal Online Ground School provides complete multimedia instruction right on your computer. It should be you primary training resource.

Sign up for free at **www.GroundSchool.com**.

The flight portion of your training is not geared toward filling your logbook with hours. Its goal is to teach you the necessary skills, regardless of how many hours it takes. The FAA does set some minimums, but most people take considerably more hours to attain sufficient mastery.

Requirements

There is no minimum age to begin flight training, although a student pilot must be at least 16 years of age to solo. A student pilot must be at least 17 years of age to take the Practical Test. This is the final exam (usually called the "checkride") conducted with an FAA or FAA-designated examiner. Upon successful conclusion of the Practical Test, the candidate is immediately issued a pilot certificate.

To take the Private Pilot Practical Test, a student pilot must:

- Be at least 17 years of age
- Be able to read, speak, write, and converse fluently in English
- Obtain a 3rd-Class Medical Certificate (which doubles as the student pilot license) - this is not required for Sport Pilots
- Pass the FAA Knowledge Test (usually called the "written test") with a score of at least 70%
- Complete a curriculum of flight training (which generally entails between 50 and 80 hours of in-flight training plus some unspecified amount of ground training) - less training is required for Sport Pilots, but they also have fewer privileges

You’ll find more details about all of this in the next section.

iPad Users

If you use an iPad with one of the popular aviation apps (such as Foreflight) you will have access to digital versions of the sectional charts and A/FD information. Even though your instructor may allow you to use this in lieu of the “old” paper versions, we strongly recommend that you start out with paper. There are several reasons why:

(1) Paper always works – it doesn’t require electricity
(2) Paper versions are used in your FAA written test
(3) The examiner may "fail" your tablet at some point during your checkride. Have paper charts at the ready for backup.

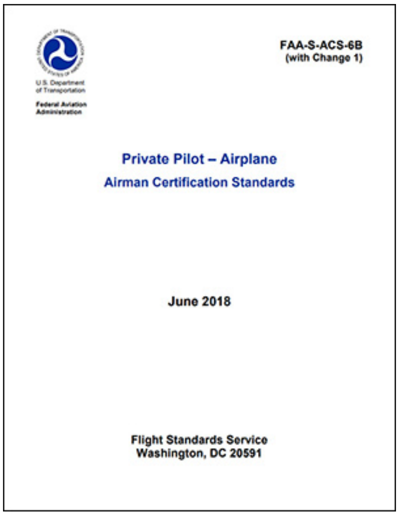
When using your iPad in the cockpit, make sure it is in a mount or kneeboard. This will help you in cockpit management and workload reduction.

How Does it Work?

Your training program may take any of a number of forms. The order in which you do parts of it may vary. But the skills you learn and knowledge that you master will be the same.

For example, some people take the Knowledge Test before they begin their actual flight training. Other people prepare for it during the flight portion of their training and take it whenever they are ready. The one thing that you don't want to do is to put if off until the end. Don't feel the need to take the test at the very beginning, but do try to get it done by the halfway point in your flight training.

The specific flight skills and their required tolerances are documented in an FAA publication called the Airman Certification Standards (ACS). Don't buy a hardcopy version of this. It is freely available on the internet as a .pdf file. You can download a copy from the FAA or from the Gold Seal Online Ground School Library. Print it out and go over it with your flight instructor.



U.S. Department of Transportation
Federal Aviation Administration

FAA-S-ACS-6B
(with Change 1)

Private Pilot – Airplane
Airman Certification Standards

June 2018

Flight Standards Service
Washington, DC 20591

The ACS dictates precisely what must be covered during your Practical Test. Obviously, you will want to know what is expected of you in advance. This is an important document and you should refer to it frequently throughout your training.

Note: The ACS is periodically updated. The cover shown to the left was current as of July, 2023.

Your training program will roughly follow this sequence:

(1) Select a flight school or flight instructor.
(2) Learn the basic flight skills needed for solo flight. These include the obvious skills of takeoffs and landings. But they also include several basic flight maneuvers along with the knowledge of regulations, airport operations, and radio communications. (See Section III)
(3) Unless you are training for light sport, get your FAA medical certificate. This FAA page will help you find a medical examiner: https://www.faa.gov/pilots/amelocator/
(4) Apply for your Student Pilot Certificate at iacra.faa.gov. Your flight instructor will help you with this.
(5) Begin studying for the FAA Knowledge Test. Much of this is material is needed for your day-to-day training flights.
(6) Prepare for a pre-solo written test that your instructor will provide.
(7) Continue learning more advanced flight skills with your instructor.
(8) Solo! This is your first flight by yourself. It generally entails three takeoffs and landings at your training airport. It is your first major milestone. Don't worry – your instructor will know when you are ready for this important event.
(9) Continue learning more advanced flight skills with your instructor.
(10) Take, and pass, the FAA Knowledge Test.
(11) Solo practice.
(12) Cross country flights with your instructor.
(13) Solo cross-country flights.
(14) Night flight training with your instructor.
(15) Preparation for the FAA Practical Test. This includes an oral portion and a flight portion, conducted with an FAA (or FAA-designated) examiner. The requirements for this are documented in the Airman Certification Standards.
(16) Take, and pass, the FAA Practical Test. After you pass this test you will be issued a temporary Pilot Certificate identifying you as a fully certificated Pilot.

Tools of the Trade

Certain items are needed by pilots. This list contains the basics that you will need as a student pilot.

(1) FAR/AIM – book of FAA regulations (new one every year)
(2) Sectional Chart – an aeronautical chart of your geographical area
(3) A/FD – Airport/Facility Directory (contained in the "Chart Supplement" booklet); provides information about airports in your geographical area (updated every 56 days)
(4) Flight Computer – inexpensive mechanical or electronic device or smartphone app used to make specific types of calculations
(5) Plotter – a clear plastic gage used to measure distances and plot magnetic headings on charts
(6) Headset – your instructor or flight school may provide you with one to use during your training but you will eventually want to purchase your own (airplanes are noisy!)
(7) Small electronic calculator
(8) Text books – your instructor or flight school will probably suggest specific texts for your study; the FAA's *Pilots Handbook of Aeronautical Knowledge* and *The Airplane Flying Handbook* are good options. You may download these for free from GroundSchool.com.

The Written Test

Just about every student pilot puts the FAA Knowledge Test at the top of the list of hurdles. Many assume that it is the main reason they have to study or attend a ground school. That's not quite the case.

First, the written test is not just some obstacle that the FAA has placed in your path. It is not an issue of jumping through a hoop. The material it covers is, for the most part, very important in the day-to-day duties of a pilot. It really is stuff you need to know.

Second, the study you do during your training is not just for the written test. There is a lot of pilot material that is not covered in the test, but you still need to master it. Don't make the mistake of cramming for the written test and think that's all there is to it. Study from a *complete* ground training program.

The Knowledge Test is composed of 60 multiple choice questions. A minimum score of 70% is required to pass. The questions came from an FAA bank of over 800 possible questions. Thus, many students, too many actually, simply studied the questions and answers in preparation for the test.

The FAA recognized that this was happening, and started adding new questions with more frequency. No study product has precise, accurate list of all the questions and answers, so don't try to memorize the questions. Learn the material and it won't matter how the questions are worded.

As you study for the written test, by all means, take advantage of the sample quizzes available online. But commit yourself to a thorough study of all the conceptual material, not just the questions you think may appear on your exam.

In Section II, you'll be introduced to the basic knowledge subjects required of pilots. It's a quick overview of the fundamentals. You will learn more of the details as your training progresses. There is nothing that will impress your instructor more than for you to walk through the door with a good foundation in the principles of aviation.

Being prepared and studying on your own will expedite your training as well as save you money. For more tips on saving money, see the Article in the Gold Seal Online Ground School entitled "How To Save Money on your Flight Training". You have the ability to minimize your costs. You just have to do it.

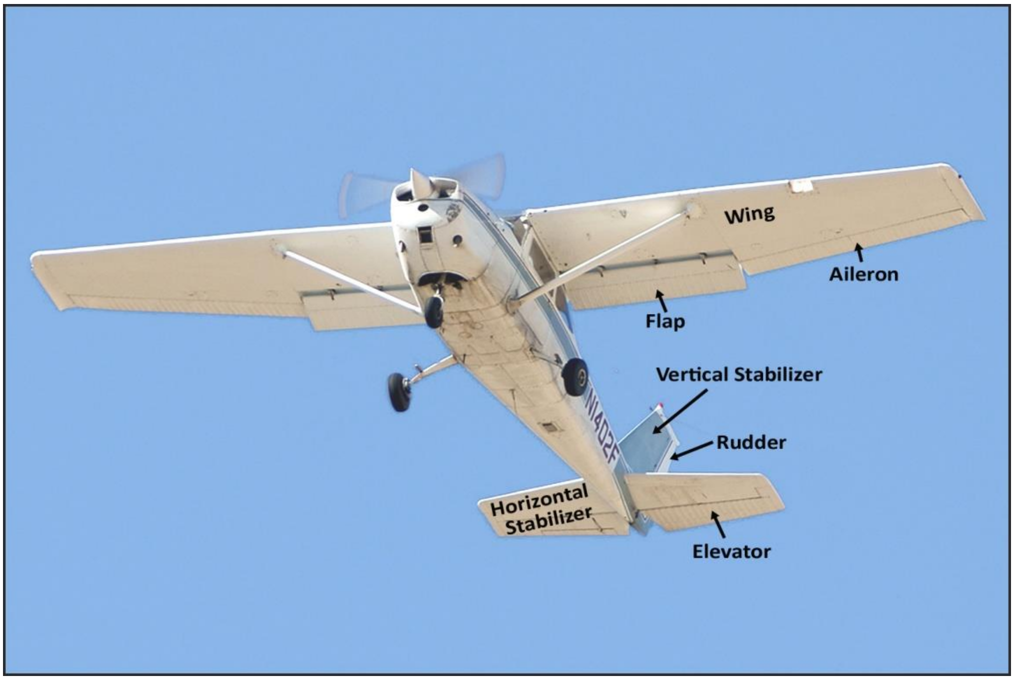
Section II

The Airplane

Airplanes are the most common form of aircraft in the FAA Category. Other types of aircraft include balloons, gliders, and rotorcraft such as helicopters. While you could do your private pilot training in a multi-engine airplane, it is more likely that you will train in a light single engine airplane. Models frequently used for training are manufactured by companies such as Cessna, Piper, and Diamond.

Airplane Structure

The main body of an airplane is called the *fuselage.* It extends from the tail to the firewall and upon it are mounted the engine, wings, landing gear and tail section (which is called the *empennage*). The cabin or cockpit is located inside.

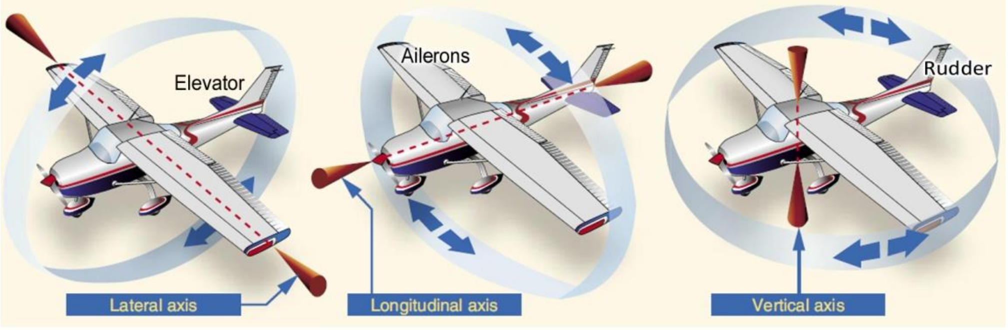


When air flows over an airplane's wings, an upward force called *lift* is generated. Lift is what enables an aircraft to remain in the air. In flight, an airplane moves in three dimensions. Control surfaces on the exterior of the airplane allow the pilot to maneuver the airplane. Two of these control surfaces, the *ailerons* and *elevator*, are manipulated using the yoke (or in some airplanes, a control stick). A pilot controls a third control surface, the *rudder*, by pressing foot pedals. These same foot pedals are also used to steer the airplane on the ground.

Elevator – Controls *pitch*; the nose of the airplane moves up or down

Ailerons – Control *roll*; as one wing goes up, the other goes down

Rudder – Controls *yaw*; the nose of the airplane moves side to side



The coordinated use of all three control surfaces allows the pilot to smoothly maneuver the airplane in three dimensional space.

Another type of control surface, called *flaps*, is used to assist in landings. Pilots generally land with the flaps extended, but during your training, you will learn to land with or without them. In some airplanes, flaps may also be used during takeoffs to get the airplane airborne more quickly. There are several types of flaps. Most are used to increase lift at lower airspeeds.

Thrust, the force that moves the airplane through the air, is generated by the turning motion of the propeller. In the early days of flight, the propeller was frequently called the airscrew. And honestly, that's a pretty descriptive term. It pulls the airplane through the air just like a screw pulls itself through wood. As the airplane moves forward, air rushes over the wings creating lift, and there you are – flying!

Training Airplanes

Two popular training airplanes are the Cessna 172 and Piper Warrior. Both carry up to four people and both have similar handling characteristics.

Because the Cessna, shown above, has high wings, you are given a good view of the ground, but an obstructed view above and to the sides. The Piper, shown below, provides a better view around you, but a poorer view of the earth’s surface. So which one is better? That’s a long-standing debate that will likely never be answered. Both are excellent for training.

The Diamond DA-20 and DA-40 models are also used frequently as training aircraft. They have a more modern design and are operated with a control stick instead of a yoke.

Airplane Instruments

While flying, pilots must be able to monitor a variety of factors affecting the airplane. These include things like airspeed, altitude, heading, and the airplane's attitude. Attitude refers to the airplane's position in 3D space. As we discussed earlier, an airplane's motion revolves around 3 axes. The motions about these axes are called roll, pitch, and yaw. The instruments that display this information are called flight instruments. Pilots frequently call these the "six pack" because the round dials look something like a six-pack of canned drinks.

To assist with navigation, instrument panels will also include navigation instruments. These work in conjunction with the navigation radios and, if present, the GPS receiver.

Finally, there are the engine monitoring instruments. In most training airplanes these include a tachometer (which shows engine RPM), an oil temperature gage, an exhaust gas temperature gage, and an oil pressure gage.

In this picture we see the “six pack” of standard flight instruments. They may look slightly different in your training airplane, but this is basically how they are laid out. In this example, the airplane is sitting motionless on the ground – that explains why the Airspeed Indicator and Altimeter both show zero.

Airspeed – An aircraft’s speed is measured as airspeed, not ground speed. Airspeed indicates the aircraft speed within the air mass. The air mass, itself, will usually also be moving. Ground speed is the speed at which the aircraft moves over the ground. Obviously, the ground is stationary. Airspeed and ground speed will usually be different. They will only be the same when the air is totally calm.

Altitude – Altitude is generally measured in feet above mean sea level (MSL). The reason for this is simple. Terrain goes up and down. But airplanes reporting their altitudes over the radio must use a measure in terms of some standard starting point. Altimeters operate based on barometric pressure. The current pressure is entered into the altimeter by the pilot prior to takeoff. During cross-country flights, the pressure setting must be updated.

Shown above is a Cessna 172 with a panel of conventional instruments. Although they use older technology, they are still accurate and reliable. The rectangular stack to the right of center contains the radios and other navigational avionics devices.

Below is a Cessna 172 with a more modern instrument panel. This one is the Garmin G-1000. It is frequently referred to as a “glass panel”. In spite of all the computer displays, it gives the pilot the same information provided by a conventional instrument setup.

Rental prices on airplanes with glass panels such as the G-1000 will likely be higher than fees for airplanes with conventional instruments. Most newer airplanes are being manufactured with glass panels, but there remain a huge number of older airplanes.

Unlike cars, airplanes from the 1960s and 1970s are not “too old.” Planes are not generally discarded when they pass their tenth birthday. Owners keep them fresh and safe with extensive maintenance.

Training in an older airplane can be just as safe as training in a brand new one. Complete inspections, conducted by FAA licensed mechanics, are required of all airplanes used in commercial training. When maintained properly, older airplanes can provide a great opportunity for you to save money.

If you decide to train in an airplane with a G-1000, take advantage of Gold Seal’s online training course at www.Fly1000.com. It’s an easy way to get yourself up to speed quickly with this exciting new technology.

Airplane Engines

Most single-engine airplanes have four-cylinder, four-stroke, air-cooled engines manufactured by Lycoming or Continental. LSA (light sport) airplanes frequently use smaller engines manufactured by companies like Rotax. These may be two-stroke or four-stroke engines.

An airplane’s battery is used to start the engine, but once it is running, the sparks plugs are fired from devices called magnetos. If the electrical system fails in flight, the spark plugs will continue to receive electricity from the magnetos and the engine will remain running.

Most airplane engines are designed to burn 100LL aviation gasoline, referred to as avgas. This fuel has a distinctive blue color. When fueling, it is important for pilots to ensure that the proper type of gasoline is pumped.

Fuel is tested by draining a small amount from valves under the wings and engine compartment into a clear receptacle. The pilot can then visually confirm that the fuel is the proper blue color and contains no water or other contaminants. This is part of the standard preflight inspection that is performed by the pilot before every flight.

Additionally, fuel in the tanks must be manually checked for quantity by inserting a marked stick or tube into the tanks. There are fuel quantity gages on the instrument panel but these are notoriously inaccurate. Always confirm the amount of fuel manually prior to flight.

Also during the preflight inspection, the oil dipstick is checked to make sure that engine contains an adequate amount of oil. This will range from six to twelve quarts depending on the specific engine.

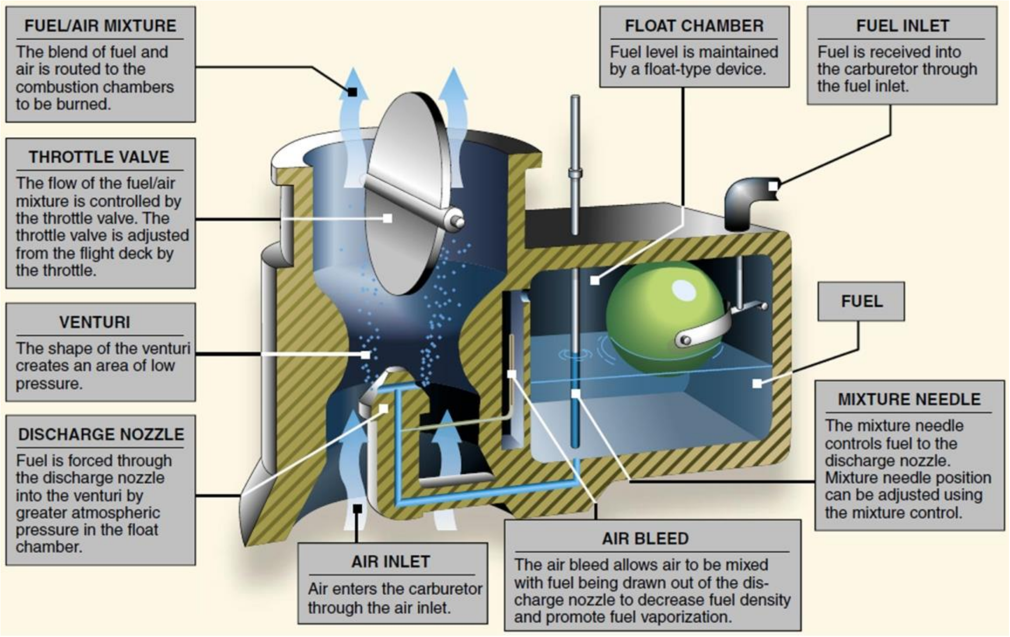
As a pilot, it is your responsibility to know exactly how much fuel and oil your airplane engine carries and to confirm that there are adequate amounts for flight. You must also know how many gallons of fuel the airplane burns per hour. Knowing that and how many gallons are in the tanks allow you to calculate how long you can fly. Regulations require that you carry a minimum of 30-minutes worth of reserve fuel. For safety, always have at least an hour's worth more than you need for the flight.

The power control for an airplane engine is the throttle, operated with the pilot's right hand. Pushing it in causes more fuel to flow and the engine's RPM (revolutions per minute) to increase. Engine RPM is measured with a gage called a tachometer. Most people refer to it simply as the "tach". In airplanes with a controllable-pitch propeller (known as a "constant-speed" propeller), engine power is measured instead by a manifold pressure gage. Most training airplanes will not have a constant-speed prop.

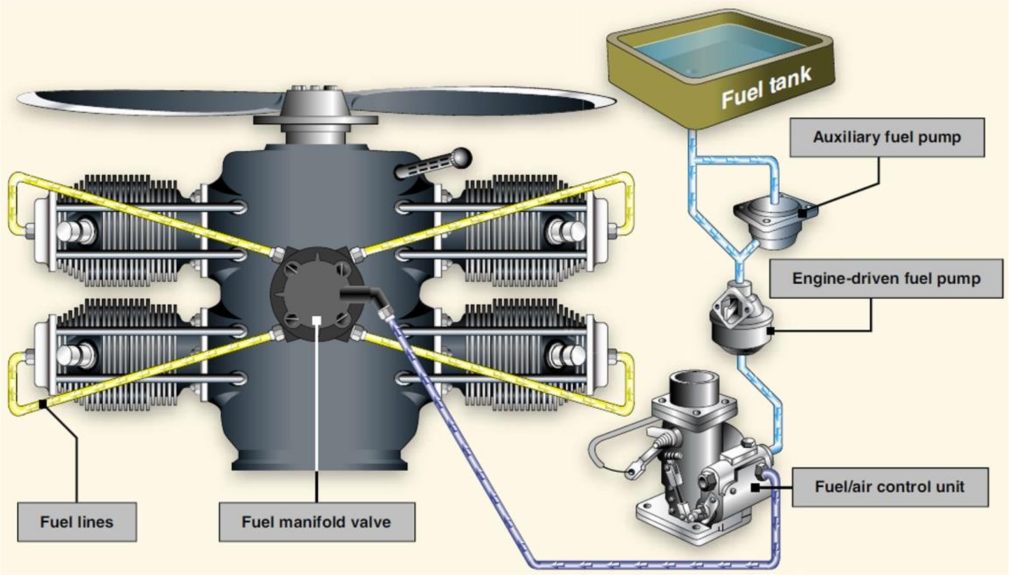
Fuel Systems

Most training airplanes have fairly simple fuel systems consisting of two fuel tanks, one in each wing, a fuel selector valve, and either a carburetor or fuel injection system to deliver fuel to the engine.

Carburetors take fuel and air, mixing them into a mist. This mist is sucked into the engine cylinders for ignition by the spark plugs.



Fuel-injected engines handle the fuel delivery issue a bit differently. Fuel is pumped from the tanks into a control unit which mixes it with air. The fuel/air mixture is then piped into a fuel manifold which distributes it to the cylinders where it is directly injected.



The Airport

If you mention the word airport to a non-pilot, most people immediately think you're talking about the large complexes where commercial passenger jets operate. If they have a small municipal airport in their own town, they might not even be aware it exists. Most Americans would be surprised to learn that there are over 5,000 public use airports in the United States. And subject to some restrictions, if you're a pilot, you can fly in and out of any of them.

Some airports have a control tower. At these, a controller verbally directs all traffic via the radio. At non-towered airports, pilots follow standard practices and announce their movements on a frequency specific to that airport. This frequency is called the Common Traffic Advisory Frequency (CTAF). Pilots must understand and abide by specific rules when operating at any airport.

Airport Layout

While airports vary widely in their physical layouts, there are major distinctions that are common to all of them.

Control Tower – A physical building, usually in a tower, where controllers monitor and direct aircraft operations. There are special rules for operations at these airports including the requirement for pilots to maintain radio contact with controllers. Airports with towers are normally designated as Class B, Class C, or Class D. Smaller airports frequently are non-towered and are designated as Class G or Class E.

Runways – Used for aircraft takeoff and landing operations. Runways may be paved or they may be "unimproved" (grass, dirt, etc.). Runways are identified by numbers that correspond to their approximate magnetic headings. For example, Runway 27 faces to the west on a heading of 270°. At towered airports, aircraft must be cleared to takeoff or land by the tower controller. At non-towered airports, it is the pilot's responsibility to announce his or her intensions on the Common Traffic Advisory Frequency.

Taxiways – Used for taxi operations, that is, ground movement of vehicles. Taxiways are bordered by blue lights and marked by yellow centerlines, and they are identified by alphabetic letters or combinations of a letter and a number. At towered airports, aircraft must be cleared to taxi by the ground controller.

FBO – Fixed Base Operator. This is generally a business that services aircraft and crew with parking facilities, fuel, maintenance, and amenities. Most airports will have at least one FBO, but some smaller airports may not have any. Flight schools and independent instructors (CFIs) sometimes operate from an FBO. Pilots usually check on the availability of FBO services before visiting an airport for the first time.

Standard Signage – Airports are covered with signs assisting pilots in locating taxiways and runways. There are also standard signs instructing pilots in certain operations. Every pilot must be familiar with the standard signage.

Airport Identifier – A three or four-digit code that identifies each airport. Pilots are expected to know these identifiers for the airports they may be visiting or using as waypoints. These codes are shown on aeronautical charts and in the Airport/Facility Directory (contained in the *Chart Supplement*).

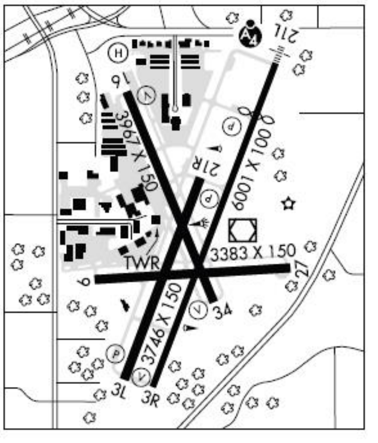
The legal source for airport information is the Airport/Facility Directory (A/FD). It is contained in an FAA publication called the *Chart Supplement*. This little green book is published every 56 days and provides descriptions of every public use airport in your area. It should be considered your primary reference for airport information. You will find digital versions of the A/FD information online as well as in tablet apps.

As a student pilot, you will use the A/FD to learn about any airport prior to visiting it. Additionally, some questions on the FAA Knowledge Test refer to the A/FD so you will need to be very familiar with it.

This is the entry in the A/FD for Atlanta's DeKalb-Peachtree Airport. It lists geographic information about the airport, runway data, remarks, radio frequencies, and information about radio navigation aids.

DEKALB–PEACHTREE (PDK) 8 NE UTC–5(–4DT) N33°52.54´ W84°18.12´ **ATLANTA**
1003 B S4 **FUEL** 100, JET A, A1 OX 1, 2, 3, 4 TPA—See Remarks LRA NOTAM FILE PDK **H–9A, 12F, L–18J, A**
IAP, AD
RWY 03R–21L: H6001X100 (CONC–GRVD) S–46, D–75, 2S–84 HIRL
RWY 03R: REIL. VASI(V4L)—GA 3.0° TCH 23´. Trees. Rgt tfc.
RWY 21L: MALSF. PAPI(P2R)—GA 3.0° TCH 61´. Thld dsplcd 999´. Pole.
RWY 16–34: H3967X150 (ASPH) S–20 MIRL
RWY 16: VASI(V4L)—GA 3.4° TCH 41´. Pole.
RWY 34: REIL. VASI(V4L)—GA 3.3° TCH 45´. Trees.
RWY 03L–21R: H3746X150 (ASPH) S–20 MIRL 0.4% up S
RWY 03L: PAPI(P2L)—GA 3.0° TCH 34´. Trees.
RWY 21R: PAPI(P2L)—GA 3.0° TCH 50´. Trees. Rgt tfc.
RWY 09–27: H3383X150 (ASPH) S–20 HIRL 0.8% up W
RWY 09: Trees.
RWY 27: Tree.
RUNWAY DECLARED DISTANCE INFORMATION

RWY 03R: TORA–5411	TODA–6001	ASDA–5411	LDA–5411
RWY 09: TORA–3293	TODA–3383	ASDA–3293	LDA–3293
RWY 21L: TORA–5801	TODA–6001	ASDA–5801	LDA–4801
RWY 27: TORA–3383	TODA–3383	ASDA–3383	LDA–3293



AIRPORT REMARKS: Attended continuously. Pilots should be alert when opr at PDK due to high number of rwy incursions. Be alert during acft gnd ops. Multiple rwy/twy crossing rqr. Heavy helicopter ops NW corner of arpt. Helipad located north of Rwy 16 thld. Flocks of birds on or near arpt during dalgt hrs. TPA—2003 (1000) single engine, 2503 (1500) all multi engine. PPR for acft with max gross weight more than 75,000 pounds. PPR for all transient military acft. All Twy K is non–movement area. Voluntary ngt curfew in effect from 0400–1100Z‡. No high power engine/maintenance runups from 0300–1200Z‡. Noise sensitive area all quadrants; pilots use close–in dep procedures. ARFF on fld, no index. When twr clsd HIRL Rwy 03R–21L preset med ints; to increase ints and ACTIVATE MALSF Rwy 21L and twy lgts—120.0. Flight Notification Service (ADCUS) available.
WEATHER DATA SOURCES: ASOS (770) 457–1691 LAWRS.
COMMUNICATIONS: CTAF 120.9 **ATIS** 128.4 **UNICOM** 122.95
PEACHTREE RCO 122.1R 116.6T (MACON RADIO)
Ⓡ **ATLANTA APP/DEP CON** 126.975 **CLNC DEL** 120.9
PEACHTREE TOWER 120.9 127.2 (1130–0400Z‡ Mon–Fri, 1200–0400Z‡ Sat & Sun) **GND CON** 121.6 **CLNC DEL** 125.2
AIRSPACE: CLASS D svc 1130–0400Z‡ Mon–Fri, 1200–0400Z‡ Sat–Sun other times CLASS E.
RADIO AIDS TO NAVIGATION: NOTAM FILE PDK.
PEACHTREE (L) VOR/DME 116.6 PDK Chan 113 N33°52.54´ W84°17.93´ at fld. 970/5W.
ILS 111.1 I–PDK Rwy 21L. Glideslope unusable byd 4° left of course and 8° right of course. Glideslope unmonitored.

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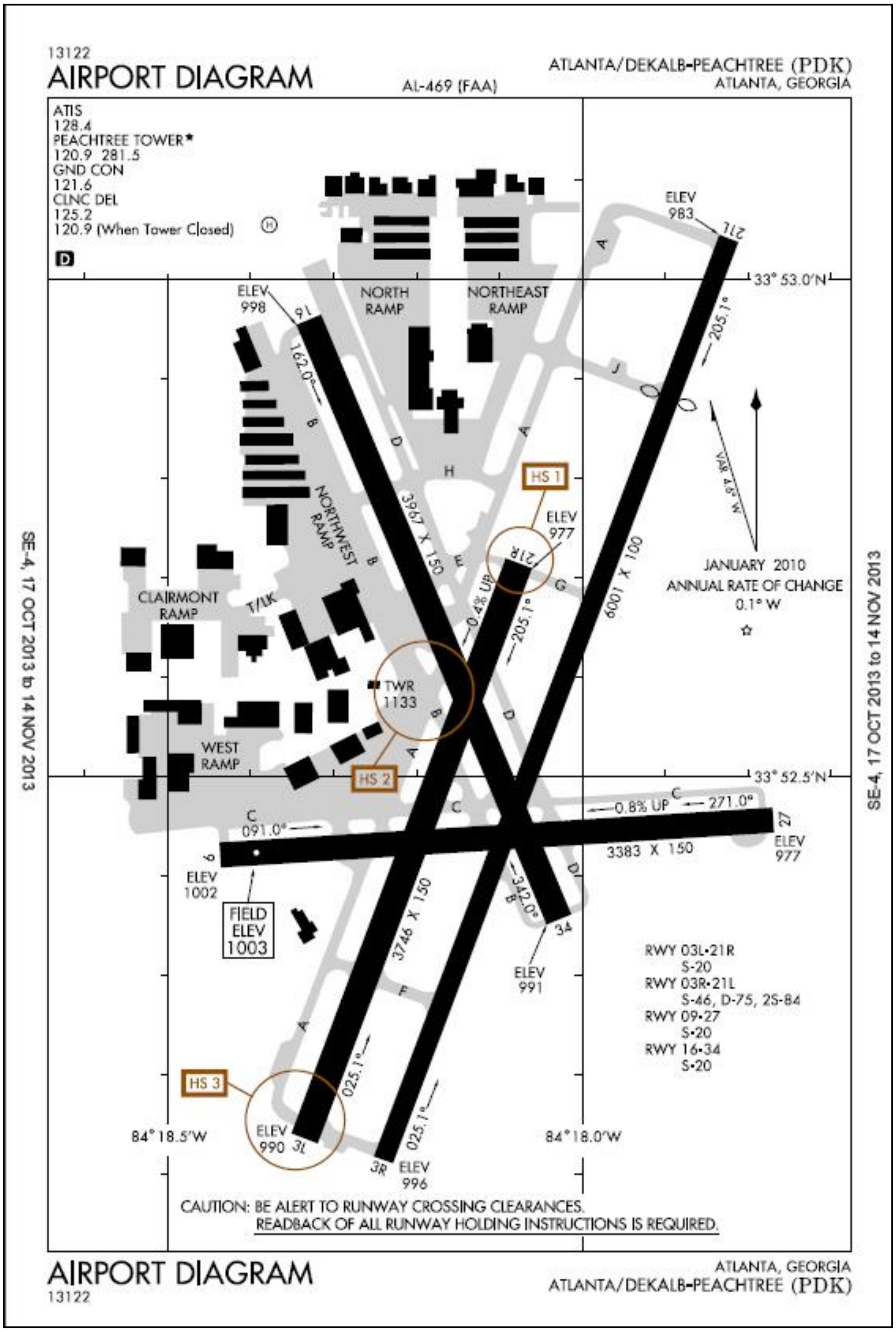
HELIPAD H1: H56X56 (CONC)
HELIPORT REMARKS: H1 perimeter lgts opr dusk–dawn.



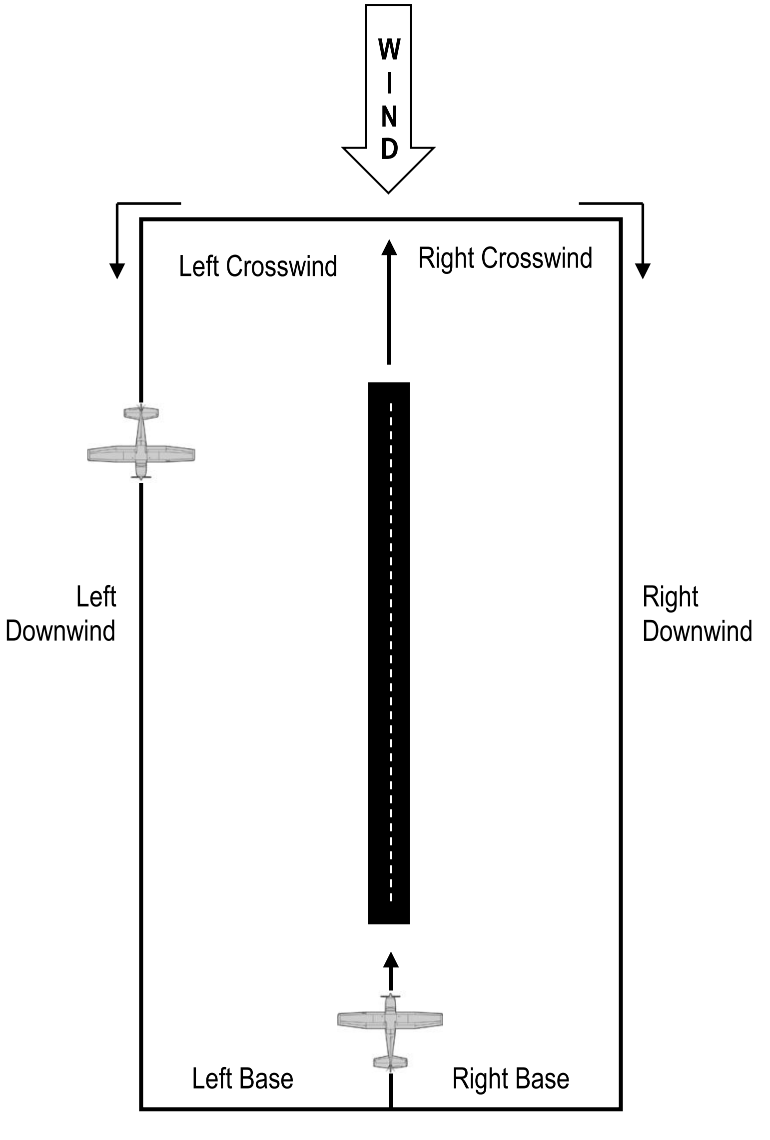
This airport diagram depicts DeKalb-Peachtree Airport (PDK). Notice the two parallel runways. Since they share the same magnetic heading, the letters “L” and “R” are appended to designate left and right.

Compare this overhead image of PDK with the airport diagram on the previous page.

The Traffic Pattern

Airplanes landing at an airport enter into the airport's traffic pattern. This is a rectangular flight path that usually exists 1000 feet above the surface. At some airports, the traffic pattern may exist at 800 feet above ground level (AGL) or may even exist at some other specific altitude. 1000 feet AGL is the norm, but refer to the A/FD to determine the proper traffic pattern altitude (TPA) at any airport you visit.

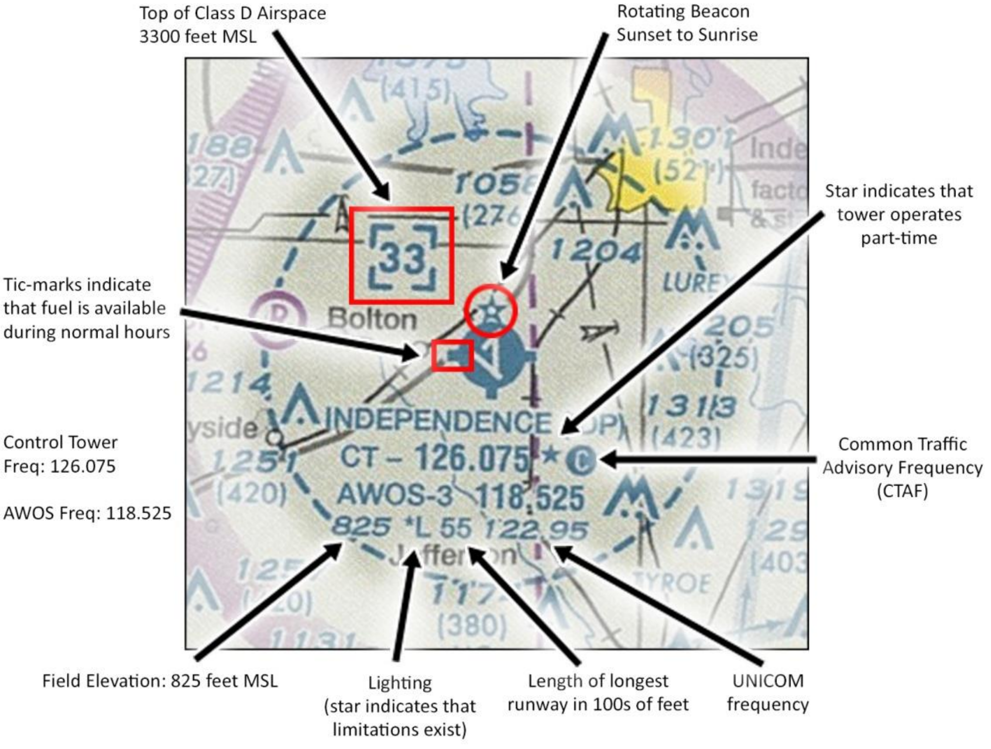
Traffic patterns are divided into legs called the crosswind, downwind, base, and final as shown in this diagram.



As a standard, traffic patterns move in a counterclockwise direction. This is called “left traffic” because all turns in the pattern are to the left. Some airports have non-standard patterns and use right traffic. And to make things even more complicated, sometimes the pattern direction differs between each runway at a single airport. Again, check the A/FD to determine which is appropriate.

Airport Symbology

Airports are depicted on Sectional Charts for obvious reasons. Note that towered airports are shown in blue and non-towered airports are shown in purple (magenta). Study the diagram below to see what type of information is shown on charts for airports.

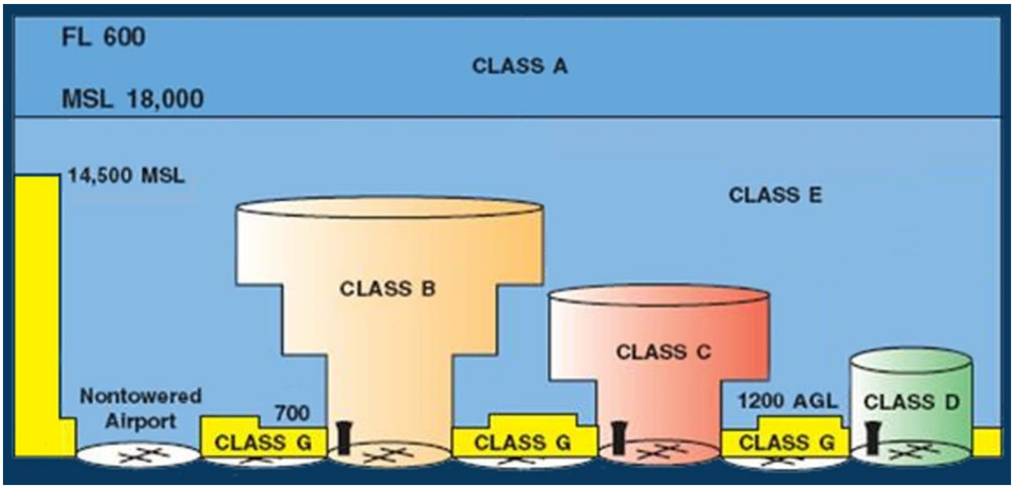


The Airspaces

The atmosphere is divided into a three-dimensional complex of specific volumes. This is the National Airspace System and it is administered by the Federal Aviation Administration. It begins at the surface and extends up to FL 600 (roughly 60,000 feet MSL). Every cubic inch is included.

Airspaces are divided into controlled and uncontrolled volumes and are further categorized by letter, A through G.

In addition to the lettered airspaces, there are Special Use Airspaces. These include MOA (military operations areas), restricted, prohibited, ADIZ (air defense identification zone), TFR (temporary flight restriction), warning areas, alert areas, and controlled firing areas. Each type of airspace has its own characteristics and rules. Pilots must understand these in detail.



Class A			**A**ltitude greater than 17,999 feet MSL; IFR only
Class B	T o w e r s	*controlled*	Shaped like a **B**ig inverted wedding cake; Biggest/Busiest
Class C			Shaped like a **C**ake with two tiers
Class D			Shaped like a **D**rum or a cylinder
Class E			**E**verything else that is controlled; usually starts at 1,200 ft. AGL
Class G	*uncontrolled*		**G**round upward; may contain untowered airports

As was noted in the previous section, airports with control towers normally exist in Class B, C, or D airspace. There are exceptions, however.

Pilots must have a thorough knowledge of the lettered airspaces. They must be able to instantly recognize them on aeronautical Sectional Charts and know the rules for operating within them.

Class A – Exists from 18,000 feet MSL to 60,000 feet MSL. There are no VFR (visual flight rules) operations allowed in Class A. Aircraft must be on IFR (instrument flight rules) flight plans to operate in Class A airspace.

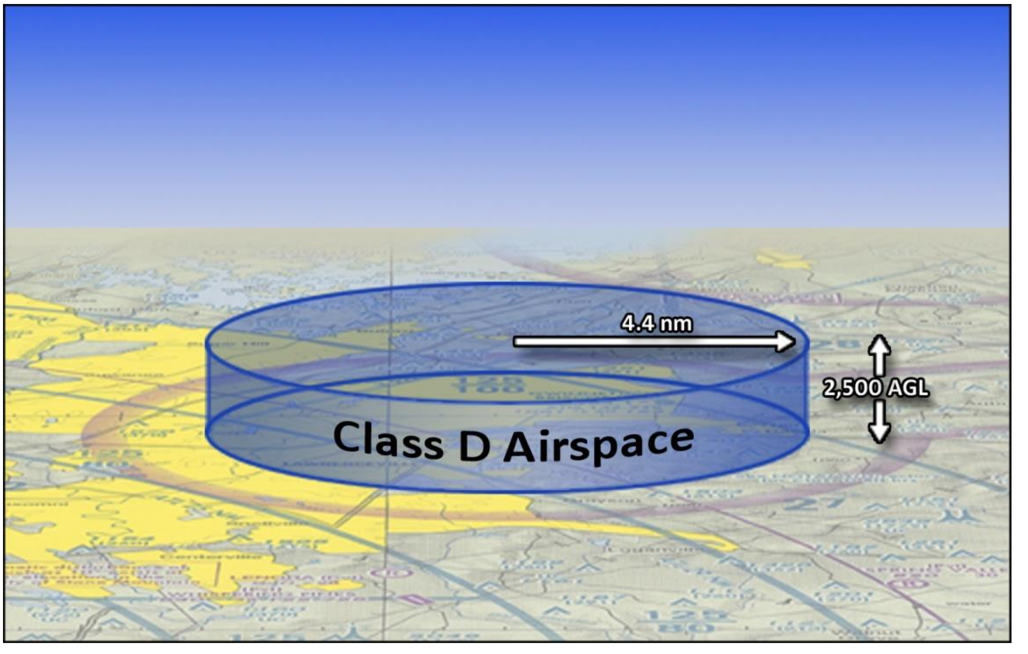
Class B – Exist around the nation's largest and busiest airports such as Atlanta Hartsfield, Chicago O'Hare, Los Angeles International, and Dallas-Fort Worth. Pilots must have an explicit clearance to operate within Class B. VFR flights require a minimum of three miles visibility and the aircraft must remain clear of clouds. The top of a Class B multi-tiered airspace is usually 10,000 feet AGL although this does vary from one airport to the next. Class B airspace is indicated on Sectional Charts by solid blue outlines.

Class C – Exist around busy airports that are serviced by their own dedicated approach controllers. Pilots must establish communications with the approach controller prior to operating in Class C. The top of Class C is usually 4,000 feet AGL. Class C airspace is indicated on Sectional Charts by solid purple (magenta) outlines.

Class D – Usually, but not always, this airspace exists around smaller airports. They will have operating control towers. Pilots must establish communications with the tower controller prior to operating within Class D. The top of Class D is usually 2,500 feet AGL. Class D airspace is indicated on Sectional Charts by dashed blue outlines.

Class E – This is any controlled airspace that is not already designated as Class A, B, C, or D. Think of it as "everything else". When you're out flying around the countryside, away from an airport, you will probably be in Class E airspace. Usually starts at 1,200 AGL, but may start at 700 feet AGL around some airports, or even start at the surface.

Class G – Exists from the surface up to any overlying airspace. Think of it as from the "ground up". Class G is the only uncontrolled airspace in the National Airspace System.

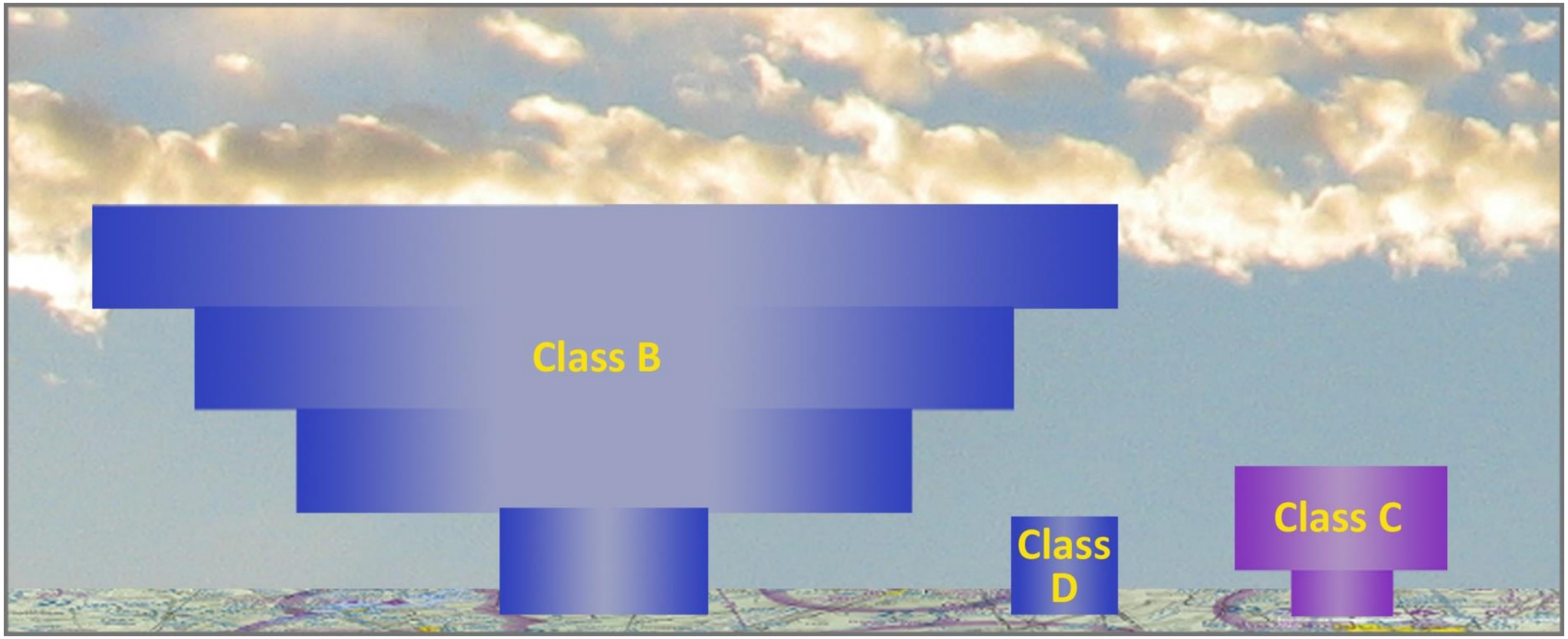


VFR Minimums

The regulations for VFR (Visual Flight Rules) flight vary in the different classes of airspace. They are expressed in terms of visibility (in statute miles) and cloud separation (i.e. your distance from the clouds). Since there are no VFR operations in Class A, there are no VFR minimums in Class A airspace.

You can expect questions about VFR minimums on both the Knowledge Test and in the oral portion of your Practical Test. You will need to commit this chart to memory.

Airspace			Visibility	Cloud Separation
Class B			3 statute miles	clear of clouds
Class C			3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
Class D			3 statute miles	
Class E	less than 10,000 MSL		3 statute miles	
	at or above 10,000 MSL		5 statute miles	1,000 feet below, 1,000 feet above 1 statute mile horizontal
Class G	1,200 feet or less AGL	Day	1 statute mile	clear of clouds
		Night	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
	more than 1,200 AGL but less than 10,000 MSL	Day	1 statute mile	
		Night	3 statute miles	
	more than 1,200 AGL and at or above 10,000 MSL		5 statute miles	1,000 feet below, 1,000 feet above 1 statute mile horizontal



A comparison of Class B, C, and D airspaces showing their approximate relative sizes and general shapes. Many examples of non-standard sizes and shapes exist in the real world.

The Regulations

The FAA mandates regulations, known as the FARs, that pilots are required to understand and comply with. Updates are made to the FARs annually. A big part of preparing yourself to become a pilot is to learn the regulations that will affect you. Following is a plain-language summary of some of the regulations that a student pilot must learn. There are others, but these have appeared on tests in the past. Your knowledge of them will be applied every time you get inside of an airplane. Learn them now.

Required Documents

The following documents are required to be in the airplane prior to flight. Remember them using the acronym AROW:

(A) Airworthiness certificate,
(R) the aircraft registration,
(O) operating limitations, and
(W) weight and balance data.

A logbook is required for student pilots, but it is not required to be in the airplane with you once you become a private pilot. You do need to keep one to show currency, but are not required to carry it with you (unless you are a student).

You must have either on your person or available in the airplane:

(1) your valid pilot certificate,
(2) your valid medical certificate, and
(3) a picture ID.

A pilot certificate is essentially valid forever, but your medical certificate must be renewed periodically, based on your age. A Class 3 medical certificate is good for five years if you are under the age of 40, and good for two years if you are 40 or over. It expires at midnight on the last day of the month two or five years from the date it was issued.

Special Endorsements

You may not fly an airplane having an engine greater than 200 horsepower, retractable landing gear, or a tailwheel without additional training and logbook endorsements attesting to your satisfactory completion of that training.

This brings us back to the logbook again. You must possess one with the necessary requirements and endorsements for the type of flying you will be doing.

You may not act as PIC (pilot in command) in a high performance airplane, that is, one powered by more than 200 horsepower without an endorsement.

You may not act as PIC in a complex airplane, that is, one with retractable landing gear and a constant speed prop without an endorsement.

And you may not act as PIC in a tailwheel airplane without a separate endorsement.

Change of Address

If you move, you have 30 days to notify the FAA that you have a new address. If you don't provide them with the new address, you can legally fly for only thirty days after your move.

Currency

To carry passengers during daylight hours, you must have made at least three takeoffs and landings within the preceding 90 days. They don't have to be fullstop landings – touch and goes are fine. If your 90-day period has lapsed, you must either make these takeoffs and landing solo or with a certificated instructor on board.

To carry passengers during nighttime hours, you must also have made at least three takeoffs and landings within the preceding 90 days. These night landings, however, must be to a *full stop*. No touch and goes for nighttime currency requirements.

If you get a tailwheel endorsement at some point, you will have a similar requirement for takeoffs and landings within 90 days. In this case, regardless of whether it is day or night, landings in a tailwheel airplane must be to a full stop to qualify for currency.

And while we're on the subject, what constitutes nighttime? For the sake of nighttime currency, night is defined as the period that begins one hour after sunset and ends one hour before sunrise.

Category and Class

All of these landing requirements for currency refer to the aircraft's category and class. *Category* is the broad group of flying machines. It contains airplane, glider, rotorcraft, and lighter-than-air aircraft. It's easy to remember if you note that the word *category* has the letters A, G, and R in it. Category breaks aircraft into airplanes, gliders, and rotorcraft.

For you, the airplane *class* will be single engine land. Look at the letters in the word *class*. L-A-S. Land and sea. Class breaks airplanes into land and seaplanes.

Fuel Requirements

Fuel management is obviously a very big issue to pilots. A surprisingly large number of off-airport landings are the result of fuel starvation. If you run an airplane out of gas, but set it down without a scratch in a beautiful forced landing, your pilot buddies will *not* admire you. In fact, some insurance policies will not pay a claim that results from a crash landing when the pilot simply ran the airplane out of gas. Civil Air Patrol pilots have it really tough – if they run an airplane dry, they are grounded as CAP pilots permanently.

VFR flight requires enough fuel to reach the first airport of intended landing with enough remaining fuel to fly an additional 30 minutes. At night, it's enough fuel to fly to the airport and remain flying an additional 45 minutes. Personally, I'm not flying anywhere without at least one hour of reserve fuel.

Be aware that in order to know how much fuel is burned in 30 or 45 minutes, you must know how much fuel your airplane is burning per hour. Your fuel burn requirements should be an important part of every flight plan that you put together.

Inspections

We said that an airplane must have the AROW documents on board before it can be legally flown. There are some other regulatory requirements, too.

Rental airplanes must undergo a 100-hour inspection every hundred hours. The inspection must be logged in the airplane logbooks, endorsed by a licensed A&P mechanic. (A&P, by the way, stands for "airframe and powerplant.") If you rent an airplane that has not had a hundred hour inspection in the last one hundred hours, you are the one who will get nailed if the FAA does a surprise ramp check and discovers it.

Virtually every airplane, rental or pilot-owned, must undergo an annual inspection each year. This is essentially the same as the 100-hour inspection, but must be signed off by an A&P with an IA certification. IA stands for "inspection authorization."

The ELT, or emergency locator transmitter, must be inspected each year. Most A&Ps do this as part of the annual inspection. ELT batteries must be replaced after one hour of cumulative use, or when half of their useful life has expired.

If your airplane contains a transponder, it must be inspected every two years. This is not normally included in an annual inspection.

Airworthiness Directives (ADs)

These are directives issued by the FAA regarding the maintenance of specific aircraft or aircraft systems. Compliance with them is mandatory.

VFR Equipment Requirements

Seat belts are required in all aircraft. Newer aircraft must also have shoulder harnesses. And with only a few exceptions, an ELT (emergency locator transmitter) is required equipment.

For VFR flight, an aircraft must have three navigation instruments: an airspeed indicator, an altimeter, and a compass. Think about it - you have to be able to tell how fast, how high, and in what direction you're going.

Airspeed indicator, *altimeter*, and *compass*.

The airplane must also have an oil pressure gage, a temperature gage, and a fuel gage. These are the instruments that let us monitor the engine's likelihood to remain running.

Oil pressure gage, *temperature gage*, and *fuel gage*.

So that the pilot can control the airplane, a *tachometer*, a *manifold pressure gage* if the airplane has a constant-speed prop, and a *landing gear position indicator* if the airplane has retractable landing gear are required. Think of what you need to control the engine's power and the airplane's landing gear. Since it is unlikely that you'll be doing your training in a high performance, complex airplane, the only gage you'll need from this final group is the tachometer.

Instruments required for day VFR flight include:

(1) Airspeed indicator, altimeter, compass
(2) Oil pressure gage, temperature gage, fuel gage
(3) Tachometer, and maybe a manifold pressure gage and maybe a landing gear indicator

Night VFR Flight Equipment

For night flight, the aircraft must also have:
Approved position lights, approved anticollision lights, a landing light (if the aircraft is used for hire), *and a spare set of fuses* (obviously, not needed if the aircraft is equipped with circuit breakers). And it's not a requirement, but a prudent pilot will also carry two flashlights.

Minimum Altitudes

Except during takeoffs and landings, the minimum altitude over a heavily populated area is 1000 feet above the highest obstacle within a 2000-foot radius.

Over open water or sparsely populated areas, there is no minimum altitude, although a pilot must remain at least 500 feet from any person, vehicle, or structure.

Separation from Clouds

During VFR flight, pilots must remain specific distances away from clouds. There's nothing inherently *wrong* with being close to a cloud. The issue is IFR traffic that might suddenly emerge. You need to remain far enough away so that you and the IFR pilot have enough time to see and avoid each other.

Generally speaking, in most airspaces, a VFR pilot should remain at least 500 feet below a cloud, 1000 feet above a cloud, and at least 2000 feet away horizontally.

Visibility Requirements

In addition to cloud separation and altitude requirements, there are also visibility requirements for VFR flight. Basically, any visibility less than three statute miles is considered IFR, but that does vary with airspace. In class G, for example, you can legally fly VFR with a one-mile visibility during the day. Smart? No. But legal? Yes, it is. If you will abide by a three-mile minimum, you'll be VFR legal in just about every case.

Section III

Basic Aerodynamics

Pilots need to have a good understanding of the fundamentals of aerodynamics. Don't let this fact intimidate you. You do have to learn it, but it is very basic stuff. It is not difficult to master.

Airplanes travel in a fluid environment. Their interaction with the air defines how they turn, climb, and descend. Wings support the airplane by the production of lift. Propellers pull the airplane through the air by generating thrust. This chapter will introduce you to some of the basics. Learn the full story in the Gold Seal Online Ground School.

The Four Forces of Flight

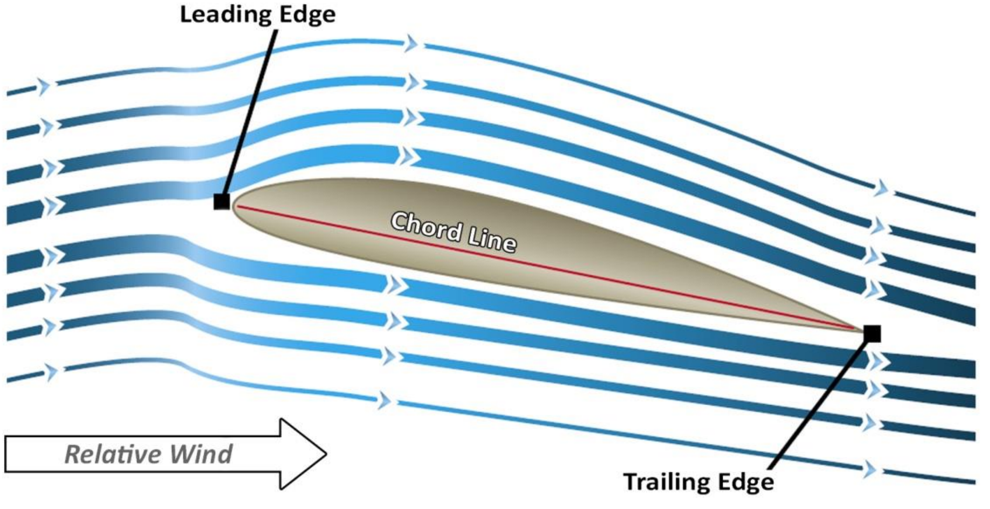
Airplanes in flight are affected by the forces of *lift*, *weight*, *thrust*, and *drag*. There is a famous test question for which this is the answer: When an airplane is in unaccelerated flight, lift equals weight and thrust equals drag. That is, when an airplane is in steady-state flight, lift and weight balance each other as do the forces of thrust and drag.

Lift is produced by the smooth motion of air over the wings. Weight is a result of gravity and counteracts lift.

Thrust, the forward pulling force, is generated by the turning propeller. Drag, the force that opposes thrust, exists in two forms: parasitic drag and induced drag. Parasitic drag is essentially due to friction caused by the movement of air over the airplane's surface. Induced drag is a by-product of the production of lift.

Airfoils

A wing cross-section describes the shape of an airfoil. Airfoils exist in a number of shapes, each having different efficiencies in differing forms of flight. The most common type of wing shape in subsonic airplanes is shown below. The outer curve is called the *camber*. A line drawn from the leading edge to the trailing edge is called the *chord*.



In this graphic, air flows over the airfoil from left to right. The smooth attached flow is integral to the production of lift. If the airflow separates from the upper surface, turbulence and cavitation occur resulting in a loss of lift. This loss of lift is known as a *stall*.

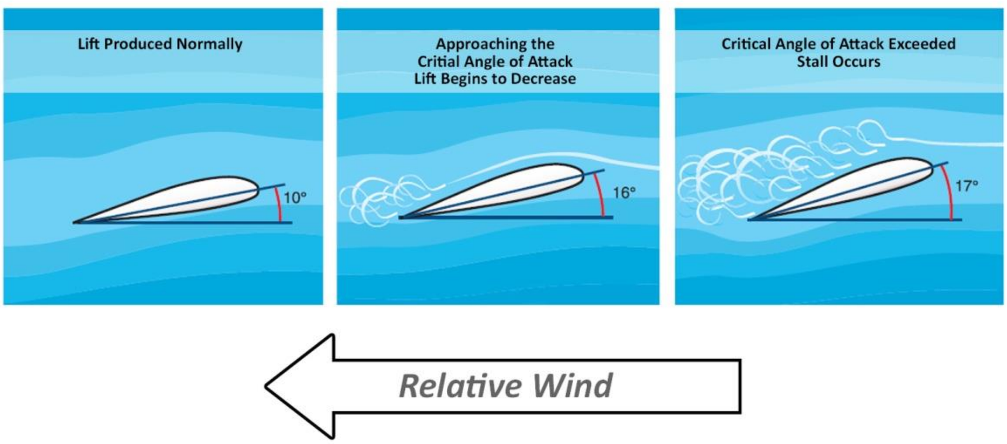
Non-pilots frequently believe that a stall is the loss of engine power. Not so. A stall is a loss of lift accompanied by an increase in drag.

The term *relative wind* refers to the direction from which the air hits the leading edge of the wing. *Angle of attack* is the angle between the wing's chord line and the relative wind. A positive angle of attack is required for the production of lift.

There is a *critical angle of attack.* Below this angle, smooth airflow follows the wing's camber and lift is produced normally. Exceeding the critical angle of attack results in a stall (a significant loss of lift). That's the answer to another likely test question.

It is important to understand that both lift and drag increase as angle of attack increases – up to a point. And that point is the critical angle of attack. Pitching the nose upward so that the angle of attack exceeds this critical point causes lift to decrease while drag continues to increase.

A stalled airplane will lose altitude quickly. As you might expect, a swift recovery to normal flight is generally recommended.



Controlling Lift

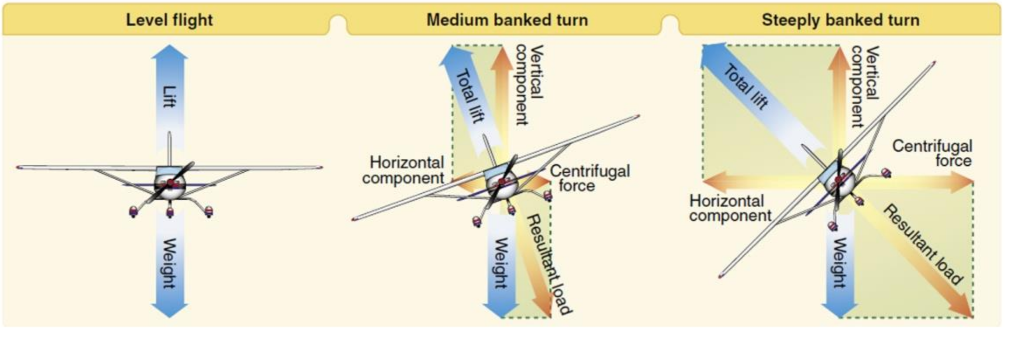
Pilots control the amount of lift generated by the wings by either increasing the angle of attack (but keeping it below the critical angle of attack) or by increasing airflow over the wings.

Raising the nose in relation to the relative wind increases the angle of attack. This is done by pulling the yoke or stick backward. Airflow is increased by increasing the airplane's airspeed. This can be done by either a lowering of the nose or by an increasing engine power with the throttle (or both).

The Physics of Turns

It you try to compare turns in an automobile to turns in an airplane, you will fail to find any similarity. In a car, you steer the front left or right to turn. In an airplane, however, yawing the nose left or right (using the rudder pedals) will simply throw it out of aerodynamic balance. Airplanes are properly turned by rolling the airplane into a shallow bank. The steeper the bank, the tighter the turn.

In the diagram below, notice that the lift vector points straight up in level flight. When the airplane is banked, a portion of that lift is diverted to the side. This is the *horizontal component of lift*. And it is what pulls an airplane through a turn. Turns result from the horizontal component of lift.



Because the lift vector is redirected in a turn, the horizontal component of lift increases and the vertical component of lift decreases. During all of this, the weight vector remains unchanged.

In order to maintain level flight the lift vector and the weight vector must balance each other. Thus, some extra back pressure on the yoke or stick is required (to increase slightly the vertical component of lift) during a turn to prevent the airplane from entering a descending turn known as a *spiral*.

Private Pilot Maneuvers

Private pilots must be masters of all the basic flight maneuvers. As a student, much of your time in the air will be spent learning them. The characteristics of these maneuvers are well defined. During your training you will learn to fly these within tolerances prescribed by the FAA Practical Test Standards. This is the document that defines the Practical Test, your final exam.

Obvious maneuvers include takeoffs and landings.

- **Normal Takeoffs and Landings**
- **Short-Field Takeoffs and Landings**
- **Soft-Field Takeoffs and Landings**
- **Crosswind Takeoffs and Landings**

Other maneuvers that are practiced at higher altitudes include:

- **Slow Flight**
- **Steep Turns**
- **Departure (power on) Stalls and Stall Recoveries**
- **Approach (power off) Stalls and Stall Recoveries**

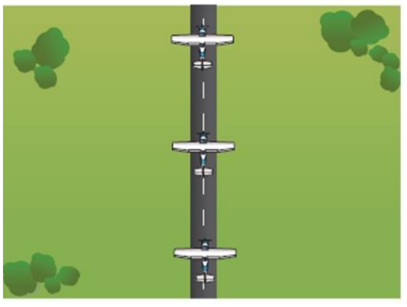
Ground reference maneuvers are generally practiced at 1000 feet above the surface. These require you to follow a prescribed ground track while maintaining altitude and airspeed, and simultaneously watching for other traffic. Enter these on the downwind, i.e. with the wind at your back.

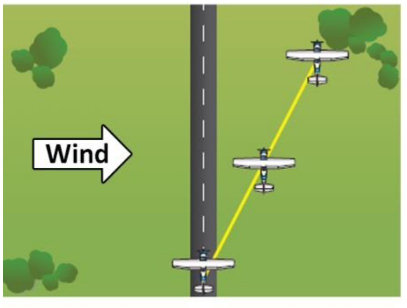
- **Rectangular Pattern**
- **Turns About a Point**
- **S-Turns**

All of these maneuvers are fairly easy to learn in calm conditions. The ability to perform them in varying wind conditions requires special understanding and practice.

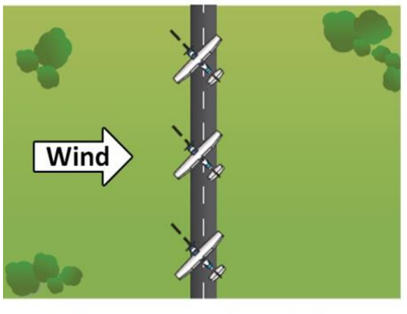
Effect of Wind

An airplane in flight moves within an air mass. On any day but a calm one, the air mass, itself, is also moving. The ground is clearly stationary, completely unaffected by the wind. The airplane's movement over the ground, however, will be impacted by the moving air.


No Wind - No Drift



With any wind, the airplane drifts downwind unless corrected.



With proper correction, airplane stays on intended course.

Imagine that you wish to fly a straight course that parallels a straight road. You can see this flight path in the first image to the left. On a calm day this is an easy thing to do. No wind, no problem. Add wind, however, and the airplane will be blown off course.

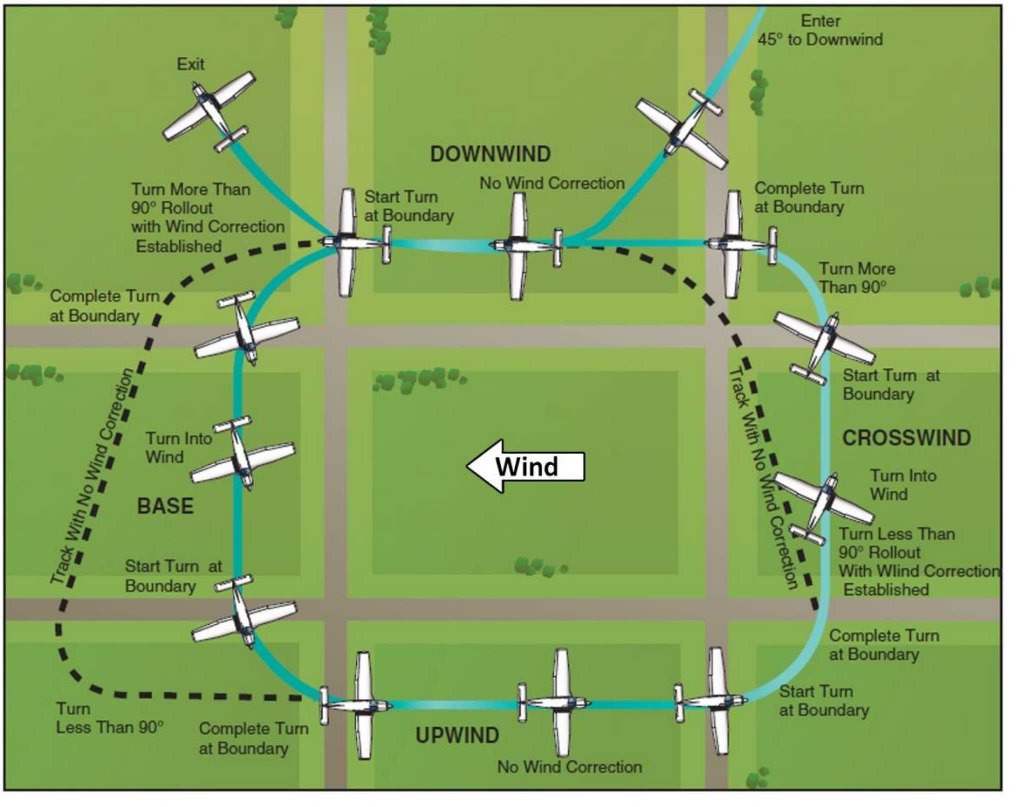
The second image shows the airplane, holding the same heading as that of the road. Within the air mass, the airplane continues to fly a straight line. But in relation to the road, the airplane moves at an angle. This modified ground track prevents the airplane from arriving at the intended destination.

To correct this problem, the pilot changes the airplane's heading to compensate for the wind. This is referred to as *crabbing*. In the third image such a correction is shown. The proper crab angle allows the airplane remain on the intended course line.

Whether you are flying cross country, or trying to maintain a rectangular path in the traffic pattern, winds must always be considered and compensated for. The Practical Test Standards defines a series of ground reference maneuvers. In order to maintain the correct ground track in these maneuvers, you will have to apply the necessary wind correction.

Rectangular Pattern

Every trip around the traffic pattern is an opportunity for you to practice this maneuver. It is very easy to master when there are no winds. Add some air movment, though, and keeping that squared-off ground track becomes a much bigger challenge.

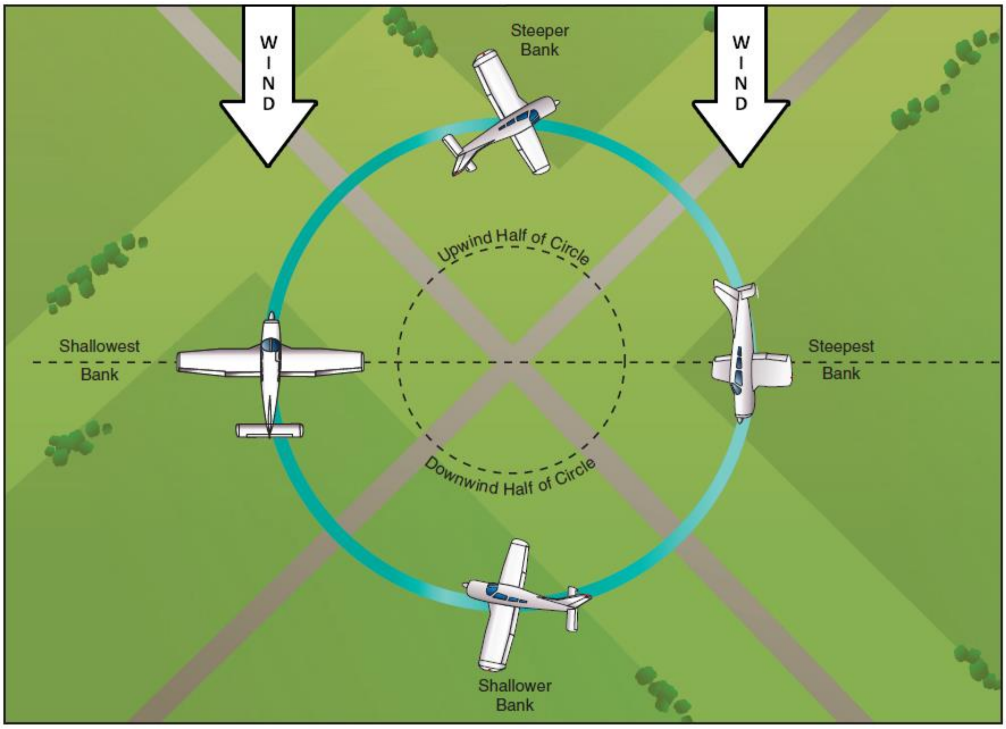


Visualize your ground track when you are practicing rectangular patterns. Look for landmarks on the ground that you should fly over. These will be outside of the rectangle you are using for reference.

Notice in the diagram how the airplane is crabbed to compensate for the effect of wind.

Turns About a Point

This maneuver is easy to do badly, and tricky to do really well. Even without winds it is a challenge to maintain a constant distance and altitude from the central point on the ground about which you are orbiting. It is best to first practice this one on calm days.

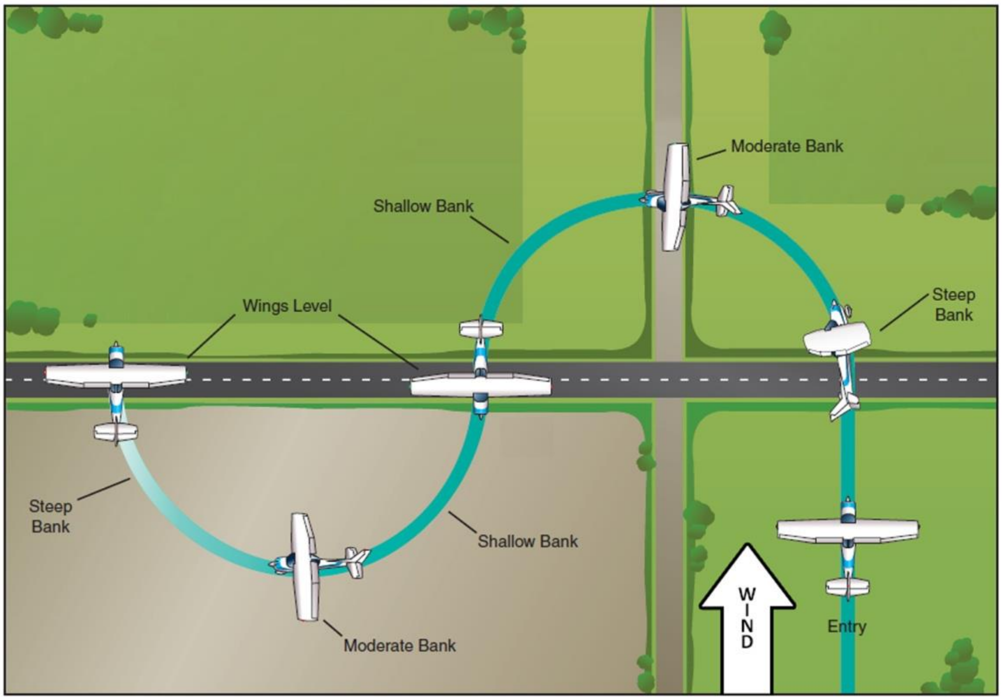


Two hints that will help you with turns about a point: First, pick a point that is easily visible. You don't want to choose something that is obscured from view during part of the turn. Water towers tend to be good pivot points if they are not in a populated area.

Second, set up for the maneuver about a mile from the pivot point. Make sure that can see the object you've chosen from that staging point. Then, don't fly to the point – fly to the downwind point (with the wind at your back) that is abeam it. Then start your turn.

S-Turns Over a Road

And it doesn't have to be a road either, although that may be the only long straight line you can find. A big key to success with this maneuver is timing. Plan your turns ahead so that you roll out level over the road.



Performance During the Practical Test

The ACS (Airman Certification Standards) is very cut and dried regarding these maneuvers. It provides explicit tolerances in terms of altitude, angle of bank, and airspeed for each one. During your checkride, the examiner will be watching closely to confirm that you are performing the maneuvers within the tolerances specified in the ACS. Thus, you need to know exactly what they are.

You should have your own full copy of the ACS. For study and practice, however, you may find the following abridged descriptions to be helpful. Vy is the best rate of climb speed and Vx is the best angle of climb speed. Va refers to maneuvering speed (specified in the airplane's handbook).

Traffic Patterns
(1) Exhibit knowledge of the elements related to traffic patterns at controlled and uncontrolled fields.
(2) Comply with proper traffic pattern procedures and maintain adequate spacing.
(3) Correct for wind drift to maintain proper ground track.
(4) Maintain Traffic Pattern Altitude +/- 100 feet.
(5) Maintain Appropriate Airspeed +/- 10 knots.

Normal and Crosswind Takeoffs and Climbs
(1) Position flight controls for existing wind conditions.
(2) Maintain directional control and proper wind drift correction.
(3) Lift off at recommended airspeed and accelerate to Vy.
(4) Establish pitch attitude to maintain airspeed at Vy +10/-5 knots.
(5) Retract flaps (and landing gear) after an appropriate positive rate of climb has been established.
(6) Maintain Vy +10/-5 knots until reaching a safe maneuvering altitude.

Normal and Crosswind Approach and Landing
(1) Establish the recommended approach and landing configuration and airspeed, adjusting pitch and power as necessary.
(2) Maintain a stabilized approach at the recommended airspeed +10/-5 knots with wind gust factor applied.
(3) Touch down smoothly at the approximate stalling speed.
(4) Touch down at or within 400 feet beyond a specified touchdown point, without drift along the runway centerline.
(5) Maintain directional control and crosswind correction.
(6) Complete after landing checklist.

Forward Slip to a Landing
(1) Select a suitable touchdown point.
(2) Establish a slip attitude at a point from which a landing can be made using the recommended approach and landing configuration and airspeed.
(3) Maintain a ground track along the runway centerline.
(4) Touch down smoothly (aligned with the runway centerline) at the approximate stalling speed at or within 400 feet beyond the specified touchdown point, maintaining directional control and crosswind correction.
(5) Complete after landing checklist.

Soft Field Takeoff and Climb

(1) Position controls for existing wind conditions and maximum lift (setting flaps as recommended).
(2) Maintain directional control and proper wind drift correction.
(3) Clear the area and taxi into the takeoff position without stopping.
(4) Smoothly advance the throttle (in a tricycle gear airplane, raising the nosewheel from the surface).
(5) Establish and maintain a pitch attitude that will transfer weight from the wheels to the wings as quickly as possible.
(6) Lift off at the slowest speed possible and remain in ground effect until reaching either Vx or Vy as appropriate.
(7) Climb out at Vx or Vy +10/-5 knots as appropriate.
(8) Retract flaps (and landing gear) after clearing any obstacles or as recommended.
(9) Maintain Vy +10/-5 knots until reaching a safe maneuvering altitude.

Soft Field Approach and Landing

(1) Establish the recommended approach and landing configuration and airspeed, adjusting pitch and power as necessary.
(2) Maintain a stabilized approach at the recommended airspeed +10/-5 knots with wind gust factor applied.
(3) Touch down softly without drift along the runway centerline.
(4) Maintain directional control and crosswind correction.
(5) Complete after landing checklist.

Short Field Takeoff and Maximum Performance Climb

(1) Position controls for existing wind conditions and maximum lift (setting flaps as recommended).
(2) Clear the area and taxi into position using all available takeoff area.
(3) Apply brakes while advancing throttle smoothly to takeoff power.
(Release brakes and begin takeoff
roll after maximum power has been achieved.)
(4) Lift off at recommended airspeed and climb out at recommended obstacle clearance airspeed or Vx.
(5) Establish a pitch attitude that will maintain Vx +10/-5 knots until the obstacle is cleared.
(6) After clearing the obstacle, accelerate to Vy and maintain Vy +10/-5 knots during the climb to a safe
maneuvering altitude.
(7) Retract flaps (and landing gear) after clearing any obstacles or as recommended.

Short Field Approach and Landing

(1) Consider the wind conditions, landing surface, and obstructions to select the most suitable touchdown point.
(2) Establish the recommended approach and landing configuration and airspeed, adjusting pitch and power as necessary.
(3) Maintain a stabilized approach at the recommended airspeed +10/-5 knots with wind gust factor applied.
(4) Touch down smoothly on the centerline at minimum controllable airspeed at or within 200 feet beyond the selected touchdown point, maintaining directional control and crosswind correction.
(5) Apply brakes to stop in the shortest distance consistent with safety.
(6) Complete after landing checklist.

Go Around/Rejected Landing

(1) Make a timely decision to discontinue the approach.
(2) Apply takeoff power immediately and transition to a climb pitch attitude for Vy, maintaining Vy +10/-5 knots.
(3) Retract landing gear and flaps as appropriate.
(4) Maneuver to the side of the runway, parallel to the centerline for traffic avoidance.
(5) Maintain Vy +10/-5 knots until reaching a safe maneuvering altitude.

Steep Turns

(1) Establish the recommended airspeed or a safe airspeed not to exceed Va.
(2) Roll into a coordinated 360° turn maintaining 45° of bank.
(3) Divide attention between control, orientation, (and traffic avoidance).
(4) Maintain the entry altitude +/-100 feet, airspeed +/- 10 knots, and bank angle +/-5°.
(5) Roll out on the entry heading +/-10°.

Ground Reference Maneuvers

(1) Enter the maneuver on the downwind (i.e. with the wind at your back).
(2) Begin the maneuver at an altitude between 600 and 1000 feet above ground level.
(3) Apply adequate wind drift correction to maintain ground track during the maneuver.
(4) Divide attention between aircraft control, ground track, (and traffic avoidance) while maintaining coordinated flight.
(5) Maintain altitude +/- 100 feet and airspeed +/-10 knots.

Maneuvering During Slow Flight

(1) Select an altitude that will allow the task to be completed no lower than 1,500 feet AGL.
(2) Establish an airspeed at which any change in angle of attack, increase in load factor, or reduction of power will result in a stall warning.
(3) Accomplish coordinated straight and level flight, climbs and descents, and turns with any flap configurations.
(4) Divide attention between airplane control and orientation.
(5) Maintain the specified altitude +/-100 feet, specified heading +/- 10°, airspeed +10/-0 knots and specified angle of bank +/-10°.

Power-Off Stalls

(1) Select an altitude that will allow the task to be completed no lower than 1,500 feet AGL.
(2) Establish a stabilized descent in the approach and landing configuration.
(3) Transition smoothly to a pitch attitude that will induce a stall.
(4) In straight and level flight, maintain heading +/-10° and bank angle not to exceed 20° while inducing the stall.
(5) In turning flight, no more than 10° of bank while inducing the stall.
(6) Recover promptly by lowering the nose to reduce angle of attack, increasing power to the maximum allowable power setting, and return to straight and level flight with a minimum loss of altitude.
(7) Retract flaps after a positive rate of climb has been established.
(8) Accelerate to Vx or Vy before final flap reduction.

Power-On Stalls

(1) Select an altitude that will allow the task to be completed no lower than 1,500 feet AGL.
(2) Establish takeoff or departure configuration with power set to no less than 65% of available power.
(3) Transition smoothly from the departure attitude to the pitch attitude that will induce a stall.
(4) In straight and level flight, maintain heading +/-10° and bank angle not to exceed 20° while inducing the stall.
(5) In turning flight, no more than 10° of bank while inducing the stall.
(6) Recover promptly by lowering the nose to reduce angle of attack, increasing power to the maximum allowable power setting, and return to straight and level flight with a minimum loss of altitude.
(7) If flaps (and landing gear) are extended, retract them after a positive rate of climb has been established.
(8) Accelerate to Vx or Vy.

Maneuver Description	Altitude	Heading	Airspeed (kia)	Bank	Touchdown	Other Notes
Traffic Pattern	+/- 100		+/- 10			
Takeoffs and Climbs			Vy +10/-5			
Approach and Landing			+10/-5		at or within 400 feet beyond	
Soft Field Takeoff and Climb			Vx/Vy +10/-5			keep moving
Soft Field Approach and Landing			+10/-5			touch down softly
Short Field Takeoff and Climb			Vx +10/-5			Vy +10/-5 after clearing obstacle
Short Filed Approach and Landing			+10/-5		at or within 200 feet beyond	maximum safe braking
Forward Slip to a Landing					at or within 400 feet beyond	
Go Around/Rejected Landing			Vy +10/-5			sidestep from runway
Steep Turns	+/- 100	+/- 10°	+/- 10	+/- 5°		45° of bank
Ground Reference Maneuvers	+/- 100		+/- 10			600-1000 ft AGL; downwind entry
Slow Flight	+/- 100	+/- 10°	+10/-0			minimum 1500 ft. AGL
Power-Off Stalls		+/- 10°				recover at least 1500 AGL
Power-On Stalls		+/- 10°				recover at least 1500 AGL

This chart summarizes the private pilot flight maneuvers as defined in the FAA Practical Test Standards. Tolerances for Altitude, Heading, Airspeed, Bank Angle, and Touchdown Point are indicated where applicable. Note that “Vy” refers to the airplane’s best rate of climb speed and “Vx” refers to its best angle of climb speed.

VFR Radio Communications

Communicating on the radio is intimidating for some student pilots. It is frequently mentioned as one of the more difficult skills to master. While there are some rules regarding what is said in different circumstances and in different airspaces, there really isn't anything to be apprehensive of. A small communications mistake is nothing to sweat over. With study and practice you will develop the confidence that you need.

In the airplane, you are generally talking either to other pilots (at or near non-towered airports) or to ATC controllers. In some instances, you may be talking to briefers at an FSS (flight service station). In any of these cases, remember that you can always speak in plain English if you aren't sure of the precise correct verbiage.

This chapter will go over some common exchanges on the radio. These are just simple examples. They are not intended to provide you with a complete tutorial in radio work. In the real world, many other circumstances might crop up. You might be told to give way for some other traffic, or perhaps to comply with some complicated taxi instructions. During your flight training you will encounter many new situations with your flight instructor. He or she will help you learn the details.

The AIM (Aeronautical Information Manual) does include a fairly good discussion of radio procedures, but even it cannot elaborate on every single situation that might occur. Nevertheless, study it and learn what it does offer. For a more detailed study of radio communications, consider getting Gold Seal's *Squawk VFR* audio course. It is available on audio CD and as an "app" for the iPhone or iPad. Search for "Gold Seal" in the Apple Appstore.

Prior to Takeoff

Non-Towered Fields – Each non-towered airport will have a specific radio frequency assigned. This is the Common Traffic Advisory Frequency or CTAF. It is shown on Sectional Charts and in the A/FD. You must know what this frequency is. On this frequency you state your intentions so that other pilots know what you are doing. It's a simple issue of safety.

Before you taxi from your parking spot at the Centerville Airport, press the microphone button and say:
"Centerville traffic. Cessna 12345 is taxiing from the ramp to the runup area for Runway 7. Centerville."

When you prepare for takeoff say:
"Centerville traffic. Cessna 12345 is taking Runway 7 for departure to the west. Centerville."

It's very painless. Tell them who you are, where you are, and what you are doing. It is important to add the name of the airport at the beginning and end of each transmission. Multiple airports will share the same frequency. Pilots listening must know from which airport you are operating.

Towered Fields – Towered airports will generally have a separate frequency for ground operations. This is usually for the ground controller.

Before contacting the ground controller, listen to the recorded weather broadcast. At many airports, this will be provided by ATIS (Automated Terminal Information Service). The weather information will be frequently updated and each new recording will have a letter assigned to it. When you call the ground controller to taxi, he must confirm that you have listened to the latest weather information. In this example, we will assume that the current ATIS is designated as Delta (for the letter D) and that you have listened to it.

Pilot: *"Metropolis Ground. Cessna 12345 at the FBO with information Delta, ready to taxi for a northbound departure."*

Controller: *"Cessna 12345, Metropolis Ground. Taxi to Runway 31 via taxiway Bravo."*

Pilot: *"Taxi to Runway 31 via Bravo. Cessna 12345."*

That's it. You are now cleared to taxi to the runup area for Runway 31. Go there and do your pre-takeoff checklist items. When you are finished:

Pilot: *"Metropolis Ground, Cessna 12345 at the Runway 31 runup area is ready."*

Controller: *"Cessna 12345. Taxi to Runway 31 and contact the Tower at 123.50. Hold short of Runway 31."*

Pilot: *"Taxi to Runway 31 and hold short. Cessna 12345."*

Once you're there:

Pilot: *"Metropolis Tower, Cessna 12345 is ready for takeoff at Runway 31."*

Controller: *"Cessna 12345, cleared for takeoff. Make right turnout."*

Pilot: *"Cleared for takeoff, Cessna 12345."*

Prior to Landing

Non-Towered Fields – As you approach a non-towered field, you should be listening to the CTAF to determine which runway is in use and what other pilots in the area are doing. They should be communicating their intentions over this frequency. As you get closer to the airport, make your own calls on the CTAF alerting pilots to your presence and intentions.

"Centerville Traffic. Cessna 12345, ten miles north at 3,500, inbound landing. Centerville."

As you close in on the airport, make another call.

"Centerville Traffic. Cessna 12345 four miles north at 2,500 feet. Will be entering on the left downwind for Runway 7. Centerville."

As you enter the traffic pattern, plan on making a call announcing your location on each leg of the traffic pattern.

"Centerville Traffic. Cessna 12345 is left downwind for Runway 7. Landing. Centerville."

After you have landed and cleared the runway:

"Centerville Traffic. Cessna 12345 is clear of Runway 7. Taxiing to parking. Centerville."

Towered Fields – Towered airports normally exist within Class B, C, or D airspace. Before you may enter any of these airspaces you must have permission. This is accomplished in different ways.

To enter Class B airspace, the approach controller must give you an explicit clearance. He must say the words “Cleared into the Class Bravo.” It is extremely important that you not stray inside the Class B without a clearance. Student pilots will rarely, if ever, operate within Class B airspace.

The FARs (Federal Aviation Regulations) require that you establish radio communications with the appropriate controller before entering Class C or Class D airspace. Talking to him is not enough. Communications are not considered to be “established” until the controller has said either your tail number or your callsign.

You do not make position reports in the traffic pattern at towered airports unless the tower controller has instructed you to do so.

To enter Class C airspace, you must call the approach controller on the appropriate frequency. Once he has said your tail number you may enter the airspace. As you get closer to the airport he will ask you to contact the tower controller. The tower controller will tell you how he wants you to enter the traffic pattern. Once you are in the pattern and traffic spacing allows, the controller will tell you that you are “cleared to land.” You must call him back and repeat the instructions: “Cleared to land. Cessna 12345.”

To enter Class D airspace, you must call the tower controller on the appropriate frequency. Once he has said your tail number you may enter the airspace. The tower controller will tell you how he wants you to enter the traffic pattern. Once you are in the pattern and traffic spacing allows, the controller will tell you that you are “cleared to land.” You must call him back and repeat the instructions: “Cleared to land. Cessna 12345.”

After you have exited the runway at a Class B, C, or D airport, you must stop past the yellow hold-short line and call the ground controller. He or she will then provide you with taxi instructions to your requested parking location.

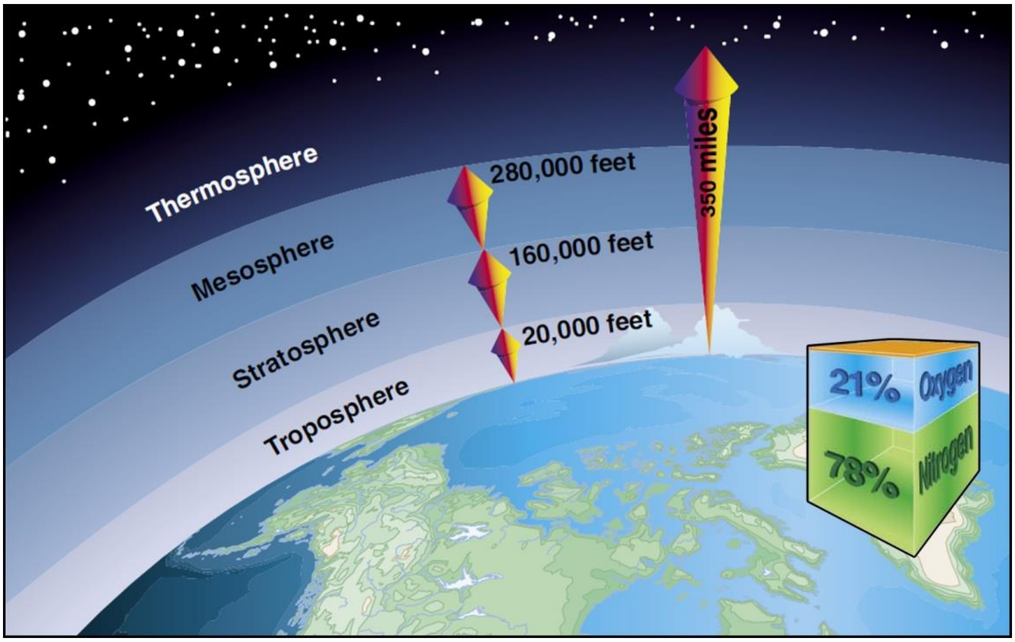
Aviation Weather

Weather has an obvious impact on the safety of flight. It's no surprise that pilots must have a good understanding of the physics of weather as well as of the various weather reporting products. Go/No-Go decisions are frequently based on weather, both existing and forecasted. Learning this material is not just a requirement for passing the FAA Knowledge Test. It's a requirement for safe flight.

In this section we'll cover some of the basics of Aviation Weather. You will find complete coverage of the subject in the Gold Seal Online Ground School. Additionally, the FAA publishes a book called, oddly enough, *Aviation Weather*. You can purchase a copy of this book or can download it for free on the internet. Search for "FAA-H-8083-28".

The Atmosphere

The earth is surrounded by a blanket of gases that we call the atmosphere. The gaseous mixture, which we fondly call the air, is made up mainly of nitrogen and oxygen. Although the atmosphere extends outward approximately 350 miles, 90% of the air exists in the bottommost layer called



the troposphere. This is where virtually all weather occurs. At the poles the troposphere extends from the surface to approximately 20,000 feet. At the equator it extends to approximately 48,000 feet.

Some pressurized jets may fly into the stratosphere, but general aviation propeller-driven airplanes operate only in the troposphere. Above that, the air is so thin that only the most highly-specialized propeller airplane could fly.

Air Density

Air density is a crucial issue for airplanes because it affects how efficiently they can fly.

Density is a measure of the molecular mass within a given volume of air. Because lift is produced when air rushes over a wing, dense air will produce more lift than less dense air. And the same idea applies to propellers. More thrust is created when a propeller chops its way through relatively dense air.

Air density decreases with altitude. The higher you go, the fewer air molecules exist. Air will tend to be the most dense close to the ground.

Air density decreases with rising temperature. On a warm day, the air will be less dense than on a cooler day.

Air density decreases with increasing relative humidity. Damp air has less molecular mass than the same volume of dry air. When the humidity goes up, air density goes down.

These are very important concepts for pilots. You can bet that you will see them on written tests. Remember that air density decreases when (1) altitude increases, (2) temperature increases, and (3) humidity increases.

Remember these facts: dry air is more dense than damp air, and cool air is more dense that warm air. Airplanes operate more efficiently in dense air.

Atmospheric Circulation

The earth's atmosphere is in a constant state of flux. Columns of air rise and fall, and larger air masses slide across the surface bringing changes in wind, cloud cover, precipitation, and barometric pressure. These all have significant effects for aircraft operations.

While the rotation of the earth does play a big part in weather changes, the primary engine for weather is solar heating. When air is warmed by the sun, it expands and becomes less dense. Since it is less dense than the cooler surrounding air it rises. As it rises it cools and regains some of its original density. The air is heavier and it falls back to the surface. This type of movement is called *convection*.

Dense cooler air spreads out at the surface. This causes a lateral movement of air termed *advection*. The boundaries of these air masses are called *fronts*.

Thus, the air circulates and mixes all around the planet. The associated changes in temperature, pressure, and humidity result in weather.

Clouds

Clouds are formed in parcels of air that are saturated with water vapor. In any specific air parcel, the saturation point is determined by its temperature and barometric pressure. The temperature where a given volume of air becomes saturated is called the *dew point*. When the temperature falls to the dew point, clouds or fog appear.

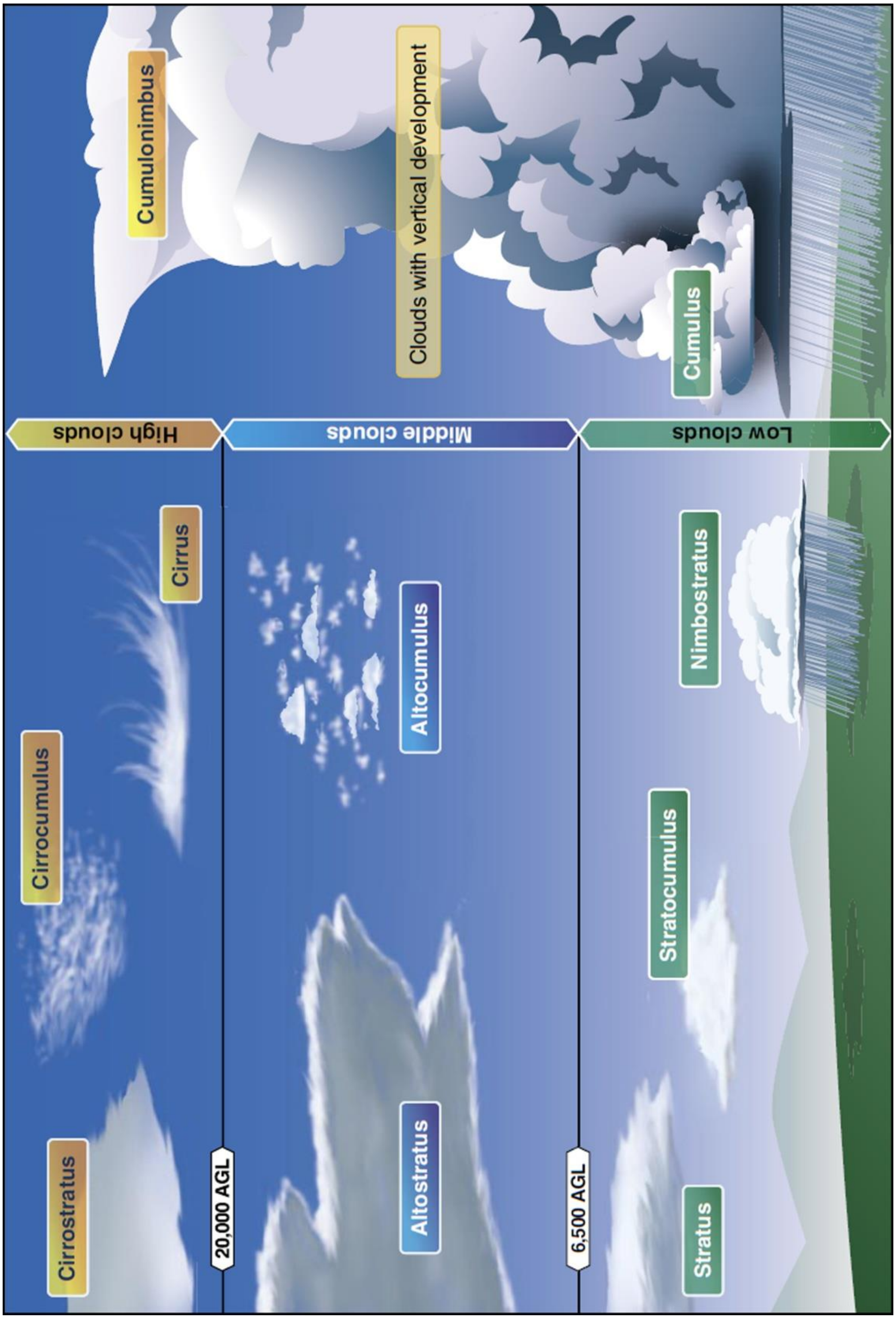
Clouds are obstacles to pilot visibility. To fly in the clouds a pilot must have special training and possess an Instrument Rating. It is not only illegal for a VFR pilot to fly in the clouds – it is extremely dangerous.

Clouds are categorized by family. Cloud families include low clouds, middle clouds, high clouds, and clouds with vertical development. Extensive vertical development indicates major updrafts and instability. Thunderstorms may be likely to develop.

Thunderstorms

These are among the most violent of storms. Pilots must use great caution to remain clear of them. An airplane caught inside of a thunderstorm can be torn apart by powerful wind shear and destructive hail.

Thunderstorms form when warm moist air is raised in unstable conditions. The air can rise to incredible altitudes sucking in more warm air from below. Like a machine, it pulls air upward and forces air downward in massive downdrafts. Thunderstorms grow through a life cycle made up of three phases: (1) cumulous, (2) mature, and (3) dissipating.


High clouds
Cirrostratus
Cirrocumulus
Cirrus
20,000 AGL
Middle clouds
Altostratus
Altocumulus
6,500 AGL
Low clouds
Stratus
Stratocumulus
Nimbostratus
Cumulonimbus
Clouds with vertical development
Cumulus

Weather Reporting Products

There are a large number of weather charts and reports. These are referred to as weather products. Pilots learn to use these very effectively so that they can determine when it is safe to fly.

Before making a trip, you might first watch the weather report on television. This can give you a broad overview, but should not be used as your only investigative tool. Internet-based services provide up to date reports and forecasts using the same charts that the professional meteorologists use. Some examples are:

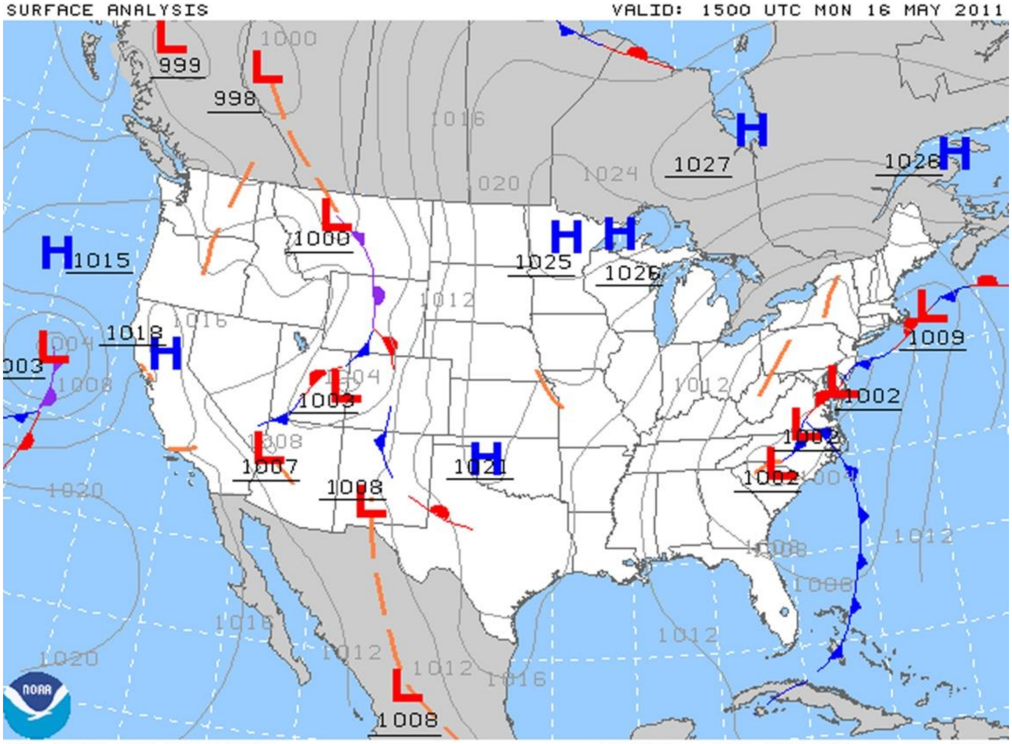
METAR – a coded text report of current conditions at a reporting airport

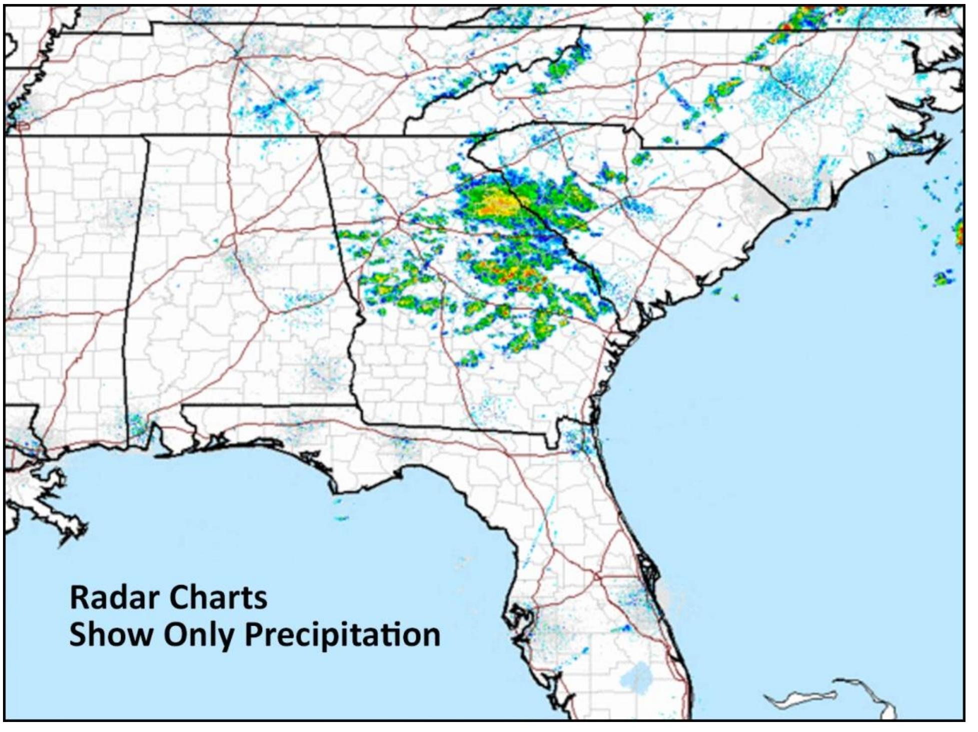
TAF – a coded text report of forecasted conditions in a specific area

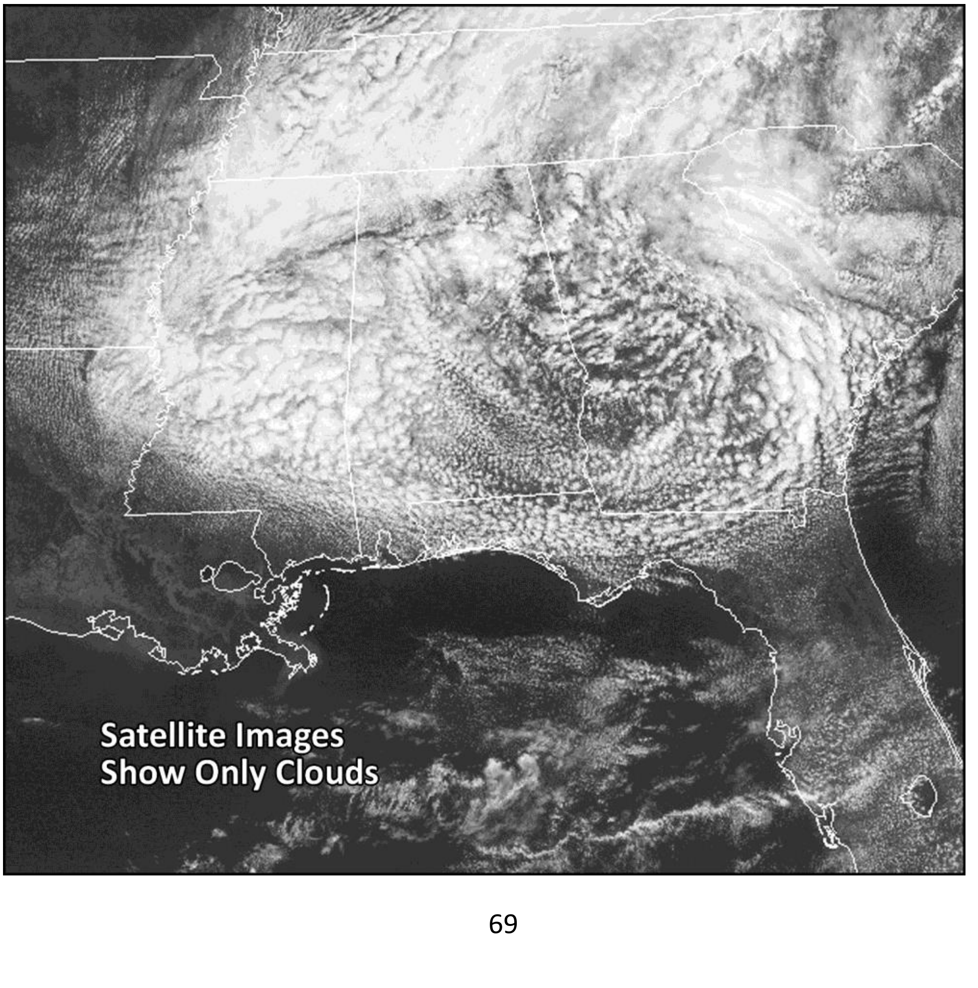
Radar – color-coded radar charts show precipitation, usually within the last 15-20 minutes

Satellite Imagery – show visible clouds but not precipitation; infrared imagery shows clouds based on their temperature

Surface Analysis – a chart showing fronts, pressure systems, and lines of equal pressure called isobars




Radar Charts
Show Only Precipitation


Satellite Images
Show Only Clouds

Flying Solo

The first big milestone for a student pilot is usually the solo flight. It is something most students look forward to with a high degree of anticipation and maybe a little nervousness. Everyone learns at a different pace and there is no set number of hours required for a first solo. When the big event occurs is a judgment call by the instructor.

Preparation for the first solo involves a lot more than just learning how to take off and land. Radio communications must be learned, airport operations must be understood, and instruction in a variety of flight maneuvers must be performed.

Requirements for Solo Flight

The FARs (regulations), in Part 61.87, mandate specific training that must be given to a student prior to that first solo.

A student pilot must have a student pilot certificate in order to fly solo. Unless the student is training to be a sport pilot, this certificate is the Third Class Medical Certificate. Thus, the medical examination must be completed before solo flight can be approved.

The instructor will also administer a Pre-Solo Knowledge Test. It may or may not be open book, and the instructor will review the test results with the student to make sure that he or she understands everything.

Although some students may solo in as little as ten hours, they are few and far between. The average time-to-solo ranges between 15 and 35 hours. If you're a pre-solo student, don't fixate on how many hours it is taking you. Learn the knowledge material and practice with your instructor. When the time arrives, you'll be ready.

When solo time arrives, your instructor will endorse your logbook and your medical certificate. This is legal documentation and must accompany you on solo flights. Unless you have additional endorsements, you may not land at other airports and you must remain within a 25 nautical mile radius of your home field. Your solo endorsement expires every 90 days. Make sure that your instructor signs a new endorsement when this occurs.

Passing the Checkride

The Practical Test – your final exam. It is the culmination of all of your hard work. During your training you will probably feel like you will never get there. You're not alone, either. We all felt like that at some point.

The Practical Test, usually called the checkride, is conducted with an FAA or FAA-designated examiner. He or she will be a highly experienced pilot and one who is used to evaluating the performance of others.

Make sure to bring all the proper paperwork to your test. Have it neatly separated in a file folder so that you don't have to nervously fumble around to find what you're asked for. A checklist of necessary items found in the PTS document is shown on the next page.

The checkride is broken down into two parts: (1) the oral exam, and (2) the flight portion. It is defined by the ACS and is a very precise and standardized affair. If you study the ACS diligently you will be prepared for everything asked of you.

The oral exam will probably last from one to two hours. It will be conducted as a discussion. The examiner may ask you some questions straight out. Others will be embedded in discussions of specific flight scenarios. Expect to spend a lot of time with the sectional chart and don't be surprised if the examiner asks you to check the weather either on the internet or using some charts he already has printed out.

Make sure to bring your FAR/AIM (your book of regulations) with you and know exactly where to find specific topics. It is a good idea to go through it in advance with a yellow highlighter and maybe even attach tabs to key sections. Part 91 contains regulations pertinent to private pilots.

The flight portion will last about an hour and a half. If you've practiced your maneuvers and mastered them to the tolerances in the ACS, there won't be any surprises.

Remember, the examiner is not there to fail you. He wants you to pass! But he also must confirm that you have learned the skills and conceptual material needed to be a safe and proficient pilot. Without question, you can do it. Good luck and good flying!

Applicant's Practical Test Checklist (from the ACS)

ACCEPTABLE AIRCRAFT

- ☐ Aircraft Documents:
  Airworthiness Certificate
  Registration Certificate
  Operating Limitations
- ☐ Aircraft Maintenance Records:
  Logbook Record of Airworthiness Inspections
  and AD Compliance
- ☐ Pilot's Operating Handbook, FAA-Approved
  Airplane Flight Manual

PERSONAL EQUIPMENT

- ☐ View-Limiting Device
  Current Aeronautical Charts
- ☐ Computer and Plotter
- ☐ Flight Plan Form
- ☐ Flight Logs
- ☐ Current AIM, Airport Facility Directory, and Appropriate
  Publications

PERSONAL RECORDS

- ☐ Identification—Photo/Signature ID
- ☐ Pilot Certificate
- ☐ Current and Appropriate Medical Certificate
- ☐ Completed FAA Form 8710-1, Airman Certificate and/or
  Rating Application with Instructor's Signature (If
  applicable)
- ☐ Computer Test Report
- ☐ Pilot Logbook with appropriate Instructor Endorsements
- ☐ FAA Form 8060-5, Notice of Disapproval (if applicable)
- ☐ Approved School Graduation Certificate (if applicable)
- ☐ Examiner's Fee (if applicable)