Sporty's Private Pilot Training Course

Video Training Study Guide and Review Notes

04/22 v2.1

Chapter 1 – Your First Few Hours

Intro / The Flight

Private Pilot Chapter 1 – Video Segment 1

Watching a video is not a substitute for good flight instruction. However, this program will give you the necessary material to learn at home before and after your flying lessons. Review this program on a regular basis. Even after you get your certificate, you can maintain a high level of proficiency with a frequent study of the program.

Review:

1. We will be flying a Cessna Skyhawk, one of the finest training airplanes and an excellent personal airplane. The Skyhawk will easily go twice as fast as a car and air travel distances are, on average, about fifteen percent less than road distances.
2. You'll learn to navigate by using a map, compass, clock, as well as some higher tech devices. This program is not designed just to help you pass the written and flight test – it covers everything you'll need to become a safe and knowledgeable pilot.
3. Flying a light airplane is a great way to explore the countryside. You can really see everything from up there. Fly a trip and you'll remember many things along the way. But regardless of how many times you fly the same trip, you'll always see something new.
4. Getting around in an airplane is a simple matter of comparing what you see on the ground to the features on your chart.
5. Many smaller airports don't have a tower. In these situations, pilots have a frequency (Common Traffic Advisory Frequency) to use to announce their intention or position.
6. You enter the traffic pattern on the downwind leg, transition to the base leg, and line up with the runway on final approach. You'll learn to manage speed, power, and altitude on your approach and landing.

When Should You Fly?

Private Pilot Chapter 1 – Video Segment 2

Flying is challenging, interesting, and downright fun. Before your flight lesson, you must make an important decision – whether to fly today or not. This is commonly referred to as the go/no-go decision. Even though at this stage of your education your flight instructor will help you make this decision, it's important that you learn to analyze conditions for yourself. The decision is made based on several factors. One of the most important factors is the existing weather conditions.

Review:

1. Before ever leaving the ground, each pilot must make an important decision. Whether to fly or not, commonly referred to as the go / no-go decision. And even though you're a student pilot, the operative word is pilot, and you, along with your instructor, should make this decision each lesson based on several factors, among these factors is weather.
2. Anytime of the year can be a great time to fly. Summer's warm weather typically offers many flyable days. But summer storms are not to be trifled with and are always a reason to delay a flight if they are near. Winter typically offers the clearest air of the four seasons, and since cold air is more dense than warm air, aircraft performance is at its peak.
3. Visibility is another factor to consider – three miles is the lowest practical visibility.
4. Be aware of the wind. Even clear days could have difficult wind conditions beyond your ability.
5. The type and amount of cloud cover must also be analyzed. Visual flight rules specify a minimum ceiling height of 1,000 feet above the ground.
6. Clouds may become a ceiling that you can't legally penetrate. A ceiling is the lowest cloud layer that covers most of the sky. If it's solid, it's called overcast. A broken ceiling is simply an overcast with a few holes in it.
7. As you begin training, you'll fly mostly during the day. Later, you'll enjoy learning to fly at night.

Air Facts: Weather Geeks

Private Pilot Chapter 1 – Video Segment 3

One of the really great things about learning to fly is the new relationship you'll develop with the study of weather. You'll acquire a knowledge of highs, lows, and fronts and how these phenomena affect weather patterns.

Review:

1. Many pilots either watch the morning TV shows, browse online or check their favorite aviation app to get an idea of what the synopsis is going to be that day.
2. Make a practice to study the weather daily. Decide for yourself if today is a good day to fly or not based on your observations. Later, you can compare your conclusions with the actual results of the day.
3. Forecasting, especially forecasting more than a few hours ahead of time, is not an exact science. That's why a real pilot is what you might call a weather geek. We're always checking the latest forecast and report on our mobile device and comparing it to what we see out the window.
4. You can't learn enough about weather patterns. Keep up with your study of weather even after attaining your Recreational or Private Pilot Certificate.
5. Always respect the weather.

Introduction to the Airplane

Private Pilot Chapter 1 – Video Segment 4

In this section you will investigate the various aspects of the airplane – its controls, and the aerodynamics that make it fly.

Review:

1. There are four forces that act on an airplane in flight – lift, weight, thrust, and drag. Lift is the force that acts upward, against gravity. Thrust propels the airplane forward, and drag acts opposite of thrust.
2. A Swiss mathematician, Daniel Bernoulli, found that, as the speed of the air increases, its pressure will decrease.
3. The upper surface of a wing is curved and the lower surface is relatively flat. As air flow meets the wing, the air flowing over the top curve, or camber, increases speed decreasing the pressure on top of the wing. This decreased pressure is the major source of the lift needed to make the airplane fly.
4. The front part of a wing is called the leading edge and the back is called the trailing edge. In cross section, an imaginary line drawn between the leading edge and the trailing edge is called the wing chord.
5. An airplane has three axis of movement – the longitudinal axis which passes through the length of the airplane, the lateral axis which passes through the wings, and the vertical axis, which passes through the body of the airplane perpendicular to the other two axes.
6. To maneuver an airplane you must control its movement around these three axes. This is done by moving the primary control surfaces – the elevator, ailerons, and rudder.
7. Ailerons control roll, pitch is controlled by the elevator, and the rudder controls yaw.
8. Pulling the yoke back moves the elevator to rotate the airplane around the lateral axis pitching the nose up. Pushing the yoke forward pitches the nose down.
9. Turning the control yoke moves the ailerons. Turn it right, right aileron is up and the left one is down, and the airplane banks right. Move the control yoke left and the left aileron is up and the right one is down, banking the airplane to the left. The bank will normally continue to increase until the ailerons are returned to the neutral position.
10. Pushing the right rudder pedal moves the rudder to the right and the airplane’s nose yaws to the right. Push the left rudder, and the nose goes left. Yawing the nose is not necessarily turning the airplane.
11. In turning flight, the rudder's function is to counteract adverse yaw which occurs when the airplane is rolled into a turn and when it's rolled back to wings level flight.

12. A trim tab is used to relieve the pressure needed to hold a primary control surface out of the streamlined position. In many cases, elevator trim can be adjusted in flight. In some airplanes it can only be adjusted on the ground.
13. The flaps are the movable panels on the trailing edge of the inboard parts of the wings. Both flaps are extended and retracted at the same time. Lowering the flaps increases both lift and drag.
14. Extending the flaps allows the landing approach to be steeper and slower. In some situations flaps are also used to shorten the takeoff run.

Closer Look: Training Airplanes

Private Pilot Chapter 1 – Video Segment 5

There are various models of airplane commonly used for training.

Review:

1. The Cessna 152 is a high-wing, 2-place trainer that cruises around 95 knots.
2. The larger 4-place 172, also known as a Skyhawk, will cruise around 120 knots.
3. The 152 and 172 are the most common trainers around.
4. The Diamond D-A-20 is a two seat trainer of composite construction. The D-A 20 will cruise about 120 to 130 knots. The four seat Diamond D-A-40 cruises at 130 to 150 knots depending on the model.
5. Moving up, the Cirrus SR20 and 22 are four seat composite airplanes with much higher cruise speeds. These aircraft have an airframe parachute available for use in emergencies.
6. Another traditional choice is the PA28 series from Piper. This family of airplanes includes the Warrior and the Archer. They both have an endurance of about 4 hours.
7. There are a number of light sport training airplanes available. These aircraft have no more than two seats, are subject to airspeed and weight limits, and have been tested and approved under a different set of regulations than traditional airplanes. Recreational and private students can train in these LSAs subject to the limitations imposed on the aircraft.
8. Popular models include the Flight Design CTLS, Cessna Skycatcher, Tecnam, and Vans RV 12.

Introduction to the Cockpit

Private Pilot Chapter 1 – Video Segment 6

In this section we will move inside the cockpit and take a look at the flight instruments and the rest of the airplane panel. Most training airplanes have fully functioning dual controls and can be flown from either side. Traditionally, the pilot flies the airplane from the left.

Review:

1. The instrument panel is roughly divided into 3 areas. On the left are the flight, navigation and engine instruments, electrical switches and circuit breakers. The radios, engine controls, fuel controls, flaps and trim, are positioned in the middle. On the right are the cabin environment controls, hour meter, and space for options.
2. The flight instruments are the airspeed indicator, attitude indicator, altimeter, vertical speed indicator, turn coordinator, and heading indicator, also called the directional gyro.
3. The airspeed indicator is typically marked in nautical miles per hour, called knots for short. A nautical mile equals 1.15 statute miles. To convert a distance in nautical miles to statute miles multiply nautical miles by 1.15. For example, ten nautical miles equals 11.5 statute miles.
4. The airspeed indicator is color coded. The speed marked by the red line should never be exceeded. You should only fly at airspeeds in the yellow arc in smooth air. The green arc denotes the normal operating airspeed range. The white arc is the flaps operating range.
5. The vertical speed indicator measures the rate of climb, or descent, in feet per minute. The altimeter measures the altitude, or height, of the airplane above sea level.
6. An altimeter has three hands, just like a clock. The fastest moving hand, which looks like a minute hand, is the hundreds of feet hand. The short hand reads in thousands of feet and the longest hand, which moves the slowest, indicates tens of thousands of feet.
7. The altimeter reading is based on barometric pressure, and barometric pressure is constantly changing. Therefore, the altimeter must be set prior to every flight to field elevation before takeoff.
8. The attitude indicator is a gyroscopic instrument. The miniature airplane pitches and banks around the horizon bar the same way your training airplane pitches and banks around the natural horizon.
9. The magnetic compass is located away from metal and electrical wiring to reduce the effect of local magnetic fields. It is a very useful instrument but has some peculiarities that you will learn about later.
10. The heading indicator, not the compass, is the principle direction instrument used in flight. Because the heading indicator is gyroscopically stabilized, it's not affected by banks, turns, and speed changes. However, the heading indicator must be set to the compass indication before takeoff and periodically adjusted to the compass indication while the airplane is in steady, level flight.

11. The turn coordinator, a gyroscopic instrument, provides information about the direction and rate of the turn. The ball, or inclinometer, which is under the turn coordinator, shows the quality of the turn based on the proper balance of the forces acting on the airplane. If everything is balanced, the ball will remain centered.
12. The power setting is shown on the tachometer, which indicates the revolutions per minute of the engine and is marked to indicate the maximum permissible RPM of the engine.
13. The engine controls begin with the throttle, which is like the accelerator pedal on a car. Push it forward to increase power and pull it back to decrease power. The throttle friction lock adjusts the ease with which the throttle can be moved and can lock the throttle in one position so it doesn't move.
14. Some airplane engines have a mixture control to regulate the ratio of gasoline to air entering the fuel distribution system. Push forward to enrich, and pull back to lean the amount of fuel in relationship to the amount of air entering the carburetor.
15. The oil pressure and temperature gauges are used to monitor engine operation and the fuel flow gauge monitors fuel flow in gallons per hour.
16. The flap control generally indicates the position of the flaps.
17. The elevator trim control wheel is rotated forward for nose down trim, aft, for nose up trim.
18. The vacuum gauge enables the pilot to check the operation of the engine driven vacuum pump.
19. The fuel selector allows the pilot to draw fuel from both tanks simultaneously or either tank individually. In some airplanes, you have only an on/off arrangement.
20. Spend some time on your own sitting in the airplane learning the position of the switches, instruments, and gauges.

Closer Look: Cockpit Variations

Private Pilot Chapter 1 – Video Segment 7

Depending on the model airplane, the cockpit can be quite varied in its layout and arrangement.

Review:

1. Beginning with the engine controls, the throttle and mixture control may be levers instead of push/pull knobs.
2. High wing Cessnas, with carbureted engines, don’t have fuel pumps. The fuel is gravity-fed from the wings.
3. The fuel selector in many Pipers can draw fuel from either the left or right tanks – not both simultaneously. The 152's fuel control, located between the seats, has only an on/off position, and fuel is always drawn from both tanks at the same time.
4. Many electrical system master switches are divided in two – one for the battery and one for the alternator.
5. Some of the most dramatic cockpit variations are found in the electronic instrument panels used in some airplanes. These glass cockpit equipped airplanes have digital computer displays which replace the traditional analog instruments.
6. You will learn how to calculate a number of important performance numbers related to your speed through the air and over the ground. Modern glass cockpits do many of these calculations automatically.
7. Engine instruments can be found on the multifunction display, along with a large GPS-driven moving map. The GPS map makes it easy to keep track of your position, and provides quick information on nearby airports and airspace.
8. A glass cockpit equipped airplane can provide a lot of information. However, the time required to master these systems may be a consideration when deciding on your training aircraft.
9. Remember, your eyes need to spend most of their time looking outside.

Introduction to Airplane Engines

Private Pilot Chapter 1 – Video Segment 8

In this section we investigate the typical training airplane engine. Most training airplanes use four-stroke, internal combustion, reciprocating engines which operate on the same principle as automobile engines. A reciprocating engine converts the back and forth motion of the pistons to the rotary motion of the crankshaft.

Review:

1. There are six basic parts of an airplane's engine – cylinders, pistons which are inside the cylinders, valves at the top of each cylinder, connecting rods linking the piston to the crankshaft, and the crankcase, which is the metal engine frame.
2. Each cylinder has two spark plugs for improved combustion and as a safety backup.
3. There are five events that occur in the cycle of a four-stroke engine:
    1. During the intake stroke, the piston is moving in toward the crankshaft and the intake valve is open, allowing the fuel air mixture to flow into the cylinder.
    2. As the piston starts moving out, away from the crankshaft, both valves are closed and the fuel/air mixture is compressed in the cylinder. This stroke is called the compression stroke.
    3. As the piston nears the end of its outward travel, the fuel air mixture is ignited and the rapid burning and expansion of the fuel pushes the piston toward the crankshaft in the power stroke.
    4. During the exhaust stroke, the last stroke in the cycle, the piston moves out and the exhaust valve is opened and the burned gasses are forced out of the cylinder.
    5. As a cylinder is undergoing this cycle, the other cylinders are each going through different parts of the cycle. No matter how many cylinders an engine has, each of the cylinders will complete the cycle every time the crankshaft makes two revolutions.
4. In burning the fuel/air mixture, heat is produced, most of which is evacuated through the exhaust system.
5. Most airplane engines are air cooled. Baffles guide the airflow to the heat critical parts of the engine. The cylinders have cooling fins which increase the effectiveness of the air flow. The air enters the front of the engine compartment, passes over the baffled fins, and exits through the rear of the engine cowling.
6. Engine lubricating oil performs three functions – it coats the surfaces of all moving parts with a slick film, it dissipates heat as it circulates through the oil cooler, and third, it carries any foreign materials to the oil filter.
7. Airplane engines have a two magneto ignition system. The magnetos power the spark plugs which ignite the fuel/air mixture in the cylinders. The magnetos allow the engine to

run independently of the airplane's battery and electrical system. It is one of the redundancies built into the airplane for safety.

8. The ignition switch in the cockpit has five positions – off, right, left, both, and start. With the switch in the left or right position the engine is running on only one of the magnetos and only one set of spark plugs. When the switch is placed in the both position both magnetos are supplying ignition and all spark plugs are firing. During engine run-up you'll check both magnetos to be sure they're operating correctly.

Air Facts: Engine TLC

Private Pilot Chapter 1 – Video Segment 9

This section discusses the need to develop a healthy respect for your airplane's engine.

Review:

1. Engines need tender loving care to perform at their best. For example, use smooth throttle movements
2. – don't jam it in and yank it out.
3. Gradual engine temperature changes are best. For example, after starting, especially in cold weather, let the engine run for a minute or so before using a lot of power to start taxiing.
4. Aircraft engines are reliable and economical.

Propeller, Fuel and Electrical System

Private Pilot Chapter 1 – Video Segment 10

In this section we continue a discussion of airplane systems – most specifically, propeller, fuel, and electrical.

Review:

1. The fuel tanks on present day light training airplanes are located in the wings and are filled through openings in the top of the wing and covered by caps.
2. Fuel lines carry the fuel from the tanks to the rest of the fuel system. The fuel caps are vented permitting air to replace the fuel consumed during flight.
3. A fuel vent is located under the wing allowing for expansion of fuel caused by warm temperature. Some fuel dripping from this vent, with full fuel and hot weather, is normal.
4. Airplanes have fuel drain valves located on the bottom of each wing. This allows you to draw fuel samples to check for water, sediment, and proper fuel octane – fuel grades are color coded. Aviation gasoline is colored blue and rated at 100 octane.
5. You'll also find drain valves at the lowest point in the fuel selector, fuel reservoir, and fuel strainer. Contaminants can accumulate here.
6. Jet fuel is clear or straw colored and smells like kerosene. At some airports, automobile gasoline called MOGAS is sold for aircraft use. MOGAS can only be used if your airplane is specifically approved for it.
7. Fuel flows by gravity from the two wing tanks to a selector valve, into a reservoir tank, and then through the electric auxiliary fuel pump and so forth until it is injected into each cylinder.
8. The electric fuel pump is operated and controlled by the pilot from a switch on the instrument panel. It is normally used to prime the engine before starting.
9. The propeller is simply a rotating airfoil. When the propeller is turning it produces thrust in much the same way as a wing produces lift.
10. A propeller is twisted so it can produce equal thrust from the hub to the tip and pull the airplane through the air.
11. Most training airplanes are equipped with a fixed pitch propeller that provides the best compromise between climb and cruise for the engine and airframe combination. It can't be changed by the pilot.
12. The throttle enables the pilot to control the RPM of the engine and thus the power output – basically, the more RPM the more power.
13. The electrical system is used to power the engine starter, instruments, lights, and radio equipment. The battery is the heart of the system.
14. Once the engine has started an engine driven alternator supplies direct current to the system plus maintains a charge on the battery.

15. The master switch turns on the electrical system and supplies energy to all electric circuits except the ignition.
16. Circuit breakers are used to safeguard electrical equipment.
17. The ammeter measures the performance of the entire electrical system. A positive reading shows the system is working.

Closer Look: Carbureted Engines

Private Pilot Chapter 1 – Video Segment 11

In this section we continue a discussion of the operational differences in engines that you may find in your training aircraft – especially regarding the primer, carb heat, and mixture control.

Review:

1. Many carbureted engines have a fuel primer, which puts fuel directly into the engine cylinders. This makes it easier to start in cold weather. After using a primer, be sure it is closed and locked before attempting flight.
2. Many carbureted light sport airplanes use a choke control for cold starting rather than a primer.
3. Carbureted engines are susceptible to carburetor icing. The temperature of the fuel/air mixture in the venturi can drop as much as seventy degrees Fahrenheit, changing the water vapor to ice inside the carburetor. This causes lower power and eventually engine stoppage.
4. Carburetor icing is most likely to form when there is high humidity or visible moisture with temperatures below seventy degrees Fahrenheit. On engines with fixed pitch propellers, the sign of carburetor icing is a gradual reduction of RPM.
5. The solution to carb ice is to apply carburetor heat. This increases the engine intake air temperature. The heated air melts the ice that has formed and stops further ice formation.
6. If there is no carburetor ice, you will notice a slight drop in engine RPM only.
7. If you suspect carburetor ice, use full carburetor heat immediately. The engine will run somewhat rough with a further drop in RPM as the melted ice, enters the cylinders. After the ice is cleared, the RPM will increase.
8. Some engines provide an automatic mixture control. The size of the venturi is automatically adjusted to maintain optimum conditions.
9. Some fuel injected engines automatically adjust the output of the fuel pump to maintain an appropriate fuel air mixture.

Air Facts: Purposeful Preflight

Private Pilot Chapter 1 – Video Segment 12

In this section we discuss the importance of a good preflight inspection.

Review:

1. You'll do a complete preflight before every flight. It's extremely important – neither neglect it nor let it become a mindless ritual.
2. In cold weather dress properly for the preflight. You don't want to rush through just because it's cold outdoors.
3. The preflight will be more enjoyable if you consider it as part of flying. Not just an initial annoyance.
4. Think about the flying surfaces and what they do as you inspect the airplane. What's the purpose of the Pitot tube, and the static vents, and the stall warning vane? If you think about what the Pitot tube does – provide information for airspeed indication – you won't likely leave the cover on.
5. If you make your preflight a thinking session about each part of the airplane, the experience becomes much more constructive.

Preflight

Private Pilot Chapter 1 – Video Segment 13

In this section we investigate the preflight inspection. We conduct it every time before we fly to ensure that all systems are working properly and that enough fuel and oil is on board. Our preflight is based on the Cessna 172.

Review:

1. The preflight is your chance to look the airplane over and assure yourself that it's ready to fly. Once you're airborne you can't pull over in an emergency.
2. The preflight begins as you approach the airplane. Look at its general appearance for such items as fuel or oil leaks, flat or underinflated struts and tires, snow, ice or other obstructions on or near the airplane. After this general overview, it's time to become specific.
3. To conduct the preflight, use a written checklist.
4. During the preflight keep an eye out for items that look different or out of the ordinary. You are looking for dented, cracked or wrinkled surfaces, loose or missing rivets and screws, and the like.
5. Take care when examining control surfaces, antennas, and other parts. Don’t slam them against the stops.
6. Make sure the required documents are on board. These include the airworthiness certificate, registration, operating limitations, and weight and balance information. The airworthiness certificate is required to be displayed so you can see it.
7. Remove the control lock and turn the master switch on. Check the fuel quantity gauges and remember the amount of fuel for later when you visually check the tanks. The low fuel annunciator lights should be off.
8. Switch the avionics master to ON and listen for the cooling fan – then turn it OFF.
9. In most airplanes, check the operation of the flaps by lowering them all the way.
10. Turn on the exterior lights and quickly make sure they're all working. Having completed the check of the electrical system, turn the master switch OFF. In most airplanes, the fuel selector valve should be on BOTH, and the fuel shutoff valve should be ON. The seat stop bolts should be in place and secure.
11. For the exterior inspection, begin on the left side and proceed around the entire airplane in logical order. When checking the movable panels, don’t forget to look at the hinges, cotter pins, and the like.
12. Look at the vertical stabilizer, rudder, and beacon.
13. Don’t forget to check the fuel sumps on the wings and the bottom of the engine cowling.
14. Observe the gear and tires and check the oil.
15. You want to do the preflight the same way every time, using your checklist, to ensure that you haven’t missed anything.

Engine Start

Private Pilot Chapter 1 – Video Segment 14

In this section we investigate the engine startup procedure for a Cessna 172. As a safety note, make sure no person, structure, or airplane is behind you.

Review:

1. Set the parking brake and be ready to use the foot brakes should the parking brake not hold.
2. Be sure the seats are adjusted and the seat belts buckled.
3. If your training airplane is a 172, the fuel selector valve should be on BOTH and the fuel shutoff valve pushed all the way in – the ON position.
4. Check that the circuit breakers are in and the avionics master switch is OFF, open the throttle about a quarter of an inch, confirm the mixture control is in the idle/cut-off position, and turn on the beacon switch.
5. Turn on the master switch, clear the prop, activate the electric fuel pump, and advance the mixture control until the fuel flow shows 3 to 5 gallons per hour, then pull the mixture to the idle/cut-off position.
6. Turn off the auxiliary fuel pump, turn the key to start, and when the engine starts release it. Advance the mixture control smoothly to full rich and check for proper oil pressure.
7. Turn on the avionics' master, raise the flaps, and activate any additional necessary lighting.

Aviation Communications

Private Pilot Chapter 1 – Video Segment 15

English is the international language of aviation, but the words and phrases used can be confusing to beginners. You are learning a new language. Be patient – it takes practice.

Review:

1. The Aeronautical Information Manual is the official source for good radio communication procedures.
2. The Pilot-Controller Glossary, often found in the back of the AIM, defines many of the common words and phrases that are used in the world of aviation
3. There is a proper way to pronounce the letters of the alphabet and numerals on the radio, use the phonetic alphabet constructed by ICAO, the International Civil Aviation Organization. The full list of alphabet and numeral phonetics can be found in the Aeronautical Information Manual.
4. Most of the individual numerals are pronounced the same way you would pronounce them in a non-aviation setting. A few use a special pronunciation to ensure clarity over the radio. Nine is pronounced niner, five should sound like fife, and three is articulated as tree.
5. Altitudes, ceiling heights, and other large numbers are indicated as hundreds and thousands in round numbers. A ceiling height of ninety-five hundred feet would be indicated as "niner thousand fife hundred."
6. For numbers at or higher than ten thousand feet, you should pronounce the individual digits for the thousands and hundreds if appropriate. When reporting an altitude of twelve thousand five hundred, say "one two thousand fife hundred."
7. While VFR operations are not permitted, altitudes above eighteen thousand feet are indicated as a flight level. Each digit of the flight level is pronounced when on the radio. Twenty-three thousand feet would be spoken as "flight level two tree zero."
8. The individual digits of a radio frequency should also be enunciated. The decimal point should be spoken as "point"; for example, "one two two point one."
9. The three digits of a bearing, course, heading, or wind direction should be spoken individually. Directions on the radio are in relation to magnetic unless the word "true" is added to the transmission.
10. Time may be expressed as Coordinated Universal Time or in the local time zone. The use of the "zulu" description may be used but is not required. The word "local" or the time zone equivalent would be used to denote when the time is not UTC.
11. As a general rule, most other numbers are transmitted by pronouncing each digit. An exception to this is in the description of airways used in IFR flying. Here V12 is pronounced "Victor twelve."
12. Another exception would be for ATC traffic position reports. These are given in reference to the clock face.

13. ATC traffic reports are in relation to the track rather than the nose of the airplane because radar does not show your crab angle.
14. Words like Roger and Affirmative are not interchangeable. Each has a unique meaning in radio communications. "Roger" means that I have received all of your last transmission. It should not be used to answer a question requiring a yes or a no answer. "Affirmative" and "Negative" are used for yes and no, respectively.
15. Wilco is similar in meaning to Roger. "Wilco" means I have received your message, understand it, and "will comply" with it.
16. Most training airplanes are noisy and you'll be concentrating on flying. Using a headset will make the communications much clearer and also give you the benefit of hearing protection.
17. The cockpit can be a loud place with all the engine and wind noise. To assure you're heard clearly over the extraneous sounds, position the microphone close to your lips, press the push-to-talk button and speak in a normal, but firm voice.
18. The person you're talking to is a human being. If you make a mistake, it's not the end of the world. Simply correct yourself and go on with your message.
19. Remember the four W's of radio communication: who you are calling, who you are, where you are, and what you want.
20. The proper way to initiate communication with ATC is to give your location, aircraft type, altitude, what you want to do, and if you have ATIS.
21. Try to eliminate unnecessary words like, 'ah', 'this is', 'at', and 'over'.
22. If the frequency is very busy, shorten your initial contact to save frequency congestion. Once acknowledged by the controller, complete the rest of the W's.
23. UNICOM is a non-government radio station. UNICOM is an acronym for unified communications, and it's available at most airports which do not have a control tower.
24. You can request airport advisory information on the UNICOM frequency. Calls to UNICOM are made by using the airport name and the word UNICOM. For example "Clermont UNICOM." You should be aware that a UNICOM station is not always attended.
25. The generic term for the radio channel to use at airports without an operating control tower is common traffic advisory frequency. The CTAF is indicated on aeronautical charts and other publications At a non-tower field, the four W's are still used on initial contact.

Air Facts: Getting the Message

Private Pilot Chapter 1 – Video Segment 16

Aviation jargon is terse, hardly conversational, and managing communications properly is a sign of a developing pro.

Review:

1. Pick up an air band receiver or scanner and listen to pilots communicate. If you are in a good geographical location you will be able to hear both sides of the communication. Search online for free ATC communications – listen and learn.
2. Purchase a comfortable headset with microphone – it's worth its weight in gold.
3. Practice communicating in your mind in the various situations you might find yourself. Set various scenarios and perfect the verbiage.
4. At a Towered Airport, you will first contact ground control.
5. An initial contact to ground might go something like this, "Hagerstown ground, Cessna Four Zero Romeo Charlie at the T-hangars, ready to taxi, we have information Romeo."
6. Listen well before you speak. If you don't understand something, ask for an explanation. Try not to step on another pilot's transmission.
7. At a busy place you'll be constantly reminded that saying your message in as few words as possible is a real piloting virtue, one that convinces everyone that you do indeed have the right stuff.

Taxi, Run-up, Traffic Pattern

Private Pilot Chapter 1 – Video Segment 17

Your instructor will probably have you taxi the airplane on your first lesson. Safe ground operations involve the coordinated use of the throttle, control yoke, and foot pedals. Steering with your feet is going to take some getting used to.

Review:

1. Airplanes with tricycle landing gear are easier to taxi since they have a steerable nose wheel linked to the rudder pedals. Conventional gear airplanes are a bit more difficult because of the small size and placement of the tail wheel.
2. To brake, press the top part of the rudder pedals with your toes. The right pedal controls the brake on the right wheel, and the left pedal, the left brake.
3. To make a normal right turn, push on the right foot pedal. To turn left, push on the left pedal.
4. To make a sharp right turn, for example, apply full right pedal, and add some right brake.
5. It takes more power to begin taxiing than to keep the airplane moving. The engine throttle should be advanced slowly until the airplane begins to move, then the power should be reduced once you're under way.
6. Test the brakes during the first several feet of taxiing to be sure they're working properly.
7. Rest your heels on the floor to keep from riding the brakes.
8. For control, taxi no faster than a brisk walk.
9. Strong winds can get under the upwind wing and tip the airplane.
10. Move the ailerons fully to the right in a right quartering headwind and to the left, in a left quartering headwind. Keep the elevator neutral.
11. Taxiing with a left quartering tailwind, move the ailerons fully right and push the control wheel forward. Taxiing with a right quartering tailwind, move the ailerons fully left and push the control wheel forward.
12. On reaching the run-up area, head the airplane into the wind and don't get too close to other airplanes.
13. Follow your before-takeoff checklist. Seats set and locked, belts on. Doors and windows closed and locked. Flight controls free and responding correctly. Fuel selector on proper setting. Trim tab set.
14. Do your engine check. This covers the operation of the magnetos, vacuum pumps, and alternator.
15. Oil pressure and temperature are in the green. Check and set the flight instruments, and just before you're ready to go, set the airplane lighting, flaps, and the transponder.
16. A left hand pattern is standard and should be used unless specified otherwise for an airport.
17. The upwind leg is the direction the airplane is flown on takeoff. The crosswind leg is flown at a ninety degree angle to the landing runway and off its takeoff end. On the

downwind leg you fly parallel to the landing runway but in the direction opposite to landing. The base leg is flown at a ninety degree angle to the landing runway and off its approach end. On the final approach leg you are aligned with the landing runway and therefore, heading into the wind.

18. Exit from the pattern is made after reaching pattern altitude either straight out or with a 45 degree turn.
19. The entry to the pattern is made on a forty-five degree angle to the midpoint of the downwind leg.
20. Runway numbers are determined from the approach direction. The runway number is the runway's magnetic direction rounded off to the nearest ten degrees and dropping the last zero.
21. For example, runway three six would be used for taking off and landing approximately to the north. The runway name on the other end of three six would be one eight.
22. Because runway numbers are magnetic, the runway heading should agree with the magnetic compass.

Closer Look: Wind Direction Indicators

Private Pilot Chapter 1 – Video Segment 18

Most of the time you will take off and land into the wind. To know the direction of the wind, airports have indicators that show its direction.

Review:

1. The three most common types of wind direction indicators are the wind sock, the wind tee, and the tetrahedron. They all operate like a weathervane.
2. The wind sock is a large, funnel shaped device. The wind tee resembles a small airplane. The tetrahedron looks like a flattened pyramid.
3. The most common of the three is the wind sock.
4. Many airports also offer an automated weather recording system over a dedicated frequency, referred to as an AWOS or ASOS.
5. The AWOS/ASOS frequency is located on the sectional and on the airport info page on mobile apps.
6. If there is no significant wind reported, find out if there is a preferred runway at the airport for takeoff and landing. This will take into account for runway slope, nearby obstructions and noise abatement procedures, if applicable.

Takeoff

Private Pilot Chapter 1 – Video Segment 19

Takeoff is not difficult because the airplane is designed to fly – it wants to get off the ground.

Review:

1. For takeoff at an airport without a control tower, announce over the common traffic advisory frequency (CTAF) that you're taxiing onto the active runway, check for other airplanes, and align the nose of your airplane on the centerline.
2. Add power smoothly. The throttle should be fully forward within a few seconds.
3. Pick a spot or an object beyond the end of the runway in line with the centerline. This will help you keep the airplane on a straight course after takeoff.
4. Heels on the floor. Use the rudder pedals to maintain directional control.
5. A climbing airplane wants to turn left; this is overcome by the use of right rudder.
6. As speed increases, the rudder becomes more effective until by lift-off speed it will provide directional control. Ease back on the control wheel just enough to let the airplane fly itself off the runway.
7. Now, allow the airplane to accelerate to climb speed. When reached, trim to maintain attitude.
8. Maintain the runway centerline. A turn for departure or to enter the downwind pattern should not be made until you are approximately three hundred feet below pattern altitude. Depart on a 45 degree heading or straight out.
9. As you climb out, occasionally check the gauges. Keep an eye out for traffic.

Closer Look: Tower Controlled Field

Private Pilot Chapter 1 – Video Segment 20

When ready to taxi to the takeoff runway at a tower controlled field, call ground control with your request. Remember the four Ws when making the call.

Review:

1. Once you begin taxiing, ensure you clearly understand your route and clearance limit. Focus solely on this task and defer any aircraft checks, GPS programming or other distractions until you're positioned at the run-up area.
2. Remember to stay tuned to ground control until reaching the takeoff runway in case there are any further instructions.
3. One of the biggest differences in a towered airport and a nontowered one is the amount of traffic there.
4. At the run-up area, perform your before takeoff checklist normally, and taxi to the hold short lines, or get in line for takeoff if there are other airplanes waiting. Contact the tower, advising them that you're ready to go – remember the four Ws.
5. Your initial call to tower might go something like this, "Lunken tower, Cessna 3-8-8 echo sierra, at runway 7, ready for takeoff."
6. At this point, follow tower control's directions.

Air Facts: Takeoff Tips

Private Pilot Chapter 1 – Video Segment 21

Takeoffs are really a lot of fun. It's one of the purest moments of flight.

Review:

1. Taking off has its own set of challenges. Make sure that there are no other airplanes landing. Someone might be flying an incorrect pattern.
2. Even at a towered airport, when the tower clears you to taxi into position and hold, it's a good idea to check the final approach course to make sure nobody is there.
3. Another takeoff challenge is directional control. Relax. Make sure you're not applying pressure to the brakes or to both rudder pedals at once.
4. Make sure you have the seat far enough forward so that you can use full rudder travel.
5. The final challenge on takeoff is achieving the proper pitch attitude. It takes more back pressure on the control wheel to rotate the airplane to the initial climb attitude than it takes to keep the airplane in that attitude.

Four Fundamentals

Private Pilot Chapter 1 – Video Segment 22

Every maneuver you do with an airplane involves the four fundamentals of flight – turns, straight-and-level, climbs, and descents.

Review:

1. Controlling an airplane consists of either one, or a combination of, turns, straight-and-level, climbs, and descents. You will also have to consider the proper power setting, and the pitch and bank attitude of the airplane.
2. The primary reference for attitude is the relationship between a point on the airplane and the horizon.
3. Inside the airplane, the position of the miniature airplane on the attitude indicator shows the attitude of the airplane.
4. The altimeter, heading indicator, airspeed indicator, and the turn coordinator are used to verify, and cross check, the attitude presented by either the natural horizon or the attitude indicator.
5. The three components involved in airplane control are pitch, bank, and power. The proper combination of pitch and power will always produce a predictable performance.
6. In a turn, you will use all three primary controls – the ailerons, the rudder, and the elevator.
7. There are three types of turn – shallow bank (a bank angle of less than twenty degrees), medium bank (a bank angle of between twenty and forty five degree), and steep turns (a bank angle greater than forty five degrees).
8. To turn, move the control wheel left or right. In a turn, the airplane will want to yaw opposite the bank
9. – rudder is needed to keep the turn coordinated. You will also need to apply back pressure on the elevator control to maintain the vertical lift needed to oppose gravity.
10. The reference for pitch attitude control should be a point on the engine cowl or windshield in line with the horizon and directly in front of you.
11. Always clear the area before you turn.
12. In a medium bank turn, once the bank angle is established, neutralize the controls but keep a little back pressure to maintain altitude.
13. Rolling out of the turn is like the roll-in, except control pressures are used opposite the turn, and elevator control back pressure is decreased as the bank decreases.
14. In a steep turn, the bank will tend to increase. You will need some aileron pressure against the turn to keep the bank from increasing. Also, the elevator pressure needed to maintain level flight will be greater than that required for a medium bank turn.
15. The roll-out from the turn must be started before reaching the desired heading.

16. As the airplane starts banking, the nose should start turning. If the nose turns before the bank starts, rudder pressure is being used too soon. If the nose doesn't turn, or turns in the opposite direction as the bank starts, the rudder pressure is being applied too late.
17. The inclinometer, or ball, will tell you if the turn is balanced or not. If the ball moves right, step on the ball, that is, use right rudder. If it moves left, apply some left rudder to center it.

Air Facts: Pitching and Turning

Private Pilot Chapter 1 – Video Segment 23

This section will give you a few useful ideas on pitch control and its importance.

Review:

1. As the bank angle increases past a shallow bank, you need more back elevator pressure and a little opposite aileron to keep the bank from increasing.
2. An airplane is stable in straight-and-level, properly trimmed, flight. In a turn, you are still stable, but things are different. So much so, that loss of control may be possible.
3. If the bank were to become steep enough, you may not have enough up elevator or opposite aileron to stop the bank. If everything is allowed to go to maximum, the airplane will be out of control.
4. If either up elevator and/or opposite aileron are becoming excessive in your bank, the way to fix it is to lower the nose a bit and reduce the angle of bank.
5. You might consider not using a bank angle of more than 30 degrees to ensure controllability.
6. A good rule of thumb might be; fly so your passengers hardly notice the changes that you make.

Four Fundamentals (part 2)

Private Pilot Chapter 1 – Video Segment 24

Every maneuver you do with an airplane involves the four fundamentals of flight – turns, straight-and-level, climbs, and descents.

Review:

1. In straight-and-level flight, pick a point on the nose of the airplane directly in front of you, and keep that point in a fixed position in relation to the horizon.
2. The position of the wing tips, in relation to the horizon, will help as well. Check the altimeter occasionally to see if your altitude is correct.
3. Trim should be used to relieve the control pressures.
4. The attitude indicator is used for pitch attitude information when the horizon isn't visible.
5. Airspeed indications should stay fairly constant in level flight.
6. In level flight and smooth air, the vertical speed indicator should show a zero rate of climb or descent.
7. If you decrease the power in level flight, the airplane will descend. Conversely, increasing the power setting will make the airplane climb.
8. To fly straight, choose some point on the ground and keep the nose of the airplane headed to that point. Check the heading indicator occasionally to be sure that the airplane is flying in a constant direction.
9. Any slight bank will cause the airplane to turn. The reference instruments for straight flight are the attitude indicator, heading indicator, and the turn coordinator.
10. The attitude indicator shows changes in bank instantly. The position of the bank scale pointer will give you a good check for wings level flight.
11. Bank is indirectly shown on the heading indicator because even a small bank will make the airplane turn.
12. The turn coordinator provides an indirect indication of bank.
13. If the wings are level, and the inclinometer or ball is centered, the airplane is in straight flight.
14. If the airplane is properly trimmed and the air is smooth, you won't need to hold control pressures to fly straight-and-level.
15. A climb is the basic maneuver where the combination of pitch and power allow the airplane to gain altitude. To start the climb, simultaneously apply back pressure to the elevator and set the throttle for climb power. Use rudder to help maintain heading.
16. For the best climb rate, climbing turns should be made with a shallow bank. To recover to straight- and-level, start the level off about fifty feet before the desired altitude. Maintain climb power until cruise speed is achieved.
17. Descents are made with a wide range of airspeeds and rates of descent.
18. The speed that will yield the greatest forward travel for the altitude lost is called the best glide speed.

19. To enter the normal glide, reduce power and apply back pressure to the elevator to maintain altitude. When the airspeed approaches the desired airspeed, the pitch attitude is lowered to maintain this speed. After the airspeed has stabilized, the airplane should be trimmed for hands-off flight.
20. You may have to use a little left rudder in a descent. Also, the controls are less effective in a reduced power situation. During prolonged operation at low or idle power settings, clear the engine by opening the throttle for a short period – helps keep the engine temperature constant.
21. As with climbs, you must start to level off before reaching the desired altitude. Generally, starting the level off 50 to 100 feet before reaching the desired altitude. When you have reached the desired altitude, increase power to maintain it.

Air Facts: The Proper Attitude

Private Pilot Chapter 1 – Video Segment 25

This section will further study the concept of airplane attitude – especially the notion that a wing could potentially stall at any airspeed and in any attitude.

Review:

1. Look at the pitch attitude of the airplane – nose up for example – and then look at the vertical speed indicator. If the airplane is climbing, the angle of attack is relatively low. But if the nose is up and the airplane is descending, then the angle of attack is high.
2. The airplane can even stall with the nose down if you rapidly increase back pressure and the wing blocks its own flow of air over its surface.
3. If the pitch attitude is in one direction, such as up, and the path of the airplane is in another direction, such as down, then the angle of attack is likely high.
4. If you make smooth and gentle changes in attitude, you won’t have to worry about exceeding the critical angle of attack.
5. The question to ask yourself is: where is the airplane pointed compared to where it’s moving? If you can answer that question, you can visualize the relative wind and the angle of attack.
6. Regardless of how your airplane is equipped, there’s a key takeaway here: try to fly smoothly. If you avoid aggressive maneuvers and keep the airspeed comfortably above stall speed, chances are low that you’ll ever be caught off guard by an inadvertent stall.

Conclusion

Private Pilot Chapter 1 – Video Segment 26

In chapter one, we've covered what you should learn in your first few hours of flight instruction.

Review:

1. Safety is our number one goal. It should be yours too.
2. Always conduct a complete and thorough preflight.
3. Be consistent – use a checklist.
4. Always be professional in your approach to flying.
5. Respect your airplane.
6. Read and understand the pilot operating handbook for your airplane.
7. Your instructor may approach teaching you in a slightly different way than we have presented the material here – there are many ways to accomplish the same goal.

Chapter 2 – Practicing Landings

Ground Reference Maneuvers

Private Pilot Chapter 2 – Video Segment 1

The air mass in which you're flying may also be moving – many times not in the same direction that you want to go. The net effect is that the direction your airplane's nose is pointed may not necessarily be where you'll end up, and your airspeed is not always the same as your groundspeed. So, how do we compensate for the effect of the wind?

Review:

1. A wind blowing from the side will make the airplane drift away from your course. To stay on course, point the airplane into the wind to offset the wind from the side. This is called a crab angle.
2. The direction the airplane is pointing is the heading, and the actual path made over the surface is the track. You want the course and track to be identical.
3. To practice correcting for wind drift in both straight and turning flight, you will practice ground reference maneuvers – rectangular course, s turns, and turns around a point.
4. Ground reference maneuvers will help to develop your ability to recognize and correct for the effect of wind. You learn to control the airplane by looking outside, checking your gauges inside, and keeping an eye out for traffic.
5. From the air you can see many wind indicators – smoke, blowing dust, trees, waves on water, and fields of grain crops.
6. Ground reference maneuvers are flown between 600 and 1,000 feet above the ground, the usual traffic pattern altitude – distances and mistakes are easier to judge at a lower altitude.
7. Wherever you choose to practice ground reference maneuvers, you must comply with the minimum altitude rules of the federal aviation regulations – see FAR 91.119.
8. In the case of an emergency, scope out the availability of an appropriate landing area before you start your practice.
9. The rectangular course resembles the airport traffic pattern. Select a rectangle or square field with sides between 1/2 and one mile long with boundaries defined by roads or section lines. The airplane is flown outside the rectangle, parallel to the boundaries.
10. The distance from the boundaries should be the same distance as the downwind leg of the traffic pattern is from the runway. Practice left and right turns and don't exceed medium bank turns.
11. For our purpose here we will consider the wind to be on our nose on our initial 45 degree entry. We are entering upwind.
12. The turn to the crosswind leg is started when the airplane is even with the corner. It starts into a direct headwind and ends with a crosswind. The turn is less than 90 degrees

because the airplane will have to be crabbed to the left to compensate for the crosswind from the left.

13. Start the downwind turn when the airplane is abeam the downwind boundary. This turn is greater than 90 degrees because of the crab.
14. Turning to base leg, the wind will be from the right, calling for a crab to the right a turn greater than 90 degrees.
15. Finally, turning to the upwind leg, the turn is less than 90 degrees.
16. It's important that you plan ahead of the airplane – knowing what to do before you get there will help guarantee success.

Closer Look: Taxi Tips

Private Pilot Chapter 2 – Video Segment 2

In this section we'll take a closer look at how to make your taxi time more useful to your flying.

Review:

1. Always pay attention to what's going on around you as you taxi.
2. Be conscious of your surroundings while the propeller is turning. It's courteous to avoid long periods on a crowded ramp or near a building with the engine running. After completing the after start check, use gentle applications of power to carefully maneuver the airplane to a location away from people and buildings.
3. Check your instruments to ensure they are moving in the correct direction – especially the turn coordinator and the heading indicator.
4. Use your feet to steer but keep one hand on the control wheel and the other hand on the throttle.
5. You'll want to avoid taxiing with power while simultaneously applying the brakes - the aviation equivalent of using the gas and brake pedals at the same time. Once you get some momentum, the airplane will require only a slight amount of power to continue moving forward.
6. When it comes time to cross runways or other taxiways, make sure to look both ways to visually verify there are no aircraft coming your way. You should do the same at tower-controlled airports as a double-check to your ATC clearance.
7. Finally, think ahead to the takeoff and flight anticipating what could go wrong and what your first reactions may be. Discuss your objectives with your instructor and begin mentally rehearsing them.

Engines

Private Pilot Chapter 2 – Video Segment 3

The use of internal combustion engines in aircraft presents a unique problem because fuel will only burn well when it is mixed with air in the proper proportion.

Review:

1. The ratio of air to fuel is correct at sea level when the mixture control is set to full rich.
2. As an airplane climbs the air becomes less dense but the fuel flow remains the same. The airplane is receiving less air and the mixture becomes richer, hence the need to lean out the mixture.
3. A too rich mixture will cause the engine to run rough and lose power. A properly leaned engine will run more smoothly and efficiently, and not be subjected to spark plug fouling.
4. For the analog gauge equipped Skyhawk, the exhaust gas temperature gauge is used for leaning at cruise. You will find the peak EGT and use it as a reference. Once peak EGT is reached, enrich the mixture to reduce the EGT 50 degrees.
5. Any time the throttle position or altitude changes, the mixture will have to be reset.
6. The G1000 displays the temperature for each cylinder. Pressing the engine and lean keys brings up a bar graph showing the EGT of all the cylinders, with the hottest cylinder colored cyan. If you press the assist key, then, as you slowly lean the mixture, the peak EGT is automatically detected and displayed as a hollow bar on the graph.
7. If your airplane doesn't have an EGT, lean with the mixture control until the engine begins to run rough, then enrich until the engine runs smooth again.
8. Normally you will use a full rich mixture for take-off and climb. Follow the manufacturer's guidelines here.
9. Spark plugs are used in engines to provide an electric arc that will ignite the mixture. To work properly, its gap must be set accurately. A plug covered with deposits can degrade an engine's performance.
10. An excessive mag drop may occur if a plug is fouled.
11. Normal combustion produces a smooth, downward pressure on the piston. However, there are two problems that can occur to cause abnormal combustion – detonation, and preignition.
12. Detonation occurs when the fuel and air mixture is subjected to a very high temperature in the cylinder and the spontaneous combustion point of the mixture is reached. This causes a sudden explosion which produces extremely high pressure.
13. It's hard to hear detonation in an aircraft engine due to all the other aircraft noises, but it shows up as a loss of engine power and overheating.
14. Detonation may be caused by using too low a grade of fuel, climbing at too slow an airspeed, or using too lean a mixture with a high power setting.

15. Preignition is the uncontrolled igniting of the fuel and air mixture before the time the spark plugs are set to fire. When preignition occurs, the piston is still rising to the top of the cylinder.
16. Preignition exerts a downward force opposite the travel of the piston creating severe structural stresses on the engine.
17. One of the most reliable indicators of preignition is loss of power.

Air Facts: Engine Suspicion

Private Pilot Chapter 2 – Video Segment 4

More advanced engines, such as the turbo charged varieties, require a lot more care than those used in most training airplanes.

Review:

1. If we lay a good foundation by taking care of the four-cylinder engines during the early days of training, we'll be ready for more advanced flying down the road.
2. In turbocharged engines, it's best to run with the mixture a bit on the rich side. This will generally keep the engine cooler, so that the heat that causes detonation or preignition is not as likely to develop.
3. Airplanes with more advanced engines usually have better instrumentation to help the pilot monitor and set a proper mixture.
4. Always be aware of any engine abnormality that happens right before takeoff. Don't continue - get it checked out. If something seems out of the ordinary when you are in the air, land as soon as it's safe and have a mechanic look at it.

Aerodynamics

Private Pilot Chapter 2 – Video Segment 5

In this section, we will continue our investigation of airplane aerodynamics. Review, if necessary, the discussion in Volume 1 regarding lift, weight, thrust, and drag.

Review:

1. There are two types of drag on an airplane – induced drag and parasite drag.
2. Induced drag is the rearward retarding force caused by the wings creating lift. Parasite drag is caused by the fuselage and other protrusions disrupting the flow of air. Drag opposes thrust.
3. If the airplane is in a steady climb or descent, you can further break down the forces of lift, weight, thrust, and drag into their horizontal and vertical components.
4. If the airspeed is decreasing, the rearward forces are greater than the forward forces.
5. The angle of attack is the angle between the chord of the wing and the relative wind. Simply stated, angle of attack is the angle between where the wing is pointed and where it's actually going. Don't confuse the angle of attack with the pitch attitude of the airplane.
6. By changing the angle of attack, you control and change airspeed, lift, and drag.
7. At a low angle of attack, most of the lift is caused by the decrease in pressure above the wing. As the angle of attack increases, the lift caused by the higher pressure below the wing increases. Eventually the angle of attack becomes so large that the airflow can't flow over the top of the wing.
8. When this happens the airfoil has reached the stalling angle of attack, sometimes called the critical angle of attack or the burble point.
9. The rotary motion of the air which flows from the wingtip is called a wingtip vortex. Wingtip vortices are a by-product of lift and increase in intensity as lift increases.
10. Vortices are greatest when you have a relatively high angle of attack, for example on takeoff and landing. They diminish somewhat at cruise speed.
11. A wing’s center of lift can be thought of as the point where all the lift acts. In actual practice, to determine the center of the wings lifting force, you must also consider the pressures below the wing.
12. As you increase the angle of attack, airflow separation moves toward the front of the wing. For example, at minimal controllable airspeed, any increase in angle of attack or load factor, or any reduction in power, will result in an immediate stall.
13. The turbulent airflow spreads forward and outward from the wing root.
14. As the wing is stalled, lift diminishes rapidly. Air flow is turbulent farther outboard on the wing, but the wing tips are still providing lift. The ailerons continue to have some effectiveness so some roll control remains.
15. That the wing stalls progressively from the wing root outward toward the wing tip, is advantageous.

16. The stall progresses this way because of modern wing design. For example, the wing is attached to the fuselage at an angle, called the angle of incidence. Also, the wing is slightly twisted, called washout. These design characteristics allows the outboard portion of the wing to have a lower angle of attack while the inboard part of the wing is at the stalling angle of attack.
17. An airplane tends to turn left when using high power at low speeds. Viewed from the pilot's seat, the crankshaft and propeller on American made engines turn clockwise.
18. Engine torque, the tendency of the airplane to turn opposite the propeller rotation, spiraling slipstream, gyroscopic precession, and asymmetrical propeller loading all contribute to make the airplane turn left.
19. The spiraling slipstream or corkscrew effect is caused by high propeller speed and is most pronounced at low forward speeds. The propeller rotation causes the slipstream to rotate clockwise around the fuselage striking the vertical stabilizer on the left side making the nose yaw to the left.
20. The propeller acts like a gyroscope in that a force applied to the propeller becomes apparent ninety degrees from the point where it was applied.
21. P-factor, asymmetric propeller loading, occurs when you fly the airplane at a high angle of attack. The descending blade has a higher angle of attack and therefore much higher thrust than the ascending blade on the left, causing the airplane to yaw to the left.
22. Modern airplanes are designed to correct for the left turning tendency at cruise speed and power. At high speed and low power, such as in a descent, you may have to correct with left rudder to prevent yawing to the right.

Closer Look: Angle of Attack

Private Pilot Chapter 2 – Video Segment 6

You've probably heard that "a wing can be stalled at any airspeed and at any attitude." While that's absolutely true, it's not very intuitive. In this section, we will take a closer look at the meaning of angle of attack.

Review:

1. The critical angle of attack remains the same - regardless of airspeed, weight, pitch attitude, and bank angle.
2. Exceeding the critical angle of attack will cause the wing to stall - every time.
3. In general, keep the airspeed in the green arc and you won't stall. Put another way, if your airspeed is high, your angle of attack is probably low.
4. In steeply banked turns or other unusual attitudes, airspeed is not nearly as accurate a substitute for angle of attack.
5. Maintain an awareness of your angle of attack at all times, and ask yourself if the airplane's pitch attitude and flight path are significantly different.
6. Try to fly smoothly. If you avoid aggressive maneuvers and keep the airspeed comfortably above stall speed, you will most likely fly your entire career without ever getting close to a stall.

Slow Flight

Private Pilot Chapter 2 – Video Segment 7

Slow flight and stalls are taught to make you familiar with the feel, sight, sounds, and other perceptions of the reduced margin between flying and stalling, and to develop a conditioned reflex to take prompt corrective action.

Review:

1. Slow flight will develop your feel for the controls and reinforce the relationships of airspeed and attitude control.
2. It also helps to familiarize you with the control pressures and techniques needed to fly the airplane right after takeoff and just before the landing touchdown.
3. To maintain altitude at low airspeeds the angle of attack must be increased. The angle of attack needed to maintain altitude at speeds near stalling causes a sharp rise in induced drag.
4. The airspeed which corresponds to the lowest total drag is the airspeed for maximum endurance. This is the lowest thrust required for level flight and will result in the lowest fuel consumption and allow flight for the longest time.
5. From this point, to the stall airspeed, is what is called the backside of the power curve or the region of reversed command.
6. In this configuration, to go slower and maintain altitude, you will have to increase power. Any decrease in power will result in a loss of altitude.
7. To slow fly the airplane, clear the area, and start reducing power. At the same time, increase back pressure to maintain your altitude and trim off any pressure.
8. When the airspeed is within 5 knots of the desired slow flight airspeed, increase the power just enough to maintain altitude.
9. You will have to apply right rudder to maintain coordinated flight because of the effect of high power, engine torque, P-factor, and the spiraling slipstream.
10. Check the ball frequently as well as the attitude indicator and altimeter.
11. Scan for traffic.
12. Now practice shallow turns during slow flight. Level turns at slow flight airspeed require adding power to maintain altitude, and pitch must also be changed slightly to maintain airspeed.
13. Maneuvering during slow flight should be practiced in all flap configurations.
14. Remember, extending the flaps lowers the stalling speed. However, because of the added drag, power must be increased if you want to maintain altitude.
15. With the slow speed, high drag, and high lift condition of full flaps, there is little power left to climb.
16. This is the situation when a landing has to be abandoned and a go around started in the last moments of a landing. The airspeed may be below the no flap stalling speed and sudden retraction of the flaps may stall the airplane.

17. To recover, full power is used and flaps are slowly retracted one position at a time. As flaps are retracted back elevator pressure must be used to make up for the loss of lift.

Closer Look: Change of Scenery

Private Pilot Chapter 2 – Video Segment 8

In this section we are looking at ways to break up the monotony of flight lessons while having fun.

Review:

1. One of the best ways to break up the maneuvers phase of your flight training is to leave your local airport environment and fly to new airport.
2. There will be days during your training when it seems tough to get excited about another lesson consisting of basic flight maneuvers. Don't worry, this is completely normal and your instructor obviously has good intentions.
3. Try scheduling your flight lesson at a different time of day or if you normally fly during the week in between school or work, try a few weekend lessons when you have less on your mind.
4. When practicing landings, a change of scenery can make all the difference in the world. While you can save time by staying at your home airport for repeated takeoff and landing practice, you may find it beneficial when having trouble with the traffic pattern and landings to head to a new airport for a new perspective.
5. If your flight school is based at a non-towered airport, ask your instructor to take you to a towered-airport for multiple landings; conversely, if you regularly operate out of a towered-airport, fly over to a non-towered field for some practice.
6. Refining the skills required by these maneuvers will ultimately make you a more capable and well-rounded pilot. But of course one of the main reasons you're learning to fly in the first place is for the fun of it.
7. If you normally fly during the week in between school or work, try a few weekend lessons when you have less on your mind.
8. Your instructor should notice when your interest begins to wander, but don't feel like you have to wait for them to mix things up. You should always be open with them and speak up if you want a change of scenery during your lessons, even if only for a lesson or two. You'll be instantly reminded of how much fun flying truly is and learn valuable skills along the way.

Stalls

Private Pilot Chapter 2 – Video Segment 9

Stalls are practiced to enable you to recognize an impending stall and to react in the proper manner.

Review:

1. Practicing stalls will also help you learn the low airspeed flight characteristics of the airplane, and how to control it at low airspeeds.
2. Part of your practice will include recognizing the first indications of a stall – these are called imminent stalls.
3. When practicing imminent stalls, the recovery is made at the first indication of a stall. The airplane is not allowed to become fully stalled. The object of this maneuver is to avoid a full stall.
4. When doing full stalls, the stall is allowed to progress until full up elevator, buffeting, and nose down pitching are reached.
5. During recovery from a fully stalled condition, you need to recover with a minimum loss of altitude and without entering a secondary stall.
6. A secondary stall occurs when the pitch attitude is raised too soon or too high during the first stall recovery. Recover in the normal way.
7. Stalls are especially dangerous when they occur close to the ground or if the pilot tries to recover in the wrong way.
8. A wing will always stall at the same angle of attack – this occurs when the angle of attack reaches approximately 16 to 18 degrees. However, weight, bank angle, power setting, and load factor may change the speed or the pitch attitude at which the airplane stalls.
9. To recover from a stall, you must reduce the angle of attack, either by adding power or sacrificing altitude.
10. Stall recoveries can be made without power, and your instructor will probably have you do some power-off stall recoveries.
11. Power-off stalls simulate approach and landing conditions. Power-on stalls simulate takeoff and departure situations.
12. Power-off stalls are normally called approach to landing stalls. They are practiced either as imminent or full stalls.
13. When practicing stalls, make sure the airplane is of the proper weight, that it is balanced, and the maneuver is flown at a safe altitude above the ground.
14. If weight is loaded too far forward, the airplane will stall at a higher airspeed; and if loaded too far aft, stall recovery may be difficult.

15. For the power-off stall, set up the airplane in the approach mode, then start to bring the nose up slowly until the airplane stalls. Don’t exceed a normal climb attitude. Recover in the normal way – lower the nose and simultaneously apply full power.
16. Imminent power-off stalls during turns should be made at 20 degrees of bank – simulating the turn from base to final.
17. During the stall entry, use control pressures as necessary to prevent the bank angle from changing, keep the ball in the center, and keep the nose from dropping. Then, at the first sign of the stall, lower the nose, apply power, and level the wings.
18. The entry procedure for doing full stalls straight ahead with power off is the same as for the imminent stalls. Usually the best clue that the airplane has stalled occurs when the elevator control is full back and the nose pitches down.
19. Recovery from the full stall will require a lower pitch attitude in order to avoid a secondary stall and the altitude loss will be greater. Reduce the angle of attack, add full power, and maintain directional control using coordinated rudder and aileron pressures.
20. Power-on stalls simulate takeoff and are entered in the takeoff configuration at takeoff speed and power. They are done straight ahead and in turns up to a maximum bank angle of 20 degrees.
21. In the imminent takeoff stall, the speed is reduced to liftoff speed, takeoff or recommended power is applied, and the pitch attitude is raised to the normal climb attitude – don’t forget to apply a lot of right rudder to keep the ball centered.
22. Raise the nose above the climb attitude and hold it in this position until the first buffet or control effectiveness decay is felt. At the first sign of a stall, recover by lowering the pitch attitude to slightly below level flight.
23. The full takeoff stall is identical to the imminent stall with the exception that the recovery is delayed until the airplane is fully stalled.
24. Note: during power-on turning stalls to the right, you may find it necessary to use right rudder to overcome torque and "P" factor, and left aileron to prevent the bank from increasing.
25. If the turn is perfectly coordinated at the stall, the airplane should not experience any rolling moment. The nose simply pitches away from the pilot.
26. The main elements that determine the angle of attack of a wing are airspeed, weight, and load factor.
27. Without an increased load factor, the normal weight of the airplane is 1-G. The previously discussed stalls were done at 1 G or only slightly more in turning stalls.
28. An increase in weight or an increase in load factor will cause the airplane to stall at a higher speed.
29. Stalls caused by an increased load factor are called accelerated stalls. They occur during a steep turn or an abrupt pitch change.
30. With power reduced, the airplane should be slowed to a speed one and one half times the normal stall speed in straight flight. Then initiate a 45 degree banked turn with back elevator pressure used to maintain altitude. When the bank is established, back elevator pressure is briskly increased to bring about the stall.

Air Facts: Stall Rhetoric

Private Pilot Chapter 2 – Video Segment 10

Many students don't like the idea of doing stall practice. It may be that the term stall has a negative connotation.

Review:

1. Stalls are, for the most part, easy to do and recover from – simply ease the back pressure on the control wheel. The loads in a stall are quite low too because the airspeed is low.
2. If the ball is not centered during the stall, the airplane may tend to roll. The first time you experience this you may be a little startled.
3. You recover from the stall by lowering the nose and leveling the wings with coordinated use of aileron and rudder.
4. Remember, if the ball is in the middle, the airplane will likely stall with little, or no roll, in either direction.
5. Stalling an airplane in uncoordinated flight, ball off center, and control wheel full back, may cause the airplane to start into a spin.
6. To recover set power to idle, neutralize the ailerons, apply full rudder pressure opposite the spin – right rudder if the spin is to the left. At the same time, relax the full aft elevator pressure. Recover from the developing dive with a smooth application of aft elevator control.
7. When low and slow, be wary and develop an instinctive reaction to move the elevator control forward to reduce angle of attack at any time the airplane feels near a stall.

Normal Landings

Private Pilot Chapter 2 – Video Segment 11

This section discusses your approach to the airport, proper pattern techniques, landing, taxi, and engine shutdown.

Review:

1. Approximately ten miles from a nontowered airport, call on the common traffic advisory frequency and announce your intention to land and request an airport advisory.
2. In the pattern you will make additional calls on each leg of the pattern.
3. If there is a tower present, do the same as you would for a nontowered airport. However, in this case, the tower will advise you of the active runway and give you other pertinent information.
4. As you head toward the airport, descend to the traffic pattern altitude before you arrive. Always avoid descending entries into the traffic pattern because of collision hazards.
5. Even though some airports are nontowered, there are still important procedures necessary to ensure safety and uniformity of activity.
6. Enter the downwind leg at a 45 degree angle. If approaching from the opposite side of the airport, enter the pattern 45 degrees to the upwind leg. At a towered airport, the controller will advise you how to approach and enter the pattern.
7. As you enter the pattern, conduct your pre-landing checklist. Fly parallel to the landing runway. Fly all legs of the pattern at a close enough distance that in the event of a loss of power, you can make the runway safely.
8. On downwind, reduce power and maintain altitude to slow the aircraft to the flap operating speed range shown by the white arc on the airspeed indicator.
9. Set flaps on downwind, base, and final as per your instructor's method for your particular airplane.
10. Opposite the point of intended landing, reduce power to the appropriate RPM to further slow the airplane and start a descent.
11. When the intended touchdown point is approximately 45 degrees behind the wing initiate a turn to the base leg. You may have to crab a bit here to compensate for wind.
12. At about 45 degrees to the final approach, start to judge whether you need to start a turn to final or hold your course a bit longer – wind and altitude are the primary factors here in your decision.
13. Use a medium bank turn from base to final and you should end up on final aligned with the runway.
14. Aligned with the runway, set flaps as necessary and trim for the final approach speed.
15. At this position you should be on the proper glidepath to touchdown – consider the glidepath like a line extending from your airplane to your point of intended landing.
16. The airplane should never be allowed to go below the glidepath or the approach speed.

17. Normally, it will take the airplane a longer time to reach the runway because you are flying into a headwind.
18. You will have to control pitch and power all the way to touchdown. Remember, you want your airspeed to remain relatively constant throughout.
19. Judging your height takes practice. The runway's perspective looks different depending on your altitude on final.
20. Select an aiming point down the runway. Align the aiming point with a place on the windshield. If the aiming point stays on the same place on the windshield, then you're on the right glidepath. If the aiming point moves down on the windshield, you're above the right glidepath, if it moves up you are too low.
21. Keep the airplane aligned with the runway. As you get closer, focus your sight far enough ahead of the airplane to see objects clearly.
22. As you get close to the ground, start a reduction in power and begin to flare. This reduces your descent rate. As your airplane approaches the runway, increase the flare to touchdown. Ideally, the control wheel should be all the way back at touchdown – the perfect stall.
23. Let the nose wheel gradually settle to the runway. Maintain directional control with the rudder pedals until the aircraft loses speed and you can taxi clear of the active. Announce your intentions. At a tower controlled airport follow the controller's directions.
24. Do the after landing and shutdown checklists. Pull the mixture to idle cutoff and when the prop stops turning, turn the magnetos and master switch off. Install the control lock, if available.

Air Facts: Down to Earth

Private Pilot Chapter 2 – Video Segment 12

You learn to land by doing a lot of landings – they take practice.

Review:

1. One of the keys to learning to land is to remain undaunted by mistakes. Everybody makes them, and everybody learns from them.
2. You will go through phases in your practice. Sometimes the landings seem to be coming right along. At other times they seem to be a disaster. Don't become discouraged. It will work out.
3. You want to make all your mistakes before you solo. Consider each mistake a learning experience.
4. Your landings should become smoother and smoother, regardless of the wind – this takes a while.
5. Oftentimes, the pilot causes the existing turbulence to be worse than it is because of his abrupt control inputs. Try to relax on the controls and see what happens. Usually, the bumpiness will diminish.
6. Of course, you can't sit there and do nothing. However, with practice, you will learn to use the necessary control inputs to keep the airplane in the proper landing attitude.

Takeoff & Landing Variations

Private Pilot Chapter 2 – Video Segment 13

In this section we will discuss the various types of takeoffs and landings you will learn, as well as the techniques to do them successfully.

Review:

1. We always try to land into the wind. A headwind generates airspeed and shortens the ground roll.
2. To takeoff in a crosswind, line up on the runway as usual, place the upwind aileron in the full up position, and use rudder to keep the airplane rolling straight down the runway.
3. As speed increases and the ailerons become effective, reduce some of the aileron held into the wind.
4. The airplane's area behind the main landing gear presents a wide surface to the wind and will cause the airplane to turn into the wind – just like a weathervane.
5. Keep the airplane on the runway until reaching a higher than normal takeoff speed, then smoothly but firmly apply elevator back pressure.
6. Don't force the airplane into the air prematurely.
7. Immediately after takeoff, keep the airplane in a sideslip. In other words, keep the upwind wing down using rudder to keep the airplane lined up with the runway. This will counteract the drifting effect of the crosswind.
8. When the airplane is well above the runway, the wings should be leveled and a crab established to keep the airplane on the extended centerline of the runway.
9. To make a crosswind landing, use the appropriate flap settings for your airplane on downwind, base, and final.
10. On final approach, the crosswind will drift the airplane toward the downwind side. There are two ways to correct for this drift – a sideslip or a crab.
11. While the sideslip presents a little more challenge, there is less chance of landing with a side load on the gear.
12. On final approach, the upwind wing is lowered and opposite rudder is used to keep the longitudinal axis of the airplane aligned with the runway.
13. The sideslip is correct when the airplane stays on the extended center line of the runway and pointed straight down the runway. You adjust bank and rudder to keep it there.
14. If you don't have enough rudder to keep the airplane lined up with the runway, the crosswind is too strong – go elsewhere to land.
15. The slip is used throughout the landing and touchdown will be made on the upwind main gear.
16. When you have learned to control drift with the sideslip, a combination of the crab and sideslip may be used.
17. Crab the airplane on final approach to stay on the extended centerline of the runway, then, change the crab to a sideslip before touchdown.

18. It’s important to learn how to land without the use of flaps – for example, if you encounter a strong wind situation or a flap lowering problem.
19. Fly the pattern as before. On final, without flaps, the stalling speed will be higher and the descent angle will be flatter, so you need a faster approach speed. You can also expect a longer landing roll.
20. If you are too high, rather than use flaps, use a forward slip. In a forward slip the airplane is pointed at an angle to its flight path. This is unlike in the sideslip in which the airplane is pointed down the runway.
21. The forward slip turns the airplane's fuselage into the relative wind, creating a high drag, which produces a high rate of descent.
22. Lower a wing to one side or the other, yaw the nose of the airplane in the opposite direction through the use of opposite rudder. Raise the nose a little to control airspeed. Close to the ground, level the wings and head the airplane down the runway.
23. If there is a crosswind you will have to transition into a sideslip before your wheels touchdown.
24. If you are low on final approach, apply power and raise the nose to increase lift and stop the descent. When back on the proper approach path, set up the necessary attitude and adjust power to hold it.
25. If you get too slow on the approach, add power to increase lift and reduce the sink rate.
26. If the landing is in doubt, go around for another approach.
27. To go around, add full power, change the airplane's pitch attitude to slow or stop the rate of descent, and retract the flaps per manufacturer’s guidelines.
28. If you retract the flaps suddenly at low airspeed, you might lose so much lift that you would settle onto the ground.
29. Usually, it's best to raise the flaps slowly in small increments to allow time for the airplane to accelerate as the flaps are being retracted.
30. If you round-out too high, stop the round-out by slightly releasing elevator back pressure and hold the pitch attitude constant. Then, let the airplane slow to the point where it begins to descend. You might also have to add some power to keep from losing lift and airspeed too rapidly. Now, set up the proper attitude and land.
31. If you make a late or rapid round-out, you run the risk of an accelerated stall and a hard landing. In this situation, promptly add power and land normally if enough runway is left. If not, go around.
32. If you are too high and fast, don’t dive and try to land the airplane on a specific spot. Excessive speed will cause you to float.
33. If you approach with a too high of a sink rate, when the airplane touches down, it will bounce back into the air. If the bounce is slight, and no big pitch change is needed, correct by adding enough power to cushion the next touchdown and, at the same time, adjust the pitch to the proper landing attitude. If severe, go around.

Nontowered Airport Communications

Private Pilot Chapter 2 – Video Segment 14

This segment covers procedures for operating into and out of a non-tower airport. This type of airport will be found in Class G or Class E airspace.

Review:

1. Don't forget, radio communications are not mandatory at this type of airport. Proper reporting makes your operations safer, but there may be pilots flying without a radio.
2. Maintain an active visual scan for other aircraft and always fly a standard traffic pattern even if you don't hear anything on the radio.
3. When approaching a non-tower field, you should determine the active runway.
4. Check out the local weather. Many non-tower airports in the U.S. have automated weather information available to the pilot. You can locate the frequency in the Chart Supplement, on your sectional, or in your GPS. The wind report may give you an idea of which runway is in use.
5. The weather reporting system will typically update the message on a minute by minute basis. If the weather is changing, the broadcast will be updated quickly.
6. The system may also have a provision for the airport operator to record NOTAMs that directly affect the airport. This can also be used for weather information that may not be easily discernible by the automated system.
7. The CTAF frequency can be found the same way as the weather frequency. Listen to it for a few minutes to determine what other pilots are doing in the area.
8. CTAF is an acronym for Common Traffic Advisory Frequency. It allows pilots to communicate their intentions in the environment of a non-towered airport.
9. At many airports, CTAF and UNICOM are the same frequency. The CTAF frequency on the sectional is indicated by a circle with a "C" in the center.
10. To give an advisory of your intention and position, call on CTAF by starting your communication with "Georgetown traffic." If you want information regarding the airport and its environment, call on the UNICOM frequency with the phrase, "Georgetown UNICOM."
11. The CTAF frequency is not for casual chatter between the pilots of different aircraft or personnel on the ground. Non-essential communication on this frequency may block an important radio call that is critical to someone's safety.
12. You should not transmit the phrase "Traffic in the area, please advise" to determine the active runway. This will only tend to clog the frequency without serving the intended purpose. Listening is much more effective.
13. If the airport doesn't have a weather reporting station and no communications are heard on CTAF, call UNICOM for a landing advisory.
14. If you know the active runway without the call to UNICOM, make your initial call on the CTAF frequency about ten miles out.

15. Adding the name of the airport at the end of the transmission is optional but can be useful for advising others in the area where you are located. CTAF frequencies are used for multiple airports and this can be confusing.
16. Shortened call signs are acceptable provided that your aircraft won't be confused with another on the frequency.
17. Departure from a non-towered field begins on the ramp. Listen to the automated weather broadcast if available to determine the winds and potential active. Listen to the local CTAF frequency to ascertain what other aircraft in the vicinity of the airport are doing.
18. The transponder is a useful communication device. It provides your aircraft with a higher degree of safety in an increasingly complex environment.
19. Monitor the CTAF frequency during your taxi to the active runway but recognize that not all airport users may be using a radio. Keep your eyes open.
20. Scan the area for traffic before announcing your departure. If all is clear, complete your lineup checks, including turning your transponder to altitude, announce your departure, scan the area again, and taxi onto the runway.
21. "Position and hold" or "lineup and wait" should not be used at a non-towered airport.
22. "Closed traffic" would indicate that you plan to remain in the traffic pattern at the Clermont County airport. After takeoff, you would call your turn to crosswind and successive legs as before.
23. There are only two standard traffic pattern departures for non-towered airports: Straight-out and a forty-five degree turn in the direction of the pattern.
24. Using a standard departure helps to improve safety at this type of air field.
25. Your ultimate direction of flight should be included in your departure call.
26. Correct communication is safety insurance. Adhering to the proper communication protocol, tells everyone you are a knowledgeable and professional pilot - a good example to all around you.

Wake Turbulence Avoidance

Private Pilot Chapter 2 – Video Segment 15

1. Another hazardous situation to avoid on takeoff and landing is wake turbulence. This invisible turbulence is caused by a pair of counter rotating vortices behind an airplane's wingtips, generated whenever a wing is developing lift.
2. Their strength is determined by the wing's shape, speed, and weight of the airplane. They are strongest behind large, slow airplanes that are taking off or landing.
3. Avoid flying behind and below a large airplane. When taking off behind a large airplane, watch where it rotates and takeoff before that point. Climb above the large plane's climb path until you can turn away.
4. Know that vortices drift so be careful around any large aircraft.
5. Landing on the same runway, stay above the large airplane's flight path, watch where it touches down, and land beyond that point.
6. If you are landing behind a large departing airplane on the same runway, note where it rotates and land before that point.
7. Allow at least three minutes to elapse before taking off or landing behind a large airplane to allow the turbulence to subside.
8. If you are en route, under visual flight rules, avoid flight below and behind a large airplane's flight path.

Chapter 3 – Your First Solo

Pre-Solo Maneuvers

Private Pilot Chapter 3 – Video Segment 1

In this section we will discuss S-turns Across A Road and Turns Around A Point, as well as the techniques to do them successfully. Their objective is to maintain a prescribed ground track while in turning flight.

Review:

1. S-turns across a road and turns around a point require changing the bank and the crab to maintain the desired ground track.
2. A constant bank turn makes a circle in the air, but wind drift will affect the ground track. To make a uniform circle on the ground, you must vary the bank angle and crab to compensate for the wind.
3. Before beginning s-turns across a road, practice doing a 360 degree circle using bank angle and crab to correct for wind drift.
4. Center the circle on some point on the ground. Start the turn directly downwind. To compensate for the faster groundspeed, you'll need a steep bank here. Turning from the direct tailwind, the bank will be lessened progressively until you are upwind where the wings are almost level. As the turn continues, the bank increases to its steepest point when it is headed downwind.
5. In s-turns across a road, the airplane makes semi circles of equal size on each side of a straight line on the ground. This line should be at a right angle to the wind. Roads, railroad tracks, or fence lines can be used.
6. Start the maneuver at a right angle to the road. Begin a 180 degree turn and trace a uniform semi- circle over the ground. Coming back over the road, your wings should be level. Now turn in the opposite direction and trace an identical semi circle on the other side. The maneuver is finished when the airplane is again wings level over the road.
7. Try to start the maneuver downwind, wings level, crossing the road so your first bank is the steepest. As the semi-circle continues, the bank is lessened. When crosswind, a crab is utilized to correct for the wind.
8. At the midpoint, pick a spot to cross the road in order to keep the semi circle uniform. From the midpoint on, bank and crab are decreased, so that when crossing the road wings level, the airplane is headed at a right angle.
9. Now, pick the spot where you want the airplane to be halfway around the upwind semi circle. The moment the road is crossed start a turn in the opposite direction. With a direct headwind the bank will be shallowest. As the wind changes from headwind to crosswind, start to steepen the bank.

10. Halfway around the upwind semi circle, the airplane has turned less than 90 degrees and has the maximum crab into the wind. Pick the spot where you want to cross the road. As the wind becomes a tailwind, steepen the bank to finish the 180 degrees of turn over the road.
11. In doing turns around a point you're putting the two halves of the s-turn together to trace a full circle on the ground.
12. The maneuver consists in making two or more complete circles at a constant altitude, while maintaining a constant distance from a point on the ground.
13. The point you choose should be prominent. A fence line, intersection, or the center of a crossroads is ideal because you can easily project ahead every 90 degrees.
14. The bank should not exceed 45 degrees, so start on a downwind heading where groundspeed is highest and maximum bank is necessary.
15. The bank and crab control is the same as used in s-turns.
16. Your second turn is a repetition of the first. It gives you the chance to correct errors and fine tune the maneuver.

Closer Look: International Flight Training

Private Pilot Chapter 3 – Video Segment 2

In this section we will meet Sophie Gilgean. Sophie is a Belgian citizen who came to the United States and enrolled in the University of Cincinnati's professional pilot program after getting her private license in Belgium.

Review:

1. The cost to learn to fly in Europe is considerably more expensive and you may often be flying older aircraft that are much more expensive than better equipped, more modern aircraft in the US.
2. They have other costs as well that you don't have here in the U.S.
3. You pay a landing fee every time you land on a field or do a touch and go.
4. You also pay for any IFR flight plan under instrument conditions, and you have to pay for any instrument approach that you make.
5. Because the European countries can be small, planning cross-country flights can also be a challenge.

Steep Turns

Private Pilot Chapter 3 – Video Segment 3

In this section we will discuss steep turns made at a constant bank. These are turns with a bank of 45 degrees or more.

Review:

1. First of all we'll look at Newton's first law – a body in motion will continue in motion at the same speed and direction until an outside force is applied to that body.
2. Any force applied to an airplane, to deflect it from straight flight, will produce a stress on the airplane's structure.
3. At rest, gravity exerts a force equal to the weight of the airplane. Gravity is expressed in Gs and on the earth's surface the force on an at-rest airplane is 1G.
4. Aerodynamic stress on the airplane is called load factor. A load factor of two is called two Gs.
5. Airplanes are certified and categorized according to the intended use of the airplane. The categories we are concerned with are: normal, utility, and acrobatic. Normal category airplanes are intended for non acrobatic flight, while utility category airplanes may be used for limited acrobatics.
6. The maneuvering limit load factor for a normal category airplane is 3.8 positive and 1.52 negative Gs, utility category is 4.4 positive and 1.76 negative and acrobatic category, 6 positive and 3 negative.
7. Actually, airplane structures must be capable of sustaining loads one and one half times these limit load factors to account for unexpected conditions.
8. Bank determines the load factor on any airplane during a constant altitude turn and is the result of centrifugal force and gravity.
9. A bank of sixty degrees has a load factor of two Gs. You will also weigh twice your weight at two Gs.
10. As the Gs increase so does stall speed.
11. In a steep bank turn, a reduction in back pressure reduces the load factor, but the airplane will descend. To reduce the load factor and maintain altitude, reduce the bank.
12. The speed at which an airplane stalls before exceeding the design limit load is called maneuvering speed. Maneuvering speed changes depending on the weight of the airplane.
13. Maneuvering speed should not be exceeded in rough air or when making full or abrupt control movements.
14. Steep turns call for orientation, power control, and rapid application of smooth and varying control pressures.
15. To maintain altitude you must use a higher pitch attitude and more power to compensate for the added drag.

16. Do your steep turn for 360 degrees and start on one of the cardinal points of the compass. Pick a prominent point, like a road or other landmark, to help you judge the completion of the turn. Use a 45 degree bank, and maintain altitude within 100 feet.
17. After 30 degrees, increase power as necessary, and increase back elevator pressure.
18. Don't stare at any one thing. Cross-check the attitude indicator with the nose, wings, horizon, altimeter, and reference point as you turn.
19. If you are losing altitude, don't correct with back pressure only. This will tighten the turn. Shallow the bank by 5 or 10 degrees, and then increase the pitch attitude. Return to the 45 degree bank after the airplane is back to the starting altitude.
20. If the airplane is climbing, you can make a slight increase in the bank or a small decrease in back pressure.
21. You may need to hold some aileron pressure against the turn to keep the bank from increasing.
22. You will probably need a slight amount of right rudder pressure during a steep turn, and even more right rudder pressure to enter one to the right.
23. When the airplane's heading is within 25 to 35 degrees of the reference point, apply opposite aileron and rudder pressure to roll out of the turn, relaxing back elevator pressure and reducing power to the level flight setting.

Closer Look: Touch and Go

Private Pilot Chapter 3 – Video Segment 4

In this section we will discuss the touch and go. That is, on landing, while still rolling, you will put the airplane in its takeoff configuration and takeoff without stopping.

Review:

1. Touch and go's are a way to practice takeoffs and landings without the added time used to pull off the runway and taxi back to the departure end.
2. The touch and go should not be taken lightly as there are a variety of items to adjust such as flaps and trim while still maintaining primary focus on controlling the airplane.
3. Another version of the touch and go is called a "stop and go." The airplane is brought to a full stop on the runway before again taking off.
4. At a tower controlled field, ask for a touch and go or a stop and go from the tower by requesting the "option." For example, "Lunken tower, Cessna 3-7-7-Echo Sierra, request the option, 2-1- left."
5. At a nontowered field announce your intentions. For example, "Clermont County traffic, Cessna niner five one seven Sierra is downwind, runway 4, touch and go, Clermont."

Emergencies

Private Pilot Chapter 3 – Video Segment 5

In this section we discuss emergencies. Pilots need to recognize the possibility that emergencies can occur and be prepared.

Review:

1. The regulations state that in an emergency the pilot may deviate from any rule to the extent required to meet that emergency.
2. For example, if the engine fails on takeoff, don't turn back to the runway. Your chances of making a 180 degree turn with a dead engine while in a climbing attitude at a slow airspeed, are not good. Instead, get the nose down quickly, maintain flying speed, and make the best landing you can under the circumstances.
3. If you have a partial power failure on takeoff, fly straight ahead and try to gain some altitude. Keep all turns shallow and gradually turn back to the airport. Once back in the pattern, keep the power on until you are sure you can land normally.
4. Your instructor will simulate engine failures at cruise altitude. Your first concern should be to fly the airplane and establish the best glide speed. Look for a suitable landing field. The goal is to complete a safe landing in the largest and best field available.
5. If you have enough altitude, you can spiral down and try to enter a downwind leg as normal. If you are lower than 1,000 feet, set up the best approach you can under the circumstances.
6. Follow the emergency landing checklist for your airplane. For example, establish best glide speed, check that the fuel shutoff valve is ON, set the fuel selector valve on BOTH, turn the auxiliary fuel pump ON, mixture to RICH if restart has not occurred, ignition switch to BOTH, or START, if the propeller is stopped.
7. If power is not restored, prepare for a power off landing – seat backs upright, seats and seat belts secure, mixture idle cutoff, fuel shutoff valve OFF, ignition OFF, flaps as required, approach speed as required, master switch OFF when landing is assured, and unlatch the doors prior to touchdown.
8. Once you select a field, try and stick with it and never try to stretch a glide. Discontinue the exercise when it's apparent you can make the field.
9. Instrument failure is also a cause of emergencies. To simulate an instrument emergency in the pattern, your instructor may cover the airspeed indicator or altimeter. With the proper pitch and power combination you can land quite nicely without an airspeed reference.

Air Facts: Emergencies

Private Pilot Chapter 3 – Video Segment 6

In an emergency, try to use the radio and announce your problem. However, it's up to you to safely handle the emergency.

Review:

1. Rule number one, stay as calm as possible – panic will only make things worse.
2. If the situation is critical, like in the case of an engine fire, recall the memory items from the checklist and accomplish those without delay.
3. Once the memory items are completed, assess the situation and focus on flying the airplane. Grab the emergency checklist and complete every item on the list to help remedy the situation.
4. You will be able to stay composed if you know what to do in each type of emergency.
5. Since most emergencies are preceded by a warning of some kind, stay alert and act on the information as soon as possible. By doing this, you will short circuit most true emergencies.

Fog & Atmospheric Pressure

Private Pilot Chapter 3 – Video Segment 7

In this section we begin the study of weather. As a pilot you must learn to recognize, respect, and refrain from flying near marginal or hazardous weather.

Review:

1. Weather occurring on the ground may not be what's happening higher up.
2. Clouds can be good indicators of the type of weather going on. Clouds are the visible collection of minute ice or water particles suspended in the air. There are many types of clouds.
3. Clouds are either in layers or piled up vertically.
4. Layered clouds are called stratus, and indicate stable conditions – expect a relatively smooth flight, with fair to poor visibility. If there is precipitation, it's usually widespread, light to moderate rain or snow. Layer clouds found on the surface are classified as fog.
5. Cumulus clouds are those with vertical development. A cumulonimbus cloud is a cumulus cloud which is producing precipitation – expect a bumpy flight with good crisp visibility. Rain or snow is usually heavy and localized. They indicate that the air is unstable, thus the bumpy ride.
6. The earth has an atmosphere around it. The first layer of the atmosphere is the troposphere, extending from the surface to approximately 40,000 feet. At the top of the troposphere, the tropopause marks the boundary between the troposphere and the stratosphere.
7. In an inversion, the temperature increases with altitude and results in a stable atmosphere. Inversions cause low visibilities by trapping fog, smoke, dust, and other pollutants close to the surface.
8. Two moisture related weather conditions are fog and thunderstorms.
9. Evaporation, condensation, sublimation, deposition, freezing, or melting change water from vapor to liquid to ice or back the other way.
10. Condensation is the process which makes invisible water vapor appear as clouds or liquid drops.
11. The amount of water vapor in the air is largely dependent upon the air's temperature. Cold air contains less water vapor, warm air more.
12. Relative humidity is the relationship between the amount of water vapor in the air in comparison to the maximum amount that could exist at that temperature.
13. The temperature at which relative humidity reaches one hundred percent is called the dew point. At the dew point, air becomes saturated with water vapor.
14. If the temperature and dew point get within three degrees or less of each other, clouds or fog, may form.
15. Fog is formed by either the addition of moisture to the air, or cooling the air to the dew point, or a combination of the two working together.

16. Radiation fog, called ground fog, forms on a clear, cold night when the surface of the earth is cooled by radiation until the temperature of the air near the surface is below initial dew point. Cooling of the air causes fog to form. Light winds deepen the fog while stronger winds tend to disperse it.
17. Advection fog, sometimes called sea fog, occurs mostly along coasts and is caused by wind transporting warm moist air to a colder surface. Winter advection fog, caused by strong southerly winds off the Gulf of Mexico, may cover the eastern U.S – as far north as the Great Lakes. Light to moderate winds deepen the fog while strong winds lift the fog forming low stratus clouds.
18. Upslope fog is caused by wind forcing moist stable air up a sloping land surface. Moist unstable air forced upward by mountain lift, called orographic lift, will form cumulus clouds instead of fog.
19. Precipitation induced fog is caused by the evaporation of rain or drizzle. It can form rapidly over a large area and persist for an extended period.
20. Ice fog forms in conditions similar to the conditions favorable for radiation fog, with the difference being that extremely cold temperatures exist.
21. Calm or light winds are favorable for fog formation. Higher wind speeds tend to mix the air and prevent its cooling to the dew point. Fog is apt to form when the temperature-dew point spread is small. Dense fog is more likely in urban industrial areas than in rural areas since condensation nuclei are typically more abundant there. Finally, be alert for cooling processes, such as onshore winds at night, radiational cooling of land during clear nights, or upslope winds.
22. At sea level on an average day, the atmosphere exerts a force of 14.7 pounds per square inch. At 18,000 feet, the pressure is approximately one half, or 7.32 pounds per square inch.
23. The term standard day is defined as one in which the temperature is 59 degrees Fahrenheit and the atmospheric pressure, at sea level, is 29.92 inches of mercury. From there, temperature and pressure decrease at a standard rate as you go upward in the atmosphere.
24. The altimeter measures the change in atmospheric pressure and reads it out in feet of altitude. Atmospheric pressure drops approximately 1 inch of mercury for every 1,000 feet of altitude below 10,000 feet. Therefore, it's important to reset the altimeter periodically as you fly to keep it accurate.
25. Temperature affects the altimeter because the atmosphere expands and contracts with changes in temperature. Cold temperatures make the atmosphere contract. Remember, "High temperatures to low, look out below." Look out below because the aircraft is lower than the altimeter indicates.
26. The reverse of high to low is also true. If you fly from a low pressure to a high pressure area without resetting the altimeter, you will have the aircraft higher than the altimeter indicates.
27. Flying from cold to high temperatures will also put the aircraft higher than the altimeter indicates. Remember, "Low temperature to high, look to the sky".

Closer Look: Atmospheric Pressure

Private Pilot Chapter 3 – Video Segment 8

In this section we'll use an example to illustrate that pressure decreases as you fly higher. The gasses in the air become less tightly packed at higher altitudes, and therefore exert less pressure.

Review:

1. The higher up you go, the less dense the atmosphere becomes.
2. As an example, blow up a balloon part way on the ground and put it in an airplane. As the airplane climbs, the balloon will expand because the air pressure decreases with altitude.
3. As the airplane descends, the balloon will contract because more of the atmosphere is pushing in on it.
4. We have essentially made a crude altimeter.
5. This also illustrates why there is less air available for the airplane's engine to use higher up. The engine ingests air by volume, so even though the volume of the air going into the engine is the same, there are physically fewer air molecules contained in each volume.

The Pitot Static System

Private Pilot Chapter 3 – Video Segment 9

The pitot-static system drives the airspeed indicator, altimeter, and vertical speed indicator. As a pilot, it's important to understand how this system works.

Review:

1. The airspeed indicator is an extremely sensitive pressure gauge. It measures the difference between impact pressure measured at the pitot tube, and static pressure, sampled by the static source, which is the undisturbed atmospheric pressure.
2. There are three kinds of airspeeds: Indicated Airspeed, the airspeed read directly from the indicator. Calibrated Airspeed is indicated airspeed corrected for errors. At normal cruise speeds there usually is very little difference between indicated and calibrated airspeed. True Airspeed, which corrects calibrated airspeed for variations in air density.
3. As altitude increases, the air density decreases, and the ram or impact pressure in the airspeed indicator decreases.
4. The airspeed indicator has color markings. The green arc shows the normal operating range. The low airspeed end of the green arc indicates the stalling speed power off, flaps up, at maximum certificated weight. The upper limit of the green arc is the maximum structural cruising speed.
5. The yellow arc represents speeds that should only be flown in smooth air. The red radial line marks the never exceed speed. The white arc is the full flap operating range, with the upper limit the maximum speed for full flaps extended. The lower limit is the power off stalling speed at maximum certificated landing weight with flaps extended.
6. Maneuvering speed is not marked on the airspeed indicator. If rough air or turbulence is encountered, the airplane should be slowed to maneuvering speed to minimize the stress on the airplane.
7. The altimeter is an aneroid barometer which measures atmospheric pressure and gives an altitude indication in feet.
8. Because atmospheric pressure is constantly changing, the altimeter indications will be correct only if the instrument has been set to the current atmospheric pressure.
9. If the altimeter setting is increased, the altitude indicated will also increase and vice versa. Changing the altimeter setting one inch of mercury will change the indicated altitude about 1,000 feet.
10. There are different types of altitude. Indicated Altitude is read directly off the altimeter when it is set to the current altimeter setting. Pressure Altitude is read when the altimeter is set to 29.92. Pressure altitude is used to solve calculator problems of true airspeed and density altitude. Density Altitude is pressure altitude corrected for non-standard temperature.
11. If the temperature is warmer than standard, density altitude will be higher than pressure altitude. Temperatures colder than standard, will make the density altitude lower than

pressure altitude. Density altitude must be known to calculate takeoff, climb, and landing performance.

12. Absolute altitude is the actual height above the terrain and is constantly changing.
13. True altitude is the true vertical distance above mean sea level. On aeronautical charts, the airport, terrain, and obstruction heights shown are true altitudes. Unless there is an extreme variation from standard temperature, indicated altitude is reasonably close to true altitude.
14. The vertical speed indicator works from the static system. It measures the rate of change in pressure, giving a readout in feet per minute of climb or descent. It has a 6 to 9 second lag in its indications.
15. If the exterior static source becomes blocked, the pitot-static system can be returned to operation by selecting the alternate static source, venting the system to the cabin.

Closer Look: Pilot’s Operating Handbook

Private Pilot Chapter 3 – Video Segment 10

The Pilot's Operating Handbook is an important tool for your safe flying. It's a required item to keep on board when flying. All the important data you need regarding your airplane is in this book.

Review:

1. Most modern operating handbooks are published in a standardized format common to all aircraft manufacturers, and outline the pertinent information specific to that airplane.
2. It covers areas like aircraft performance, electrical failure in flight, and a complete emergency procedures section with appropriate checklists.
3. There are two types of handbooks, the official one that's in the airplane, and a generic one.
4. Student pilots and renters usually obtain a generic copy of an aircraft information manual for flight planning and study. The official POH should remain in the aircraft.

METARs and the Weather Depiction Chart

Private Pilot Chapter 3 – Video Segment 11

In this section you will learn how to read and interpret METARs, which are hourly reports of airport weather conditions.

Review:

1. Reports are conditions in the atmosphere observed at a specific time. Always take into account the time the observation was made because weather changes.
2. The weather depiction chart gives a big picture overview of weather conditions. It shows areas of adverse weather, areas of good weather, and the fronts associated with the weather.
3. Areas where the weather conditions were reported as instrument flight rules (IFR) are shown by shading inside the contours. This occurs whenever the ceiling is less than 1000 feet and/or the surface visibility is less than 3 statute miles or both. Marginal visual flight rules (MVFR) is shown in areas without shading. VFR exists anywhere outside the contours.
4. The ceiling is always the lowest layer of clouds that covers more than half of the sky. If there is a ceiling, at least 3 quarters of the station circle is filled in. For more on the weather depiction chart, review the symbology of a station model.
5. A METAR is an hourly report of actual weather existing at an airport. If the weather changes in a way not reported in the original METAR, and before the next scheduled METAR, a special METAR is issued. It's called a SPECI. To be able to understand the METAR, review the abbreviations used. A translated version can be obtained as well.

Terminal Aerodrome Forecasts (TAF)

Private Pilot Chapter 3 – Video Segment 12

In this section you will learn how to read and interpret a TAF, which is a 24 or 30 hour weather forecast issued for specific airports.

Review:

1. In general, a short range forecast is more accurate than a long range forecast. A newer forecast is more accurate than an older forecast. A forecast of good weather, generally, is more accurate than a forecast of bad weather.
2. Pilots must carefully analyze a forecast to make a sound decision. To do this, check the present weather against the weather that was forecast for the same time period. Be suspicious of any forecast that varies greatly from the current weather conditions.
3. The area forecast is a prediction of general weather conditions for an area the size of several states. It's used mostly to check en route weather.
4. At this point in your flight training, the most useful forecast is the Terminal Aerodrome Forecast (TAF), because it's specific to an airport.
5. TAFs cover wind, visibility, weather phenomena, obstructions to vision, and cloud coverage expected during specific periods during the day.
6. TAFs are a detailed twenty-four or thirty hour forecast of weather conditions expected to occur within a five mile radius of a specific airport. TAFs are issued four times daily, 0000z, 0600z, 1200z, and 1800z and amended as necessary.
7. TAFs are written much like the METAR. Review the abbreviations used in the TAF. The TAF can be obtained in a translated version.
8. If a TAF is issued internationally or by a U-S military base, it may have some differences.

Closer Look: Get the Big Picture

Private Pilot Chapter 3 – Video Segment 13

Aviation and weather go hand-in-hand so you must always focus on a quality weather briefing to make your flights safer.

Review:

1. Many pilots base the go/no go decision on little more than the latest radar image and some METAR reports. While these are important, a good weather briefing goes much deeper than this.
2. A good weather briefing must include an understanding of weather systems and fronts.
3. Lows are responsible for more bad weather than anything else, from low ceilings to in-flight icing.
4. Get an idea of how weather systems and fronts are developing and moving to anticipate weather conditions.
5. This big picture weather briefing doesn't have to be time-consuming–in spite of what some flight instructors might say,
6. A thorough understanding of the big picture can lead to easier go/no go decisions, fewer surprises en route and more comfortable flights.

Introduction to Glass Cockpit Systems

Private Pilot Chapter 3 – Video Segment 14

Most new aircraft manufactured today are equipped with digital flight instrumentation, commonly referred to as a glass cockpit. This section explores the most common system, the Garmin G1000, and the various components that allow it to function.

Review:

1. The screen on the left in front of the pilot is called the primary flight display (PFD) and depicts your flight instruments.
2. The screen on the right is the multi function display (MFD), and depicts GPS, engine instruments, moving maps and other operational information.
3. There are a number of "boxes", called line replaceable units (LRU) that control the various aspects of the G1000’s operation.
4. An air data computer (ADC) processes information from the pitot/static system and the outside air temperature probe. This unit computes pressure altitude, airspeed, vertical speed, and OAT for display on the G1000.
5. Replacing the traditional gyros, is a solid-state unit called the AHRS, standing for attitude and heading reference system. As the name implies, this computes aircraft attitude and heading information using advanced sensors, accelerometers, and rate sensors.
6. An engine monitoring unit receives and processes signals from the engine and airframe sensors, providing digital readouts on the displays of all traditional engine instrumentation.
7. The controls on the bezels are comprised of knobs, buttons, and softkeys and are identically positioned on both the PFD and the MFD.
8. The twelve softkeys along the bottom of the bezel have various jobs depending on the system's operating mode. the same key could have different names and functions.

Runway Safety

Private Pilot Chapter 3 – Video Segment 15

A runway incursion is when someone taxies onto a runway when they should not have done so – causing a real safety problem.

Review:

1. When an airport has a control tower, you will receive a taxi clearance for departure, and a clearance to a runway along a specified route on the airport.
2. If the controller instructs you to hold short of another runway, that instruction should be read back and heeded.
3. Hold short markings for a runway are comprised of a solid line and a dashed line. You hold short of the solid line. The dashed line is toward the active side.
4. If there is any doubt, question the controller before you taxi past any yellow lines perpendicular to your path or onto any runway.
5. Taxiway and hold short markings are all in yellow.
6. There are runway holding position signs, with a red background, located at the holding position on taxiways that intersect a runway or on runways that intersect other runways, or at the departure and approach ends of the runway.
7. After landing, you are not considered clear of the active runway until your airplane is clear of the runway hold short markings on the taxiway side.
8. At a nontowered airport, there may or may not be markings. Don't taxi onto a runway until you are 100 percent positive that the runway, and its approach is clear.
9. Use the common traffic advisory frequency, CTAF, to listen for other aircraft and to announce your location and intentions. Always look for other airplanes. Sometimes a pilot may be landing the wrong direction.
10. Taxiways at large airports are identified by letters on yellow and black signs. There are also yellow stripes down the center of the taxiway. If you are unfamiliar with an airport, ask for progressive taxi instructions.
11. When told to taxi into position and hold, stay at a bit of an angle to the runway so that you can look back over your shoulder at the final approach area.
12. Always check your compass against the number painted on the runway before takeoff.
13. It's up to the controller to issue correct instructions and up to the pilot to follow those instructions.

Closer Look: Phonetic Alphabet

Private Pilot Chapter 3 – Video Segment 16

In this section, we investigate the use of the phonetic alphabet.

Review:

1. Aviation has its own version of the English language. Part of this is due to the use of the phonetic alphabet when speaking letters.
2. For instance, Skylane 6-1-6-7-L, is spoken six, one, six, seven, lima. The “Lima”, spoken for the letter "L", is just one of 26 phonetic alphabet letters.
3. The letters b, c, d, and e all have the same general sound. They are pronounced, bravo, charlie, delta, echo. The purpose is because several letters may sound very similar when spoken over a scratchy radio in a noisy cockpit.
4. Nine is spoken niner because it can sound a lot like five.

Thunderstorms and Convective Forecasts

Private Pilot Chapter 3 – Video Segment 17

Thunderstorms are always to be respected and avoided. Thunderstorms will cause damage to airplanes and its occupants.

Review:

1. Three conditions are required to create a thunderstorm: unstable air, high moisture content, and a source of lift.
2. Thunderstorms have a life cycle consisting of three stages: they start as cumulus clouds and consist entirely of updrafts. The mature stage begins when the first precipitation falls from the cloud and is characterized by both updrafts and downdrafts. In the mature stage, downdrafts grow in size and occupy the entire cell, and the thunderstorm starts to dissipate.
3. As a note, steady state thunderstorms, which are along fronts and in pre-frontal squall lines, continually regenerate and are in all three stages simultaneously.
4. Hazardous turbulence is present in all thunderstorms, with the strongest turbulence in the shear where updrafts and downdrafts meet. It can occur up to 20 miles from the thunderstorm.
5. Downdrafts in a thunderstorm may exceed the climb performance of general aviation airplanes.
6. As a hazard to aircraft, hail can be deadly.
7. Hailstones are caused by ice particles making many trips in updrafts and downdrafts. They grow larger on each trip through the levels, picking up large amounts of liquid water.
8. Lightning can cause temporary blindness, puncture the skin of the aircraft, and damage avionics. It is always present in a thunderstorm.

Radar Imagery

Private Pilot Chapter 3 – Video Segment 18

In this section we will discuss how weather radar functions and how pilots can use that information for improved flight planning and hazardous weather avoidance.

Review:

1. Areas of precipitation may bring reduced visibility and low ceilings. You may also find other adverse weather conditions such as thunderstorms, turbulence, icing and mountain obscuration.
2. Radars transmit microwave signals into the atmosphere and then listen for return signals, or echoes.
3. Most providers use the same NEXRAD data and have similar presentations.
4. Each color on the radar map corresponds to a different level of reflectivity. Blue and light green are light precipitation; yellow and orange are moderate; red is heavy; and magenta is extreme.
5. The gradient describes how quickly the colors move from green to red. A shallow gradient, where the distance between light and moderate echoes is large, often indicates a less severe cell. In contrast, a steep gradient, where the echoes quickly go from green to yellow to red, means a serious storm is developing.
6. Typically, higher echo tops correspond to convective weather and strong updrafts.
7. Cell movement is a useful guide to how a weather system or thunderstorm is developing. One way to view cell movement is to animate the radar image, which will show the last 5-10 radar images in order.

Drag

Private Pilot Chapter 3 – Video Segment 19

Aerodynamics is the branch of mechanics dealing with forces exerted by air in motion. In this section we will investigate drag – one of the four forces acting on an airplane.

Review:

1. Drag is produced by moving the airplane through the air, and is considered to act parallel to the relative wind and rearward. Drag has two components, induced drag and parasite drag.
2. Induced drag is caused by generating lift, and parasite drag is caused by the airplane's movement through the air.
3. At relatively low subsonic speeds, form drag increases approximately as the square of the speed. If airspeed is doubled, and other factors are not changed, the form drag quadruples.
4. Skin friction drag can be somewhat reduced by flush riveting, smooth paint, and waxing.
5. Another part of parasite drag is interference drag caused by the intersection of different parts of the airplane, especially the wings and the fuselage.
6. Induced drag is a byproduct of lift.
7. The wingtip vortex consists of an upward flow beyond the wingtip, and a downwash behind the trailing edge of the wing. This induced downwash is the source of induced drag and is not the same as the downwash needed to produce lift.
8. Induced drag becomes larger as the angle of attack is increased.
9. A way to minimize induced drag is to make the wings longer, like on a sailplane. Airplane designers call the ratio of the wing chord to wing length aspect ratio.
10. As one of the four forces acting on an airplane, drag is an important factor not only for speed, but also for fuel consumption, landing distance, and takeoff performance.
11. Flaps, and forward slips, cause a great amount of drag.

Closer Look: Reducing Drag

Private Pilot Chapter 3 – Video Segment 20

In this section, we investigate ways that various types of airplanes reduce drag.

Review:

1. Today's high-performance airplanes need more than just big engines to deliver top end speed. The exterior must also be aerodynamically clean and create as little drag as possible.
2. One of the best known aerial speedsters is the Cessna Citation Ten.
3. Laminar flow swept wings provide high-speed performance high into the flight levels. The winglets reduce wingtip vortices to minimize induced drag and most forward facing surfaces, such as the wind shield, are swept back. The exterior surfaces are smooth to the touch, without any evidence of raised screws or rivets.
4. Closer to home, Cirrus aircraft are known to be aerodynamically efficient and have a reputation for being some of the most modern single-engine production airplanes available.
5. Cirrus has gone to great lengths to reduce drag everywhere possible in the design, starting with an advanced composite construction. The thin laminar flow wing significantly reduces skin-friction drag, while winglets located at the tips reduce wingtip vortices and associated induced drag. Gap seals around the ailerons aim to further reduce form drag on the wing.
6. The front of the Cirrus is just as sleek, with a curved cowl designed around the engine and air inlets, plexiglass cover over the landing light and swept back windshield. Each wheel is covered with a teardrop-shaped fairing to further reduce form drag caused by the fixed landing gear.
7. Now that you know what to look for, check around the airport for other examples of drag reduction on various makes and models of airplanes.

Thrust, Stability & Center of Gravity

Private Pilot Chapter 3 – Video Segment 21

In this section, we investigate thrust, stability of the airplane, and its center of gravity.

Review:

1. Thrust is a force just as lift, drag, and weight are forces. The strength of a force is measured in pounds. A force applied over a distance, is called work. The amount of work performed over a period of time is called power.
2. Thrust is greatest as the airplane starts moving and reduces as it accelerates until thrust is equal to drag and airspeed becomes steady.
3. In level flight, if thrust exceeds drag, speed will increase. Conversely, speed will decrease if drag is greater than thrust.
4. Weight opposes lift. The weight of the airplane includes, crew, passengers, fuel, and baggage. Weight acts at the center of gravity – the point where the airplane would balance.
5. Stability is the quality of an airplane to automatically return to its original flight attitude after being disturbed by an outside force.
6. Too much stability makes the airplane less maneuverable. Not enough stability makes the airplane difficult to control. The pilot affects stability by the way the airplane is loaded.
7. The center of gravity of most airplanes is positioned slightly in front of the center of lift, making the airplane nose heavy. This will help the airplane recover from a stall.
8. To balance the nose heaviness, there is a down force on the tail. This is the result of propeller slipstream, down wash from the wing, and the angle at which the stabilizer meets the relative wind. Therefore, lift equals weight in steady unaccelerated flight.
9. Lateral or roll stability is usually achieved by dihedral. Positive dihedral occurs when the wing tips are somewhat higher than the wing root.
10. In a bank, the lowered wing has a higher angle of attack and produces more lift because of dihedral. This will return the airplane to a wings level position.
11. Another aspect of weight and balance theory is yaw or vertical axis stability. It's a function of the side area of the fuselage and the size of the vertical stabilizer.
12. The airplane will yaw around its center of gravity (CG). The side area of the fuselage and vertical stabilizer is greater aft of the CG, making the airplane weathervane back to its original direction.
13. An aft center of gravity will reduce the area behind the CG. This makes the airplane somewhat less directionally stable.
14. Improper loading of the airplane can affect the stability on all three axes, but has the greatest effect on longitudinal or pitch stability.
15. The CG must fall within a certain range. On the Skyhawk for example, at maximum weight, this allowable range is 7.4 inches. Passengers, baggage, fuel, and other items

loaded in the airplane must be placed to keep it longitudinally balanced within these 7.4 inches.

16. If the loaded center of gravity is aft of the allowable range, pitch stability will be reduced. Elevator control forces become lighter, and the airplane will tend to wander from level flight, pitching steeper up or down.
17. Loaded this way, if stalled, the airplane would remain in the stalled pitch attitude.
18. Loading the airplane with the center of gravity forward of the allowable range will increase longitudinal stability, calling for more elevator pressure to make pitch changes. In this situation, there might not be enough elevator control to flare for landing.
19. A forward CG also results in a higher stall speed and lower performance in all areas.
20. The weight of the airplane must not exceed its maximum allowable weight. This will cause higher stall speeds, longer takeoff distance, lower rate of climb, and a longer landing roll.

Flight Service Weather Briefings

Private Pilot Chapter 3 – Video Segment 22

In this section we'll look at the weather briefing services offered by Flight Service and how you can use this to supplement own personal weather briefing.

Review:

1. Flight service provides access to trained specialists who provide plain language preflight and in-flight weather briefings - often times with insight and local knowledge not found with commercial providers.
2. You can reach the flight service station serving your area by dialing 1-800-WX-BRIEF.
3. There are three types of preflight briefings available from flight service stations. The standard briefing is the most complete and is used when the pilot has not received a prior briefing. The abbreviated briefing is used to update a previous briefing, or used when the pilot only needs one or two specific items. An outlook briefing should be requested when the proposed flight time is six or more hours from the time of the briefing.
4. When you call for a preflight weather briefing, identify yourself as a student pilot and give the briefer information concerning your proposed flight. Tell the briefer your name, airplane number, the airplane type, the departure airport, that the flight is for local dual instruction, and your proposed takeoff time.
5. Many airports have computer access weather systems which are used for self-briefing.

Closer Look: Graphical Forecast for Aviation (GFA)

Private Pilot Chapter 3 – Video Segment 23

The GFA replaced the text-based Area Forecast and allows pilots to view a wealth of weather information, from TAFs and METARs to projections of turbulence and icing in a graphical form.

Review:

6. The GFA can be accessed from the Aviation Weather Center website (www.aviationweather.gov) and is presented on an interactive map.
7. When you first load the GFA, you'll see TAF information in surface plot map form.
8. Click on one of the reporting points to see the latest METAR, and - if one is produced - the latest TAF for that site.
9. Select the "CIG/VIS" button you'll see the option to display a graphical representation of ceilings, flight categories, and visibilities. The default Flight Categories view provides a big picture view of VFR and IFR conditions across the U.S., similar to legacy Weather Depiction chart.
10. Select the "Clouds" button in the upper-level hand corner to review forecast cloud coverage, tops and bases. Use the "TOPS," "COV," or "BASE" buttons in the small menu on the left side of the map to switch between views.
11. The "PCPN/WX" layer will display weather and hazards for a given time.
12. The TS, or Thunderstorm layer, will display the forecast coverage of convection or thunderstorms at a given time.
13. The "Winds" layer on the GFA shows winds aloft forecast at various altitudes. You can adjust the flight level you want to review or display the maximum wind speed sampled across all altitudes for each point on the map.
14. The "Turb" (or Turbulence) and "Ice" (or icing) layers operate similar to the "Winds" section. The Turbulence layer is based on the eddy dissipation rate and shows forecast intensity based on the altitude selected on the left side of the screen.
15. The Graphical Forecasts for Aviation or GFA tool is an excellent source of weather information during your flight briefing. Make it a point to check it out before each flight to supplement your self-weather briefings.

Federal Aviation Regulations

Private Pilot Chapter 3 – Video Segment 24

In this section, we investigate a portion of the federal aviation regulations.

Review:

1. There are seven categories of aircraft: airplanes, rotorcraft, powered-lift, gliders, lighter than air, weight-shift control, and powered parachute.
2. These categories are subdivided by classes.
3. Airplane classes are single-engine land, multiengine land, single-engine sea, and multiengine sea. Rotorcraft classes are helicopters and gyroplanes. Airships and free balloons are the lighter than air classes, while there are no class divisions for gliders, powered-lift, powered parachute or weight-shift control aircraft.
4. The less maneuverable aircraft have the right-of-way. Airplanes, for example, must give way to everything except in an emergency. Aircraft that are towing or refueling another aircraft have the right-of-way over all other engine-driven aircraft.
5. If aircraft are approaching head on each must change course to the right. If aircraft of the same category are converging, the aircraft to the right has the right-of-way.
6. An aircraft being overtaken has the right-of-way. The overtaking aircraft shall alter course to the right and pass well clear.
7. An aircraft landing or on final approach has the right-of-way over other aircraft. If two or more aircraft are approaching to land, the aircraft at the lower altitude has the right-of-way.
8. If in doubt, always yield the right-of-way. The rule is, see and avoid.
9. You should continuously scan all areas of the sky for traffic.
10. You can observe about two hundred degrees of the horizon. But only a small central area of the eye sends sharply focused messages to the brain. Scanning is the technique used to take advantage of the central visual area.
11. Use a series of short spaced (about one second) eye movements covering each ten degree segment of the sky. For effective scanning, develop a pattern that is best for you.
12. It's important to learn to divide your attention inside and outside the airplane. Your eyes require several seconds to refocus on objects in the distance after looking at the instrument panel.
13. After a scan of the area, check the instruments inside. Then start the scan process over again. Give your eyes time to adjust to each situation.
14. In a climb or descent, use gentle bank turns to see all around you.
15. If an aircraft is above the horizon, it is probably at a higher altitude than you. An aircraft below your horizon is probably at a lower altitude.
16. If an aircraft stays in one spot and does not appear to have any relative motion, it is likely on a collision course.

17. In the practice area, clearing turns should precede all stalls, slow flight, and other training maneuvers.
18. Also, remember to keep the windshield clean and use exterior lights during the day to make your airplane more conspicuous.
19. If you experience radio failure at a towered airport, expect the tower to use light gun signals. If the transmitter is working, broadcast your intentions, and request light gun signals. If the receiver is working, monitor the tower frequency for instructions.
20. If you are unable to receive instructions over the radio, join the airport traffic pattern, and look for light gun signals.
21. Learn the light gun signals by heart.

Air Facts: Eye to the Sky

Private Pilot Chapter 3 – Video Segment 25

See and avoid is the foundation of flying safety.

Review:

1. You'll learn about the concept of collision avoidance early on in your training, which is essentially the process of actively scanning for other aircraft.
2. It's important that you take on this responsibility as a student pilot early on in your training, and not assume that your instructor is the only one scanning for other airplanes.
3. When it comes time to perform maneuvers like stalls or slow flight, make it a ritual to scan the airspace with clearing turns each and every time.
4. If a potential traffic conflict arises, don't get too caught up with right-of-way rules to the point that you freeze up and do nothing. Take the course of action that puts the most space between you and the other airplane.
5. Collision avoidance is a matter of keeping up an active scan for other airplanes.
6. The basic right-of-way rule is to see and avoid. You can argue the point on the ground if you wish.
7. Day or night, use as many lights as possible to make yourself visible to other pilots.
8. Technology is also playing an important role in collision avoidance. The NextGen air traffic control system includes a traffic component, that sends out the location of other airplanes via an electronic datalink.
9. You must be equipped with 2 components to receive this traffic data: an ADS-B out transponder, and an ADS-B in receiver and display. The second half of the equation can be as simple as a portable ADS-B receiver and iPad.
10. If you're fortunate enough to fly with this traffic awareness technology, don't allow it to lead you down the path of increased heads-down time in the cockpit staring at the screen. Instead take advantage of the audio alert features to get your attention if another airplane is nearby.

Student Pilot & Medical Certificate

Private Pilot Chapter 3 – Video Segment 26

In order to solo, you must obtain a student pilot certificate.

Review:

1. To get a student pilot certificate, you must be at least 16 years old, be able to read, speak, write, and understand English, and hold at least a 3rd class medical certificate.
2. To obtain the medical certificate, you need to pass a physical given by an aviation medical examiner.
3. A third class medical certificate is good for 60 calendar months if you haven't reached your 40th birthday, and 24 calendar months if you've already turned 40.
4. Calendar months go to the end of the month.
5. For pilots who only require a third class medical - essentially all non-commercial flying, you may be able to operate under Basic Med rules as long as you've obtained at least one FAA medical at any point after July 14, 2006 and hold a valid U.S. driver's license.
6. When flying under basic med rules, a maximum of five passengers may be carried. and the aircraft may not be certified with more than six seats or for more than six thousand pounds. Pilots are restricted to operations below 18,000 feet and limited to a maximum speed of 250 knots.
7. In lieu of renewing an FAA medical with an aviation medical examiner, under basic med, pilots must visit their primary care physician – or any state licensed physician - at least once every four years.
8. Pilots are also required to complete an online training course in aeromedical factors every two years which is available at no charge from the aircraft owners and pilots association.
9. Hypoxia is a lack of sufficient oxygen which can impair brain function. High altitudes cause hypoxia because of the reduced atmospheric pressure there – less O2.
10. The nature of hypoxia makes it hard for you to judge when it occurs. The first symptoms of oxygen deficiency are usually pleasant, called euphoria.
11. Hypoxia results in impairment of judgment, memory, alertness, and coordination. Headaches, drowsiness, or dizziness are likely.
12. Flights up to 10,000 feet without supplemental oxygen can be considered safe for most healthy people.
13. The FARs require the use of supplemental oxygen after 30 minutes above 12,500 feet MSL.
14. Carbon monoxide is a colorless, tasteless, and odorless gas caused by engine combustion. If you notice engine exhaust fumes, CO is probably present. Close the heater vents and open the outside air vents.

15. CO reduces the ability of the blood to carry oxygen, causing drowsiness, dizziness, or headaches.
16. Hyperventilation occurs when an abnormal volume of air is breathed in and out of the lungs. It can be caused by breathing too rapidly as a result of stress or anxiety. You are depleting the CO_2 in your system.
17. The symptoms of hyperventilation are dizziness, nausea, tingling of the hands, legs and feet, drowsiness, and in some instances, unconsciousness.
18. To eliminate hyperventilation you can talk in a normal tone and speed or breathe in and out of a paper bag.
19. As a pilot, you can experience various illusions in flight that can contribute to landing errors.
20. For example, a runway that is narrower than usual can create the illusion that the airplane is higher than it actually is resulting in a lower approach. A runway wider than usual can have the opposite effect.
21. An upsloping runway can create the illusion that the airplane is higher than it actually is, possibly resulting in an approach that is too low. A downsloping runway has the opposite effect.
22. There are also illusions caused by water, featureless terrain, rain on the windshield, or atmospheric haze.

Air Facts: Fit for Flight

Private Pilot Chapter 3 – Video Segment 27

The FAA physical is designed to uncover any of the disqualifying conditions covered by the regulations. It's good to go beyond the rules though; because there are a lot of other factors that make it unwise to go flying.

Review:

1. A simple cold, accompanied by head stuffiness, can aggravate ear problems as you ascend and descend and the general miserable feeling can be a major distraction.
2. You shouldn't fly if you are taking any medicine unless you discussed it with the medical examiner and he okays it for flying. Even a simple antihistamine can make you groggy.
3. You have to decide if you feel good enough to fly. If whatever you are experiencing is such that you can't concentrate on the task at hand, don't fly.
4. Excessive fatigue could also be a good reason not to fly.
5. The FARs say no flying within 8 hours of consuming alcohol, or with a blood alcohol level of .04 or greater. Use common sense here. If you are not recovered after 8 hours, don't fly.

Solo

Private Pilot Chapter 3 – Video Segment 28

The FARs require that student pilots complete a written examination prior to solo. It must be given, graded, and incorrect answers reviewed by the instructor who endorses your student pilot certificate and logbook for solo flight.

Review:

1. The written covers regulations, airspace rules, and procedures for the airport where the solo flight is to be performed, as well as characteristics and operational limitations for the make and model of aircraft flown.
2. Know the limitations of the student pilot certificate.
3. To fly solo, you must have your logbook, photo I-D, student pilot and medical certificate readily available in the aircraft or in your possession.
4. Your logbook must be endorsed by the instructor who gave the flight instruction within 90 days of solo.
5. To solo an airplane, you must have received flight instruction in that make and model of airplane within the preceding 90 days.
6. You may not fly solo contrary to any limitations such as wind speed, ceiling, or visibility placed in your logbook by the instructor.
7. You may not carry passengers or fly an airplane that is carrying property for compensation or hire. You cannot be a pilot flight crew member of an aircraft which requires two pilots. You cannot be a pilot for compensation or hire or in furtherance of a business.
8. For solo flights, the surface or flight visibility must be at least 3 statute miles during daylight hours and at least 5 statute miles at night.
9. You may not fly beyond a radius of 25 nautical miles of your home base without a specific endorsement.
10. As you earn your solo privileges, you will take on increased responsibilities. For example, landing at other airports within your 25 mile radius.
11. You are now responsible for your own safety and that of others. You are now accountable regarding the applicable FARs.
12. Prior to your first solo, your flight instructor will be making fewer corrections and may seem to be more of a passenger than an instructor. One day, after making some takeoffs and landings, you will be told to taxi back to the ramp. He will endorse your pilot certificate and logbook and tell you to do a few takeoffs and landings on your own.
13. The most noticeable difference will be how quiet the cabin is without the instructor.

Chapter 4 – Your Dual Cross Countries

Night Flying

Private Pilot Chapter 4 – Video Segment 1

In this section we'll introduce you to night vision, airport lighting, and give you tips to help you with your night flying experience. You'll find that night flying is quite enjoyable since the air usually is calm and smooth.

Review:

1. To acquire your private certificate, you must have at least three hours of night dual instruction that includes a cross-country flight of over 100 nautical miles and 10 takeoffs and 10 full-stop landings.
2. Night flying is not difficult, but it differs from daylight operations in that vision is restricted at night.
3. There are techniques you can learn to enhance your night vision. For example, during the day the best way to see something is by looking directly at it. But at night, objects are best seen by viewing them slightly off center.
4. Also, you'll learn to avoid bright, white light before you fly to let your eyes adjust to the dark – called dark adaptation.
5. To help maintain dark adaptation, keep the cockpit and instrument lights at a low light setting. Red is best here.
6. As part of a night preflight, check the position lights which are red for the left wing, green for the right, and white for the tail. Also check the anticollision lights and the landing lights for proper operation.
7. Next check the instrument panel lights. The FARs require a spare set or three spares of each kind of fuse to be on board.
8. Have a flashlight in good operating condition on board such as a small one that can be carried in a shirt pocket or hung around the neck.
9. Taxi slowly at night. A lighted taxiway has blue lights. A civilian use airport has a beacon that flashes alternately white and green.
10. Military airports have beacons that show two quick white flashes between green flashes.
11. Obstructions have red lights.
12. When ready for takeoff, turn on the landing and anticollision lights.
13. Notice that the runway threshold or end of the runway is marked with green lights. Some airports have runway threshold lights that are green on the approach side, and red on the runway side.
14. Runway end identifier lights are pulsating white strobe lights.
15. Runways have white edge lights. Once in the middle of the runway, check to ensure the heading indicator and runway headings are the same.

16. It will seem like you're moving faster than usual because you have no normal visual cues as in daylight.
17. The location of navigation lights on an aircraft will help you determine the direction of the other aircraft. If you see a red light, you have the left wingtip in view and it's passing from your right to your left and has the right-of-way. If you see a white light and a flashing red or white light, you are looking at the tail of an airplane. A green light indicates you are seeing an airplane's right wing and it is moving from your left to right, and you have the right-of-way. An aircraft displaying both red and green lights will be approaching head on.
18. Regulations state that navigation lights must be on anytime an airplane is taxiing or flying during the entire period from sunset to sunrise.
19. Night is defined as the time between the end of evening civil twilight and the beginning of morning civil twilight.
20. At night, it's important to know your position at all times when away from the airport.
21. Some airports have radio controlled runway lights. Click the microphone 7 times within 5 seconds to activate the highest intensity lights available. Once activated, they remain illuminated for 15 minutes.
22. Keep the runway lights in sight as you enter the pattern. Do your before landing checklist. Use the landing light to determine when to start your flare.
23. Practice landing without a landing light as well – what if it burns out?
24. A VASI system is a great help for night landing. Two bar VASI's can be seen from 3 to 5 miles during the day and up to 20 miles at night.
25. When using a VASI, don't start your descent until the airplane is aligned with the runway.
26. With the two bar VASI, if you see red over white, you are all right – meaning you are on the glidepath. Below the glidepath both bars would be red, and above the glidepath both bars would be white.
27. A system with all light units installed in a single row is called a precision approach path indicator – PAPI. There are 2 and 4-light systems.
28. For the two light system, if you are on the glidepath, you will see a combination of red and white. If both lights are white, you're too high. If you see all red, you're too low.
29. A tri-color visual glide slope indicator is a single light unit that shows three colors. If you are on the glidepath you'll see green. Below the glidepath, you'll see red. Above the glidepath you'll see amber.
30. During the night, you can experience many illusions which can lead to landing errors. For example, when landing over darkened areas it seems like the airplane is higher than it actually is. Straight lights along a road can be mistaken for runway lights. Bright runway lights with few lights illuminating the surrounding area may create the illusion of less distance to the runway – the converse is also true.
31. Be aware of your approach speed. Use the same speed that you would use during the day.

Air Facts: The Night Shift

Private Pilot Chapter 4 – Video Segment 2

In this section we'll discuss some differences between night and day flying.

Review:

1. Because you can see well during the day doesn't mean you can do the same at night. Age and physical condition can play a significant role here.
2. Since you can't see as well as in daylight, you need to develop some techniques to help out.
3. If you takeoff and climb out over an area where there are few or no lights, maintaining attitude by visual reference to a horizon will be quite difficult. You are now flying on instruments.
4. Checking altitude at night like you do during the day doesn't work at night. You need to frequently check the altimeter to verify a safe altitude.
5. Pay particular attention to the lighting activation method in the airport/facility directory -- some airports use a separate frequency other than the CTAF, which can catch you off guard if not prepared.
6. As you make the turn to final, watch for the visual approach glide slope to come into view, in either the form of a VASI or PAPI.
7. Something else to consider when on final at night is that there is a better chance for wildlife to hang out near the runway as things cool off.

Publications and Charts

Private Pilot Chapter 4 – Video Segment 3

There are several FAA flight information publications you will use during your flying career.

Review:

1. The Aeronautical Information Manual (AIM) provides basic flight information and ATC procedures. It also contains items concerning medical factors, flight safety, aeronautical charts, and helicopter operations. A separate glossary of terms can be acquired as well.
2. The Chart Supplement (formerly known as the Airport/Facility Directory (A/FD)) is issued in seven volumes, each covering a specific geographic area. It contains all airports, seaplane bases, and heliports open to the public including information regarding each airport.
3. Notices to Air Missions, (NOTAMs) are considered essential to flight safety and contain information not known sufficiently in advance to publicize by other means.
4. NOTAMs are classed as Domestic NOTAMs, Flight Data Center, or FDC, NOTAMs, International NOTAMs, or Military NOTAMs.
5. Domestic NOTAMs, commonly referred to as NOTAM D, report changes of navaid status, runway conditions, airspace, personnel and equipment near or crossing runways, and other information essential for operations.
6. International NOTAMs are issued for airports outside of the U.S. and are also available on the FAA's NOTAM website and in several flight planning apps. These are presented in a standardized international format using keywords and abbreviations.
7. Military NOTAMs, are intended for users of a military or joint-use facility and are published in the International NOTAM format.
8. There are also FDC NOTAMs that are regulatory in nature. These are given system wide dissemination and are issued to establish restrictions to flight or to amend charts.
9. Don't use out of date charts or publications because aeronautical data changes frequently.
10. IFR/VFR Low Altitude Planning Charts are useful for routing long cross-country trips in the United States. The Eastern half of the U.S. is on one side, the Western half on the other. It depicts airways, NAVAIDs, airports, special use airspace, selected population areas, prominent bodies of water, and more.
11. Sectional charts are designed for visual navigation of slow and medium speed aircraft. Each chart is named for a major city within the area of coverage. In many ways they are similar to automobile road maps.
12. VFR Terminal Area charts are similar to Sectional charts in that they are designed for visual navigation. They are used in congested terminal areas since they provide greater detail and clarity of information.
13. Printed on the back of the terminal area chart is the VFR flyway planning chart. It identifies flight paths clear of major controlled traffic flows.

14. VFR waypoints are marked with a 4-point star. They have a non-pronounceable 5-letter name beginning with VP, and their location is pre-programmed into most GPS navigators. Most VFR waypoints are co-located with visual checkpoints, marked with a magenta flag.
15. The Sectional chart is the most common for VFR pilot training. It's used on FAA private pilot knowledge tests. Its name is shown at the top of the chart.
16. Notice the north/south arrows at the top. Opening the chart in the direction of the north arrow shows the northern half of the area covered. The southern half of the area is covered on the other side.
17. The equator divides the globe into two equal parts, the northern hemisphere and the southern hemisphere.
18. There are imaginary lines running parallel to the equator, called parallels of latitude.
19. Lines of longitude, known as meridians, cross the equator at 90 degree angles. Each meridian is drawn from the North Pole to the South Pole.
20. The zero longitudinal line, the prime meridian, passes through Greenwich, England. Longitudes to the east of Greenwich are east longitudes and vice-versa for the west.
21. We can locate a position where specific latitude and longitude lines converge. For example, Washington D.C. is located at the intersection of the 39 degree north latitude line and the 77 degree west longitude line.
22. On Sectional charts, the lines of latitude and longitude are shown and are sub-divided by tick marks. Each tick mark equals 1 minute. There are 60 minutes in each degree.
23. Using this information, Clermont County airport is located at 39 degrees, 4 minutes north latitude, and 84 degrees, 12 minutes west longitude.
24. Each minute of latitude is a nautical mile. By counting the tick marks on the longitude scale, you can measure distance. For example, the distance from Clermont County airport to Lunken airport is 10 nautical miles.
25. The only place where one minute of longitude equals one nautical mile is at the equator, because lines of longitude converge as they go north or south.
26. The Sectional chart has many symbols in its legend. Review these.
27. As a brief review consider the following: Control tower airports are in blue all others in magenta. With the airport's name, the coded data will tell you length of runway, pattern direction, contact information, airport elevation, lighting, and if it has automatic weather information.
28. Sectionals show surface elevation and obstructions, maximum elevation figures, roads, rivers, lakes, railroads, towns and much more.
29. The earth turns one revolution of 360 degrees/day. One revolution takes 24 hours. Therefore the earth revolves at 15 degrees per hour.
30. For every 15 degrees of longitude there is normally a time zone change of one hour. The lower 48 states have four time zones; eastern, central, mountain, and pacific.
31. Aviation uses a 24 hour clock to avoid mistakes between a.m. or p.m. The 24 hour clock is often referred to as military time.
32. To further avoid time confusion, all world time is converted into the time that exists at Greenwich England at that moment. This time is called Greenwich Mean Time,

Coordinated Universal Time, or ZULU time. At noon here in the EST zone, it is 5 p.m. in Greenwich, England. Therefore, using the 24 hour clock, it is 1700Z here.

Air Facts: Where Is It, Really

Private Pilot Chapter 4 – Video Segment 4

It's possible to become disoriented when flying and not know precisely where you are. This often occurs when a person becomes fixated on one point and disregards all the other telling information.

Review:

1. For example; on a day, VFR flight, you might see a town, decide it's one of your checkpoints, and head for it only to find you're off course.
2. This can more easily happen at night. You see an airport beacon and decide that's your airport.
3. Your first impression may be wrong – keep double checking.
4. Practice estimating distance from the airplane. It's not always easy to do. A lot depends on the visibility and your altitude.
5. Inadequate planning, or improper execution of the plan, can also lead to confusion.
6. Usually, your disorientation is short lived. By a complete review of all the factors and your Sectional, the problem will be quickly solved.

Sporty’s E6B: Flight Planning and Test Prep

Private Pilot Chapter 4 – Video Segment 5

In this section, we'll explore how to use Sporty's E6B flight computer, including the specifics of how to use each function required for flight planning and to answer questions on the FAA knowledge test.

Review:

1. The E6B calculator is considered required equipment by most pilots. During flight training, you’ll learn to plan your cross-country flights first by hand and use the E6B each step of the way.
2. Sporty's E6B is approved for use during the FAA knowledge test, and can make it easy to answer calculation questions.
3. The controls on the Sporty’s E6B are thoughtfully laid out and provide quick access to each of the aviation functions. These functions are organized into six groups and accessed by the buttons at the top of the keypad: Heading-groundspeed and Pressure-Density Altitude, Speed, Required, Wind, Flight, and Weight and Balance.
4. To use one of the functions, first press its respective group button, which will declutter the screen and only show the available functions that are a part of that group. Then use the up or down arrow on the right side of the screen to highlight the desired function, which will be flashing. Lastly, press the Enter key to start using the function.
5. The 20 conversion options are listed in yellow text above the gray arithmetic buttons on the E6B. To use one, enter a number on the screen, press the CONV button, and then the specific button with the conversion you'd like to execute.
6. You can use the standard arithmetic buttons at any time to perform basic math problems, such as addition, subtraction, division, and multiplication. The plus/minus key should be used when you need to make a number negative or positive. If a number is negative, a dash symbol will appear to the right of the number.
7. When entering time, first enter the hours, and then press the colon key. Next enter the minutes value and press the colon key again. Last enter the second.
8. While you can’t use it on the FAA knowledge test, Sporty’s also offers a mobile app version of the E6B for iPad, iPhone and Android devices. It includes the same aviation functions and conversions as the handheld version, but you’ll find it more convenient to access when away from your flight bag and if you’re already using a tablet in the cockpit.

Flight Planning Part 1: Plotting a Course

Private Pilot Chapter 4 – Video Segment 6

In this section we will investigate the navigation planning that's done on the ground prior to a flight. It's one of the key elements of proper preflight preparation.

Review:

1. To do this, we'll use pilotage, dead reckoning, and radio navigation.
2. Pilotage is looking out the airplane window and flying along the course by reference to pre-selected landmarks until reaching the destination.
3. Dead reckoning, is calculating the effect of the wind direction and speed on the airplane so a compass heading, groundspeed, time en route, and fuel required can be estimated.
4. Radio navigation is using an instrument to help stay on the desired course – VOR or GPS as an example.
5. A plotter is a device for measuring distance and direction. Some plotters have a sectional scale on one side and a world aeronautical chart scale on the other – take care to use the correct side.
6. After measuring the distance for the trip, determine the directions of each leg. You do this with the protractor part of your plotter. This is the true course.
7. NOTE: If a course line is long and crosses numerous meridians, measure the course on one of the meridians closest to the center.
8. Wind information is next applied. Wind information received over the radio for takeoffs or landings is given as a magnetic direction. All other wind information spoken or printed is given in true direction.
9. The airplane's path over the ground is called track. The direction the nose of the airplane is pointing is called heading. Because of the wind, we adjust the heading to get the desired track over the ground.
10. The angle formed between the heading and the course is called the wind correction angle.
11. Wind speed must be known for an accurate solution – it affects groundspeed. If you fly at 100 knots east in a no wind condition, your groundspeed is 100 knots. If there is a 10 knot headwind from the east your groundspeed will be 90 knots.
12. Groundspeed is a combination of the movement of the airplane with the movement of the air.
13. The magnetic compass is not dependent on any power source in the airplane. However, it has some peculiarities – magnetic variation and compass deviation.
14. Variation is the angle between true north and magnetic north at any given location. On sectional charts, the amount and direction of variation, are shown by broken magenta lines called isogonic lines.
15. The line with zero variation between true north and magnetic north is called the agonic line.

16. On the east coast the magnetic compass needle will point to the west of true north. On the west coast the needle will point to the east of true north.
17. Your actual course has to take into consideration magnetic variation. This is done by adding or subtracting variation to your course as shown by the nearest isogonic line on the chart. For example, if your true course is 50 degrees, and the nearest isogonic line is 5 degrees west, then you would fly a course of 55 degrees. Remember, west is best, east is least.
18. Deviation is the deflection of the magnetic compass from its normal reading caused by some magnetic influence in the airplane. To make this correction the airplane must have a compass correction card. It shows any addition or subtraction necessary to correct for various headings.
19. After measuring true course and applying the wind correction, a true heading can be determined. Next, apply variation to get the magnetic heading. Finally, correct for deviation and you arrive at a compass heading. You fly a compass heading.
20. Before you fly you want to determine the estimated time en route, groundspeed, and how much fuel will be required.
21. Normally you will make these determinations by using an electronic flight computer.
22. Other information for the trip is found in your pilot's operating handbook.
23. To calculate the dead reckoning information, you need to determine true airspeed. Use the graphs or tables in the performance section of your pilot's operating handbook to do this. Select the cruise performance that best fits your needs at your selected altitude.
24. When computing time from point to point, don't forget to add 5 minutes for climb, descent, pattern, and taxi.
25. The FARs require that day VFR flights must have enough fuel to fly to the first point of intended landing and, assuming normal cruising speed, to fly after that for at least 30 minutes.
26. It's also a good idea to check the Airport/Facility Directory for fuel availability at your destination airports if more is needed for any reason.
27. Now select your checkpoints. Make them close enough together so they are easy to find in a reasonable amount of time.
28. On a trip you can use radio navigation to help pinpoint your location – VOR, ADF, GPS.
29. A long trip is divided into a succession of short trips – from one checkpoint to the next.

Flight Planning Part 2: Preparing a Navlog

Private Pilot Chapter 4 – Video Segment 7

In this section we'll continue the dead reckoning planning process and determine the time en route, groundspeed and how much fuel will be required. We'll also select visual landmarks to use for pilotage during the flight, and wrap up by entering all the calculations in a flight log.

Review:

1. Before you fly you want to determine the estimated time en route, groundspeed, and how much fuel will be required.
2. Normally you will make these determinations by using an electronic flight computer.
3. First select your visual checkpoints from the sectional chart. Make them close enough together so they are easy to find in a reasonable amount of time.
4. It can be helpful to plan the first checkpoint near the planned top of climb.
5. Take note of the airports along the route in case a diversion to one is required.
6. Enter the name of each checkpoint on the left side of the flight planning form.
7. To calculate the dead reckoning information, you need to determine true airspeed. Use the graphs or tables in the performance section of your pilot's operating handbook to do this. Select the cruise performance that best fits your needs at your selected altitude.
8. We'd also recommend determining the time, fuel and distance to climb to the cruise altitude, which can be found in your airplane's climb performance chart.
9. Calculate the flight details for each leg using the Heading and Groundspeed function on the E6B, which will allow you to calculate a true heading and groundspeed.
10. Use a plotter to measure the distance between each visual checkpoint, use the E6B to calculate leg time and fuel burn.
11. Calculate these planning values for each of the remaining segments and enter the sum for distance, time and fuel at the bottom of the form. Complete additional forms for any subsequent legs to compute the total time and fuel burn for your flight.
12. The FARs require that day VFR flights must have enough fuel to fly to the first point of intended landing and, assuming normal cruising speed, to fly after that for at least 30 minutes.
13. A long trip is divided into a succession of short trips – from one checkpoint to the next.

Cross-country planning with iPad

Private Pilot Chapter 4 – Video Segment 8

In this section we'll show how to plan a cross-country flight using ForeFlight's digital sectional chart and performance planning resources.

Review:

1. You'll likely learn to plan a trip first with a paper sectional chart, plotter and E6B, and complete a paper navigation log with all the details of the flight.
2. Another method is to use an electronic resource, like ForeFlight on an iPad, to assist with the planning process. This method is much more convenient, delivers more accurate results, and is faster as long as you begin with accurate performance information.
3. The first step is to create a performance profile for your airplane by entering climb, cruise and descent performance data. Use Climb performance data from your airplane's flight manual to find the numbers for the climb section, and the Cruise Performance chart to determine True Airspeed and the fuel burn rate.
4. Next, enter your departure and destination airport on the maps screen.
5. Now it's time to choose a cruise altitude. Use the altitude button to display the Altitude advisor window, which shows headwind/tailwind components, estimated time en route and fuel burn for each altitude.
6. To assist with pilotage and dead reckoning, select checkpoints/landmarks on the chart. Mark them with either user waypoints or annotations on the map.
7. Tap the NavLog button at the lower right of the Route Editor to display navigation details for each leg between the selected checkpoints.
8. It's important to note that the Heading value displayed here is the magnetic heading to fly and includes adjustments for both the wind aloft and magnetic variation. You will need to adjust this though for magnetic deviation using the compass correction card in your airplane, to determine the final compass heading to fly in the airplane.
9. When it comes time to depart on the flight, you'll want to disable the display of your location on the moving map in ForeFlight, often referred to as ownship.
10.

Air Facts: Leave Yourself an Out

Private Pilot Chapter 4 – Video Segment 9

Planning a flight carefully can help avoid surprises and surprises are something that we really want to avoid in flying.

Review:

1. Since not everything always goes as planned, we need to consider alternate plans and areas of potential problems during our preflight planning.
2. Check out the airports along your route and other possible places to land if necessary.
3. Take a good look at all the terrain around your course line – ten or fifteen miles on either side of that line.
4. You want to have an idea of obstructions, terrain, airports, and landmarks located within this swatch, all along your flight.
5. The leading cause of engine failure is fuel starvation. Make sure you know how much fuel you will use on any portion of your flight.
6. Always be on the safe side here. Plan extra fuel stops if necessary. Don't continue to fly with less than one hour of fuel remaining.

VOR Navigation

Private Pilot Chapter 4 – Video Segment 10

There are several types of air navigation systems in use today. Navigation systems include any method a pilot uses to follow a predetermined flight path over the earth's surface. One common radio navigation receiver is the VOR.

Review:

1. The Very High Frequency Omni-directional Range, abbreviated VOR, is the primary navigation system for civil aviation.
2. Most VOR sites have an operating TACAN (the military version) attached to them. The combination of the two stations is called a VORTAC. A VORTAC has two distinctly different transmitters and antenna systems at the same site.
3. The VOR station is a small low building topped with a flat white disc which houses an antenna system.
4. On the Sectional chart, the frequency for the VOR is shown in a box near the station symbol.
5. A compass rose is centered on the VOR symbol. The compass rose and the VOR are aligned with magnetic north. Everything else on the Sectional is oriented to true north.
6. There are 360 different courses – radials – radiating from a VOR – something like the spokes on a bicycle wheel. Radials are defined as magnetic courses from a VOR.
7. VOR signal reception is line of sight and varies according to the altitude of your airplane. Obstructions can block a VOR signal.
8. Normal VOR reception extends out approximately 40 nautical miles from the station.
9. A VOR is identified by a three letter Morse code. Identifying the station is extremely important. Be sure the correct station is tuned in and the station is operating.
10. The VOR receiver has a volume control, ident switch, and frequency selector.
11. Pulling the ident switch allows you to hear the Morse code identification. With the switch pushed in, the Morse tones are suppressed, making it easier to hear voice transmissions.
12. The VOR indicator has an Omni Bearing Selector, OBS, a Course Deviation Indicator, CDI, and a TO/FROM indicator.
13. The Omni Bearing Selector is used to select the bearing, or course. When a course is selected, the course deviation indicator shows the position of the selected course.
14. The CDI and the TO/FROM indicator are not affected by the heading of the airplane. At any location, if the CDI indicates the selected course is to the left, the CDI will remain pointing to the left no matter which way the airplane is pointed.
15. If the needle is centered, the airplane is on a specific radial. You can read that course on the OBS. If, after setting the desired course into the OBS, the CDI is pointed to the right, the selected course is to the right. A needle to the left means the course is to the left. In both instances however, the airplane must be heading in the correct direction.

16. A full scale deflection of the CDI represents 10 degrees. How far off course you are depends on your distance from the station. For example, a 5 degree deviation, 10 miles from the station, puts you about a mile off course. Thirty miles from the station, the same deviation puts you about 3 miles off course.
17. The TO/FROM indicator shows whether the selected course will take the airplane to, or from the station. For example, from the north, on the 360 degree radial, a bearing of 180 degrees "TO" will take the airplane on a course to the station. The same course from the south will take the airplane from the station.
18. To use the VOR to find your position, tune it to a nearby VOR station. Turn the OBS to center the CDI. Read the course from the OBS, and TO or FROM on the TO/FROM indicator. Now you can draw a line from the VOR. You know that you're located somewhere on that line.
19. To find your position on the line, look for a landmark, or find your position in relation to another VOR.
20. As you get closer to the VOR station, the heading corrections will become smaller because radials, like the spokes of a wheel, converge at the station.
21. Within a few miles of the station you'll notice the CDI and the TO/FROM indicator flickering. The size of this cone of confusion is relatively small at low altitudes and increases with altitude. This flickering is not station passage. Station passage is indicated when the TO/FROM indicator makes the first complete reversal to a FROM indication.
22. As you approach the VOR station, make small corrections to keep the CDI centered.
23. A VORTAC, a VOR station in combination with a TACAN, has distance measuring capability – DME. Some DMEs show groundspeed and time to the station as well.
24. A VOR receiver, used for instrument flight, must have been operationally checked for accuracy within the past 30 days.
25. The Airport/Facility Directory lists designated ground and airborne receiver checkpoints. At these locations, a specified radial should be received. For IFR, the ground check error cannot exceed 4 degrees. Maximum error using the designated airborne check is 6 degrees.
26. Another way to check the VOR is the VOT. VOTs transmit the 360 degree radial in all directions. No matter where the aircraft is located, the VOR receiver will indicate the 360 degree radial. Electronically, the aircraft is always located north of the VOT. For IFR flight, the CDI must center within 4 degrees of 360 degrees FROM, or 180 degrees TO.

Global Positioning System (GPS)

Private Pilot Chapter 4 – Video Segment 11

GPS stands for global positioning system. It uses a constellation of 24 satellites or more to provide very accurate navigation anywhere in the world.

Review:

1. GPS units have a database, and most of these include every radio navigational point that is charted by the FAA, plus all the public use airports.
2. With GPS, you can navigate direct to any point in the database, or you can put in a flight plan that will guide you from one point to another.
3. GPS gives you information on your present position in relation to your desired course, like a VOR, and gives distance and groundspeed, like a DME.
4. Many GPS units will have all the frequencies for an airport, airport diagrams, maps of the terrain, regulated airspace, plus the time of sunset and sunrise for airports, and many have a vertical navigation feature that helps in descent planning and management.
5. Your GPS unit will tell you the track being made good over the ground, taking all the guesswork out of correcting for wind drift. They will most likely tell you how long you have been flying, and give you an ETA for your destination.
6. If you want to know about the nearest airports, that information is at your fingertips.

Glass Cockpit Flight Instruments

Private Pilot Chapter 4 – Video Segment 12

The most prominent instrument on the PFD is the attitude indicator. it's quite large, easy to interpret, and rather self explanatory - it does however have a few unique features not found on the analog equivalent.

Review:

1. The entire PFD background, the earth, horizon, and sky, moves - the yellow airplane symbol remains stationary.
2. If the pilot becomes too aggressive on the pitch, starting at 50 degrees above and 30 degrees below the horizon, red warning chevrons appear pointing in the direction of the horizon.
3. If the aircraft's pitch exceeds plus 30 degrees or minus 20 degrees, or when the bank angle is sixty-five degrees or better, the PFD automatically de-clutters, turning off its less important data displays.
4. The slip and skid indicator is a small horizontal line located under the triangle roll pointer.
5. The HSI displays a rotating compass card with the usual cardinal points, numeric labels, and tick marks. it also depicts information common to any other HSI.
6. A large heading box is centered on top of the HSI - allowing for a direct digital readout of your heading.
7. The selected course appears in a box to the right of the lubber line. it becomes a magenta color if the navigation source is the GPS, or green if the navigation source originates from the VOR or localizer receivers.
8. Another feature of the G1000 is a wide magenta line, called a trend vector. it displays the current turn rate up to 24 degrees per 6 seconds.
9. Just to the left of the attitude indicator and HSI is the airspeed indicator. airspeed is depicted on a rolling vertical tape rather than a round dial.
10. Another addition is that of v speed reference marks located adjacent to their respective speeds.
11. Below the airspeed's vertical tape is a true airspeed box.
12. The altimeter is located to the right of the attitude indicator. it's also depicted as a rolling vertical tape.
13. Besides altitude, the device features a barometric pressure setting box under the tape - set it using either of the baro knobs.
14. To the right and attached to the altimeter is the vertical speed indicator. it is shown as a non-moving vertical tape.
15. The active frequency appears on the innermost position of both. the standby frequency on the outermost position of both
16. When a navigation frequency has been entered, and the facility is in range, the G1000 will auto-identify the nav facility.

17. An inset information box can be added to the right lower side of the PFD. it shows alerts, nearest airports, a timer function, v-speed changes, your flight plan, or DME tuning.
18. A map inset box can be shown on the left lower portion of the PFD. this is an abbreviated version of your GPS position and associated flight information from the MFD.
19. On the extreme left corner of the PFD there is an outside air temperature box.
20. If a push-to-talk button becomes stuck, the communication transmitter stops transmitting after 35 seconds of continuous operation.
21. If the G1000 detects a major failure in one of its systems, a large red 'x' appears on the affected system.

Closer Look: Airport Services

Private Pilot Chapter 4 – Video Segment 13

As you make longer cross-country trips, you will need fuel away from your home airport. Most airports have at least one fixed base operator (FBO) that can sell you fuel.

Review:

1. At the FBO, you might be greeted by a line person waving his arms. He is directing you to a parking spot.
2. The motions are standardized and have specific meanings, and you can study up on them in the Aeronautical Information Manual.
3. The most common ones you'll see are a turn, come straight ahead, and stop.
4. After shutdown, the line person will approach your airplane to take your fuel order.
5. It's not a bad idea to watch this procedure to make sure that the right amount and type of fuel is being put in.

Air Masses and Fronts

Private Pilot Chapter 4 – Video Segment 14

In this section, we'll take a look inside air masses and see what happens to the weather when two air masses meet. This knowledge is important for your planning and flying safety.

Review:

1. Air masses are defined as large bodies of air in which the temperature and humidity are fairly uniform. Air masses are created whenever a large body of air approaches and remains at a source region.
2. An air mass is created whenever air remains in a region long enough to acquire the temperature and moisture characteristics of the surface.
3. When conflicting air masses meet, the differences of temperature and moisture are greatest at the ground and at lower altitudes. The weather which results from this conflict is also most intense at lower altitudes and tends to diminish higher up.
4. The best source regions are large snow and ice covered Polar Regions, cold northern oceans, tropical oceans, and large desert areas.
5. Air masses are identified using three letters. The first lower case letter identifies the surface of the source region, C for continental and M for maritime or a water surface. Source region is indicated by an upper case letter, P for polar, A for arctic, T for tropical and E for equatorial.
6. The last letter is lower case, W for an air mass warmer and K for an air mass colder than the surface over which it is moving.
7. A W air mass is cooled from below which implies stable conditions with smooth flying, stratus clouds, fog, and poor visibility. Precipitation, if any, would be widespread drizzle and rain.
8. The K air mass indicates heating air from below and therefore unstable conditions. With unstable conditions pilots can expect rough air to 10,000 feet or so, cumuliform clouds, and if there is precipitation, it is localized or showery.
9. The zone between contrasting air masses is called a front. All fronts are in troughs which extend from lows.
10. Air masses are highs meaning the air pressure within the air mass is higher than the surrounding atmospheric pressure. The lowest pressure in each air mass is found at the boundary between them – the front.
11. The position of a front aloft is just as important as its surface position. A frontal slope can be as steep as 1 to 50 and as shallow as 1 to 300. An airplane 1 mile above the surface could cross the frontal zone in as little as fifty miles from the surface position, or may have to fly as many as 300 miles beyond the surface position of the front.
12. When moving across a front, the change of temperature, wind, and humidity may be quite abrupt or very gradual depending on the properties of each air mass. Winds always change direction when you cross a front.

13. Air should flow directly from high to low pressure, down the pressure gradient, but air flow is modified by the Coriolis Effect which is caused by the earth's rotation.
14. The wind is deflected to the right in the northern hemisphere. Around a low, the flow is counter clockwise or cyclonic. Flow around a high is clockwise or anticyclonic.
15. When crossing the front the change in wind direction calls for a heading change to the right in order to maintain course. A heading change to the right is needed when crossing any front in any direction.
16. There is a difference in the rate of pressure change across a front. Make sure to keep your altimeter settings current.
17. The kind of weather you'll encounter in a front depends on the moisture available, stability of the air that is being lifted, speed of movement, frontal slope, and upper wind flow.
18. Fronts can be classified as cold, warm, stationary, and occluded.
19. When cold air advances and replaces warmer air the leading edge of the cold air is called a cold front. The chart symbol for the cold front is a line with triangles pointing in the direction of movement.
20. Cold fronts typically move toward the southeast at speeds of 25 to 30 knots. They frequently produce thunderstorms at the surface position of the front and lines of thunderstorms, called squall lines, a hundred miles or so ahead of the front.
21. If warm air is advancing, replacing colder air, the leading edge of the warm air is called a warm front. Warm fronts are charted as half circles on a line pointing in the direction of movement.
22. Because warm fronts have a shallower slope, warm frontal weather is usually found over a much wider band than cold front weather.
23. If the warm air is unstable there may be thunderstorms embedded in the massive layers of stratus clouds.
24. If a front is not moving it's called a stationary front. The cold and warm front symbols are alternated to indicate a stationary front – pointing in opposite directions.
25. Low ceilings, visibilities, and the weather associated with the stationary front may affect an area for several days.
26. An occluded front is symbolized by warm and cold front symbols on the same side of the line indicating the direction of movement. It's long lived and can cause violent weather. The warm front moving northward is followed by a cold front which moves faster catching up with the warm front – pushing air upward which tends to build towering cumulus clouds.
27. Weather associated with the occluded front is a combination of warm and cold front weather. The worst weather associated with an occlusion is normally in the northeast portion of the occlusion.
28. Occasionally a non frontal low forms just downwind of mountain ranges and can be quite a weather maker. Upslope winds from across the plains can lead to low ceilings and visibilities, drizzle, fog, snow, and ice.
29. Be wary of the lee-slopes low. Rapidly changing weather can cause a pleasant clear sky flight to turn into a desperate search for the nearest airport, especially in winter.

30. Squall lines are lines of thunderstorms that form along lines of instability. While not directly associated with fronts, squall lines tend to form 50 to 100 miles ahead of and parallel to a cold front. Squall lines are indicated on a weather map by a line drawn with two dots alternating with a long dash.
31. Frontal weather can change very rapidly. The cold front which only has cloudiness in the morning may have a strong squall line forecast for the afternoon. The warm front which causes partly cloudy skies in the afternoon may bring fog, drizzle, and low clouds by nightfall.
32. To ensure a safe flight, get a good preflight weather briefing. Don't forget to check out the TAFs, and METARs. Keep a close look at the weather when in-flight.

Closer Look: Weather Information

Private Pilot Chapter 4 – Video Segment 15

In this section, we'll take a look at resources available for obtaining preflight weather information.

Review:

1. While you always have the option to call Flight Service for a preflight weather briefing, you may find that looking at the weather data and imagery yourself can help provide a more complete picture of the weather before a flight.
2. The Lockheed Martin Flight Service website provides a good alternative to the phone weather briefing at 1800WXBRIEF.com.
3. If you're looking to view just a few text weather reports or forecast charts, another free online resource is AviationWeather.gov.
4. There are also dedicated mobile apps available for phones and tablets that provide a complete source of preflight weather for pilots.
5. When you get to the airport, you may find a computer dedicated to displaying aviation weather. The most common provider is WSI

Weather Forecasts and PIREPs

Private Pilot Chapter 4 – Video Segment 16

In this section, we'll take a look at Prog Charts and PIREPs.

Review:

1. Low-level significant weather prognostic charts (Prog Charts) are general visual weather forecasts designed for flight planning up to 24,000 feet. They provide a visual depiction of predicted weather.
2. There are four panels on the Prog Chart. The top panels forecast the weather conditions between the surface and approximately 24,000 feet. Weather conditions at the surface are forecast by the bottom charts. The left hand panels are 12 hour progs, and the right hand panels are 24 hour progs.
3. In general, the 24 hour panels tend to be less reliable than the 12 hour panels. To determine expected conditions beyond the valid time of the 12 hour prog it is necessary to interpolate between it and the 24 hour prog.
4. The surface prog outlines areas of forecast precipitation and thunderstorms. A forecast of the type of precipitation and amount of coverage is also shown.
5. Forecast areas of IFR and marginal VFR are indicated on the top two panels. The bases and tops of moderate or greater turbulence as well as freezing levels are also shown. The common standard weather symbols used on the prog are intermittent rain, drizzle, and snow.
6. Review the symbology for the Prog Chart.
7. Practice reading and interpreting both the Prog Chart.
8. Pilot Reports (PIREPs) give recent airborne information about cloud tops, icing, and turbulence. They are the only means of obtaining certain critical information for briefers and for forecasters.
9. PIREPs give the location of the report, time, altitude, aircraft type, and weather reported.
10. Depending on the reporting source, the information may or may not be useful. For example: moderate turbulence reported by a Cessna 172 at 3000 feet would not be of much use to a 747 captain. However, a 172 pilot should be very interested in moderate turbulence reported by a 747 crew at 3000 feet.
11. Pilots are requested to report anything observed that may be of concern to other pilots.

Closer Look: Tablets in the Cockpit

Private Pilot Chapter 4 – Video Segment 17

Today, pilots are using tablets to assist with just about every aspect of flying. These devices can help you plan cross-country flights, provide preflight weather briefings, display electronic sectional charts, show GPS moving maps and much, much more.

Review:

1. The knowledge you gain by learning “the old school method” will allow you to appreciate the speed and simplicity that tablets provide, but more importantly it will help understand the fundamental concepts and calculations used in flight planning. And don’t forget you have to do it by hand on the knowledge test.
2. Most of the aviation apps available today include electronic versions of all the VFR Sectional and Terminal Area Charts, meaning you won’t be required to carry paper sectionals or A/FDs for navigation and airport info if you go that route. And best of all, when using your tablet with a GPS source you’ll see your airplane’s position right on the chart.
3. Become familiar with Advisory Circular 91-78. The AC provides guidance to pilots using EFBs to replace paper charts in the cockpit. This AC says that it’s ok to substitute electronic charts for paper in flight, but you must adhere to the following guidelines. First you’ll need an application that displays the charts on the tablet, and the charts and data must be kept current. New data and chart updates are available for download every 28 days right in your aviation application.
4. AC 91-78 recommends bringing along a backup source, such as a paper chart or second EFB, but this is not mandatory.
5. Consider how to secure the tablet in a way that allows for easy operation during all phases of flight, and to make sure it doesn’t fall out of reach when flying through rough air.

The Dual Cross Country Flight

Private Pilot Chapter 4 – Video Segment 18

In this section, we'll take a look at cross-country flying.

Review:

1. The weather is checked and your flight log is filled out. After the preflight, and cockpit organization, you make the necessary radio calls before taking the runway for departure.
2. Exit the pattern straight out or at a 45 degree angle. Turn on course when clear of the airport and at least 500 feet above the pattern.
3. After starting the timer in the E6B, get on course and begin looking for your first checkpoint.
4. Log the time over the checkpoint and continue on course. When you are at cruising altitude, adjust the power to your cruise setting, and lean the mixture.
5. Check the conditions for determining true airspeed.
6. Remember to scan for traffic.
7. Over the next checkpoint, mark the time, figure your groundspeed, and project the time over the upcoming checkpoint.
8. Keep a continual check of your position on your Sectional and the features on the ground.
9. If your course takes you through controlled airspace, make any necessary radio calls.
10. Approaching your destination, make whatever radio calls are necessary and check your airport diagram so you can understand and execute the proper pattern entry.
11. Plan to arrive at pattern altitude before reaching the airport. So, begin a descent in plenty of time.
12. Don't forget the before landing checklist. Log your time of arrival and keep scanning.
13. You will either land or possibly make a touch and go to start on the next leg of your trip.
14. If you are using radio navigation, for example VOR, you will want to set it up either prior to takeoff or in the air. It works well as a help to stay on course or to find your precise location with cross reference.
15. Identifying a runway can be simple. Runway numbers are aligned in a magnetic direction. There are compass roses on the chart around any VOR which are also aligned in a magnetic direction.
16. Flying cross-country is a lot of fun. There's a lot to do to keep you busy. Remember to keep scanning, follow the checklists, and adhere to the procedures.

VFR Flight Following

Private Pilot Chapter 4 – Video Segment 19

While flying VFR, it can be useful to have an extra set of eyes on your flight. Radar flight following can be a valuable resource.

Review:

1. Flight following is an optional service in Class E airspace provided by ATC to VFR aircraft on a workload permitting basis.
2. When taking part in flight following, the VFR aircraft is radar identified and in communication with a controller. This allows the controller to provide traffic advisories and other assistance to the aircraft.
3. The controller gets a confirmation of the aircraft's identity, route of flight, and altitude.
4. Primary navigation along with "see and avoid" responsibilities remain with the VFR pilot.
5. Flight following may be requested from an air route traffic control center or from a terminal radar approach control facility.
6. ARTCC or "center" frequencies may be found in the AFD. Tracon or "approach" frequencies may be found on the sectional chart and in the AFD.
7. If you need to leave the frequency for a few minutes to update weather, simply advise the controller of this.
8. If you are listening to another frequency to obtain updated weather or for other reasons, listen carefully to both frequencies, giving ATC's frequency the priority.
9. At times, ATC will coordinate your flight following with the next sector and hand you off to a controller on another frequency. At other times, the controller's workload may not allow this direct handoff.
10. As a VFR pilot, you may also cancel the flight following yourself.

Normal Airspace

Private Pilot Chapter 4 – Video Segment 20

Understanding the airspace system is easy once you grasp this concept: the designation of a parcel of airspace is driven by what goes on there.

Review:

1. In much of the U.S. there is no need for a lot of restrictions. More control, however, is needed around an airport where airlines are coming and going frequently.
2. The International Civil Aviation Organization, ICAO, classifies airspace by the letters A through G, A being the most restrictive, G having the fewest constraints placed on it. There is no class F airspace in the United States.
3. There is also special use and other airspace.
4. Class A airspace which starts at eighteen thousand feet MSL and extends up to and including flight level six zero zero. Class A airspace is not depicted on charts.
5. Flight level altitudes are expressed in hundreds of feet. For example, flight level 350 is a pressure altitude of 35,000 feet.
6. All operations in Class A must be conducted under instrument flight rules – you can't fly at and above 18,000 feet VFR. You must be instrument rated and equipped, obtain an ATC clearance before entering class A, and maintain two-way radio contact with ATC while operating in Class A.
7. Class B airspace is located around airports where there's a large volume of air traffic.
8. Class B airspace is depicted as an upside down wedding cake in shape. It begins at the surface and extends upward to a designated altitude.
9. Aircraft inside Class B can fly at two hundred and fifty knots. Aircraft operating below the overhanging layers of the Class B airspace are limited to two hundred knots.
10. Before operating in Class B, you must receive authorization from ATC, maintain two-way radio communications, and have an operating transponder with altitude reporting.
11. Private pilots may operate in Class B. Student pilots cannot takeoff, land, or fly solo in that airspace unless they have received ground and flight instruction for the specific Class B airspace. The student's logbook must have been endorsed within the previous 90 days by the instructor who gave the flight instruction. Recreational pilots may fly in Class B airspace after receiving an endorsement for ATC communication.
12. The minimum VFR visibility in Class B is 3 statute miles and you must stay clear of clouds. Class B airspace is shown on World Aeronautical, Terminal Area, and Sectional charts.
13. Flying over or under the Class B area and within thirty nautical miles of the primary airport, the aircraft must have an operating transponder and altitude reporting capability.
14. Class C airspace surrounds airports handling a moderate volume of air traffic and resembles a two- layer, upside-down wedding cake in shape. It typically extends 4,000 feet above the surface.

15. To operate in Class C, you'll need to establish communications with ATC, and hold at least a student pilot certificate. A transponder with altitude reporting is required within and above Class C airspace.
16. For VFR flight, a minimum visibility of 3 statute miles is required and you must remain 500 feet below, 1,000 feet above, and 2,000 feet laterally away from clouds. Class C airspace is on Terminal Area, Sectional, World Aeronautical, and low altitude en route charts.
17. It's depicted by solid magenta circles on VFR charts.
18. In Class C and Class D unless otherwise authorized, you may not exceed two hundred knots within four nautical miles of the primary airport at or below 2,500 feet.
19. Class D airspace surrounds tower controlled airports that do not have an associated Class B or C area. You must establish two way radio communications with ATC before operating in Class D airspace, and you must possess a minimum of a student certificate.
20. Class D airspace is depicted on VFR charts with a segmented blue line. Many have arrival extensions, giving the airspace the shape of a keyhole. The actual vertical boundary is charted inside a blue segmented box in hundreds of feet MSL. VFR traffic advisories from ATC are provided on a workload permitting basis.
21. Class E airspace is controlled airspace that is not included in classes A, B, C or D and extends upward from the surface or up from a floor of either 700 or 1200 feet AGL in most other areas. It extends up to, but not including, 18,000 feet unless there is an overlying B or C airspace.
22. Radio contact is not required to fly VFR in Class E airspace.
23. Cloud clearances in Class E below 10,000 feet are, 500 feet below, 1,000 feet above and 2,000 feet horizontally from clouds and 3 miles visibility. At and above 10,000 feet and more than 1200 feet AGL, this increases to five miles visibility and cloud clearances of a thousand feet above and below and one statute mile horizontally.
24. To takeoff, land, or enter the traffic pattern at an airport in Class E airspace, you must have a minimum ceiling of 1,000 feet and a minimum visibility of 3 miles.
25. Special VFR allows VFR flight to and from airports in controlled airspace with a minimum visibility of one mile and still remaining clear of clouds. It must be requested by the pilot.
26. To fly special VFR at night, you must be instrument rated.
27. Check your Sectional for the many ways that Class E airspace is depicted.
28. Federal airways are designated routes between navigational facilities.
29. Class E airspace begins again above flight level 600 with no upper limit.
30. Class G airspace is referred to as uncontrolled airspace. The rules for operating in Class G are simple, you don't have to talk to anybody or get permission to be there.
31. You do need certain visibility and cloud clearances, though, which vary by altitude and whether it's day or night. Review these requirements.
32. The terminal radar service area (TRSA) is depicted on VFR charts with grey rings. There are only a few TRSAs left.

Special Use Airspace

Private Pilot Chapter 4 – Video Segment 21

Special use airspace consists of prohibited, restricted, warning, military operation, alert, and controlled firing areas. All these, except controlled firing areas, are charted on Terminal, Sectional, and World Aeronautical Charts.

Review:

1. Prohibited areas specifically prohibit aircraft flight – period. It's important to check the NOTAMs if you'll be flying around these areas.
2. Restricted areas are defined as airspace where aircraft flight is subject to restrictions.
3. Warning areas are in international airspace. Activities in warning areas may be hazardous to non- participating aircraft. Warning areas cannot be designated restricted areas because they are over international waters.
4. Military operation areas (MOAs) are segments of airspace defined by vertical and lateral limits used to segregate military training activities from aircraft operating under IFR.
5. Most military training requires abrupt flight maneuvering. In an MOA, military pilots are exempted from FAA regulations prohibiting acrobatics in certain airspace and on federal airways.
6. Pilots of VFR aircraft should contact any flight service station within 100 miles of the MOA for real- time information about its current status.
7. Alert areas warn pilots of a high volume of pilot training or other unusual aerial activity. Pilots of participating and transit aircraft are equally responsible for collision avoidance.
8. Controlled firing areas have activities which, if not controlled, would be hazardous to non-participating aircraft.
9. Other airspace includes military training routes (MTRs) and airport advisory areas. An airport advisory area exists within 10 miles of an airport which does not have an operating control tower but does have a flight service station. The FSS provides traffic advisories to arriving and departing aircraft.
10. Military training routes are mutually developed by the FAA and the department of defense. They are generally established below 10,000 feet for operations at speeds above 250 knots.
11. Pilots are not prohibited from flying in a military training route. However, pilots should be extremely vigilant when flying on, across, or near MTRs. You can check the status of an MTR by contacting a flight service station within 100 miles of the MTR.
12. Temporary flight restrictions (TFRs) may be imposed to protect persons or property in the air and on the ground from an existing or imminent hazard on the surface.
13. For example, TFRs and limitations are implemented in areas visited or traveled by the President, Vice President or other public officials.
14. Notification of TFRs or limitations is made by NOTAMs.

Airspace Preflight Planning

Private Pilot Chapter 4 – Video Segment 22

VFR flight planning has come a long way since the days of folded paper charts, plotters and highlighters. In addition to providing full flight planning calculations, today's online software and aviation apps, like ForeFlight, also provide interactive features to help plan optimum routing in and around controlled and special-use airspace.

Review:

1. Much like weather planning, it is always best to start with a big picture review of the airspace first, and then narrow down your focus to the details that apply to your planned route.
2. When using an EFB app, sectionals for the entire U.S are seamlessly stitched together, allowing you to plan a long cross-country flight and view all the information as if it were presented on one large VFR chart.
3. The VFR Flyway charts, which are printed on the back of the TAC chart in paper form, can also be displayed on the moving map by enabling that option from the Map layer menu.
4. ForeFlight includes several other airspace resources which can be found in the documents section of the app. Here you'll find additional VFR planning resources, including Class B Enhancement graphics, VFR Flyway charts, chart legends and the Aeronautical Chart's user's guide.
5. ForeFlight includes a data-driven Aeronautical Map layer. This dynamic layer is scalable, interactive and can be customized to show only the details and chart features that matter to you.
6. The aeronautical layer is interactive, allowing you to tap on any element for additional information. Initially, you'll see airspace type, altitudes and primary frequency, and then tap 'more details' if you'd like more information.
7. If you're hesitant to make the switch to using ForeFlight's aeronautical map layer over the traditional sectional, remember that you can choose to enable both layers on the map simultaneously from the layer menu.

Wrap Up - Going Places

Private Pilot Chapter 4 – Video Segment 23

You have hit another milestone – you are piloting your airplane from place to place.

Review:

1. If you don't learn something from each flight, you're not paying attention.
2. Log what you have learned and the circumstances surrounding that lesson in your logbook.
3. Learn from each flight.

Chapter 5 – Your Solo Cross Countries

ATC Radar Services

Private Pilot Chapter 5 – Video Segment 1

In this section we'll give you an overview of the entire ATC system, primarily looking at radar services. We will show you how to best use and benefit from air traffic control.

Review:

1. All ATC radar facilities provide, on a workload permitting basis, traffic advisories and limited vectoring to VFR aircraft. To receive this service you have to be able to communicate with the facility, be within radar coverage, and be radar identified.
2. Factors such as: limitations of radar, frequency congestion, volume of traffic, and controller workload could prevent the ATC controller from providing radar traffic advisories.
3. The controller has complete discretion and the controller's decision not to provide radar assistance is not subject to question.
4. Radar assistance and traffic information does not relieve the pilot of the responsibility to see and avoid other traffic.
5. You should also understand that radar vectors are advisory in nature and do not authorize the pilot to violate federal aviation regulations.
6. If an assigned heading, altitude, or route might compromise your responsibility, you must inform the controller and request a revised instruction.
7. Air Route Traffic Control Centers, ARTCC, handle en route IFR traffic in controlled airspace. There are twenty centers in the lower 48 states. Each has jurisdiction of controlled airspace the size of several states.
8. Each center controls IFR traffic within its own area and coordinates with adjacent centers for the orderly flow of IFR traffic between areas.
9. Centers are divided into sectors. Each sector controller handles IFR traffic within the sector, and coordinates with the controllers responsible for adjacent sectors.
10. Radar and automation make it possible for the system to handle the tremendous volume of air traffic.
11. Flight following is an optional service in Class E airspace provided by ATC to VFR aircraft on a workload permitting basis. When taking part in flight following, the VFR aircraft is radar identified and in communication with a controller.
12. Flight following allows the controller to provide traffic advisories and other assistance to the VFR aircraft.
13. Flight following provides the controller with a confirmation of the aircraft's identity, route of flight, and altitude. This allows the controller to provide improved service to IFR traffic in the area as well.

14. Flight following may be requested from an Air Route Traffic Control Center or from a Terminal Radar Approach Control facility.
15. ARTCC or "Center" frequencies may be found in the chart supplement. TRACON or "Approach" frequencies may be found on the Sectional chart and in the chart supplement.
16. After establishing contact, the controller will give you radar traffic advisories. Other aircraft will be described in terms of clock position, distance, direction of flight, type of aircraft, and altitude, if known.
17. When participating in radar traffic advisory service, don't change frequencies until you are told to do so. If you need to leave the frequency for a few minutes to update weather, simply advise the controller of this.
18. At times, ATC will coordinate your flight following with the next sector and hand you off to a controller on another frequency. At other times, the controller's workload may not allow this direct handoff.
19. If you hear, "Radar service terminated squawk 1200, frequency change approved," it's the end of your radar traffic advisories. You can call center and request VFR advisories from them. As a VFR pilot, you may also cancel the flight following yourself.
20. The controller's display can show a wide variety of features, including airport location, runway final approach course and special use airspace. It can also show a weather radar overlay to help controllers vector aircraft around heavy precipitation and thunderstorms.
21. All of the higher altitude airspace in the lower 48 states is covered by radar. Low altitudes which are distant from a radar site may not be in radar coverage.
22. You may hear the controller also tell you to "ident". The proper response to this instruction is to activate the ident feature of your transponder after entering the assigned code. This is simply a way of enhancing your radar identification for the controller.
23. When entering transponder codes, there are certain number combinations that should be avoided. Some squawk codes have been assigned for use during special circumstances.
24. Some transponder codes are specific to an operation. For instance, 7700 is for emergencies, 7600 is for communications failures, and 7500 indicates to the controller you have been hijacked. Avoid going through these codes when dialing in your code.
25. Procedures for using the special transponder codes are spelled out in the aeronautical information manual.

Air Facts: Getting to Know You

Private Pilot Chapter 5 – Video Segment 2

In this section we'll explain why every pilot should know an air traffic controller. It really helps the relationship if you meet and talk with them.

Review:

1. Normally, controllers are happy to have you visit their facility in order to understand better what goes on there. You'll need an appointment.
2. ATC controllers will do everything they can to accommodate any request that you make when flying.
3. That doesn't mean that you will always get what you request.
4. Controllers don't say no on general principles; there is always a good reason.
5. Phone numbers for air traffic facilities can be found online.
6. When you call, you may get into a scheduled program, or you may be handled on an individual basis.
7. Sometimes a controller will come to your flying club meeting if invited.
8. Controllers are people like you. They do their job to the best of their ability. However, if you have a question regarding the way you were handled, call them on the phone after your flight.

Magnetic Compass

Private Pilot Chapter 5 – Video Segment 3

In this section we'll explain how your magnetic compass functions. It's a required instrument and you'll find it simple in construction.

Review:

1. The magnetic compass is usually the only north seeking instrument in training airplanes. Two magnetized needles are mounted under a float with the compass card attached. This assembly is mounted on a pivot which allows the card to tilt up to 18 degrees.
2. The whole assembly is sealed in a chamber filled with a high grade petroleum distillate to dampen the oscillations of the card, lubricate, and take some weight off the pivot.
3. Actually, the magnets and compass card remain stationary, while the airplane turns around the compass card.
4. The magnetic field surrounding the earth has lines of force approximately oriented to the magnetic poles. The South Pole end of the magnetized needles are attracted to the earth's magnetic North Pole.
5. These lines of magnetic force are parallel to the surface at the magnetic equator and increasingly dip downward until they are vertical at the magnetic poles. This dip is the cause of some of the major compass errors.
6. During straight-and-level, steady speed, flight the card stays level and doesn't allow the magnetized needles to dip. When turning the airplane, or changing airspeed, the compass card tilts and does not show your real heading.
7. These turn errors are greatest on a north and a south heading. On northerly headings the compass will lag behind the airplane. On southerly headings the compass will lead the airplane. Lead and lag error is minimal at the magnetic equator and is greatest at the magnetic pole.
8. In the lower U.S. the error is generally 30 to 35 degrees. Compass turns should be made at a shallow bank to keep the card from locking against the case.
9. At the beginning of a turn from a northerly heading, the compass will show a turn in the opposite direction – it lags the turn.
10. This lag error is greatest on a north heading and decreases as the heading approaches either east or west. There is no lag or lead error on headings of east and west.
11. Continuing the turn to south, after passing through an east heading the compass starts leading the airplane and indicates a heading of about 210 degrees when the airplane is headed south.
12. The memory device NOSE can help you remember lead and lag. N is for north, O for opposite, S for south and E for exaggerate.

13. When decelerating, the aft end of the compass card is tilted downward. When you are speeding up, the compass card tilts upward. When the compass card is tilted its reading is compromised.
14. On headings of east and west, acceleration error appears as a turn to the north and deceleration a turn to the south. The memory device ANDS will help you remember the effects of acceleration and deceleration – A - acceleration, N - north, D - deceleration, S - south.
15. The error diminishes as headings approach north and south with no acceleration or deceleration error on magnetic north and south headings.
16. Most training airplanes have a heading indicator – a gyro instrument – which precesses. It should be reset every 15 minutes to the compass indication.
17. The magnetic compass is self-powered and doesn't need electricity or vacuum to work.

Closer Look: Finding A Smoother Ride

Private Pilot Chapter 5 – Video Segment 4

Learning to fly “comfortably” should be a priority. Here’s how:

Review:

1. Consider the height of haze layer. If you climb out on a typical summer day, you’ll bump along for the first 5,000 feet in hazy air. Then, if you’re paying attention, you’ll notice there’s almost a line in the sky: above is clear blue, below is murky. That’s the top of the haze layer - above it will most likely be smooth air and a nice ride.
2. Gusty winds almost always translates to turbulence. This is usually the worst within a few thousand feet of the surface
3. The combination of strong winds or full sun over uneven terrain can create some memorable turbulence, so be alert if your departure or destination airport takes you over rugged terrain.
4. The next weather phenomena to consider is thermals - the rising columns of air that are created by the sun’s heating of the earth and then the release of that heat back into the atmosphere. Large, flat, dark spaces like parking lots and freshly-plowed fields are the best thermal creators, while wooded areas don’t absorb as much heat.
5. Whether clouds are cumulus or stratus is a good indicator of the stability of the air aloft. Big, billowing cumulus clouds usually mean there’s some lifting action in the atmosphere, while flat stratus clouds often indicate more stable air.

Performance Charts

Private Pilot Chapter 5 – Video Segment 5

Airplane performance can be defined as the capability of an airplane to operate effectively while serving a specific purpose. Among the elements of performance are takeoff and landing distances, rate of climb, ceiling, speed, maneuverability, stability, payload, and fuel economy.

Review:

1. Airplanes are designed with specific performance goals. This explains the design differences among various types of airplanes.
2. The density of the atmosphere has a direct bearing on airplane performance. Airplanes perform better when the atmosphere is dense.
3. Pressure, temperature, and humidity affect the density of the atmosphere. The atmosphere is denser when pressure is high with both temperature and humidity are low. Low pressure, high temperature, and high humidity make the atmosphere less dense.
4. Density altitude is pressure altitude corrected for non-standard temperature. If pressure altitude and temperature are known, density altitude can be determined by either using a density altitude chart or an E6B.
5. If an altimeter is available, simply set the barometric scale to 29.92 inches of mercury and read the pressure altitude.
6. Before trying to use a performance chart or table for the first time, take a minute to acquaint yourself with it. The density altitude chart has temperature on the horizontal axis – both Fahrenheit and Celsius. The vertical axis of the graph is labeled density altitude.
7. Close to the top of the chart the lines which slope up from left to right are labeled pressure altitude. Work a few examples.
8. Standard temperature at sea level is 15 degrees Celsius and the standard lapse rate is about 2 degrees Celsius per thousand feet.
9. Conversion between Fahrenheit and Celsius can be made using the temperature scale.
10. Electronic calculators have a density altitude function that requires pressure altitude input. This converts indicated altitude to pressure altitude as part of the density altitude function.
11. For actual flight planning, you'll need to use the charts and tables specifically developed for the airplane you are flying. The data may be in tabular form, graphs, or a combination of tables and charts.
12. Usually there is a sample problem included. Work this out and others to become familiar with your aircraft.
13. Takeoff and landing distances are affected by several variables including density altitude, airplane weight, runway slope, runway condition, and wind.
14. If the wind direction is at an angle to the runway, the amount of the headwind must be determined using either a graph or aviation calculator. Practice a few examples.

15. Working with a graph is easy as long as you remember to enter at the proper point and follow the guide lines up or down to reach the variables involved.
16. A landing distance chart is similar to the takeoff chart in many ways. Practice the sample problems for each.
17. Before attempting to land at a short strip, check the distance required for takeoff from that strip.
18. When working these problems, don't forget to apply any notes that are applicable.
19. If the variables don't fit the table you can interpolate.
20. If the conditions of the day make it necessary to calculate the takeoff or landing distance that precisely, wisdom suggests waiting for more favorable conditions of wind, temperature, and pressure.
21. Keep condition such as temperatures, altitude, and runway lengths in the back of your mind. Know those that are close to the edge of your airplane's capabilities. Establish a conservative envelope for operating the airplane.
22. Finally, consider the variables that are not factored into performance, for example pilot ability and condition of the airplane.

Air Facts: When Enough’s Not Enough

Private Pilot Chapter 5 – Video Segment 6

The performance numbers we get for airplanes are based on new airplanes flown by professional test pilots in perfect conditions. There aren't really any margins there. The intelligent use of performance numbers becomes a matter of you developing your own margins.

Review:

1. There are no discussions of margins nor are there any guidelines in the pilot's operating handbook regarding them.
2. You have to devise our own minimum margins based on your experience and the type of airplane you are flying.
3. For example, the required runway length for airliners is based on a calculated speed called. They must have enough runway to stop at any time before reaching V1.
4. Furthermore, they must have enough performance after the failure of one engine to continue the takeoff after reaching that speed.
5. This type of reasoning can apply to us as well – we can say that in light airplanes, on takeoff, we should have enough runway to accelerate to liftoff speed and then be able to stop on the remaining runway.
6. Some of the distances shown in the handbooks, are pretty much on the short side. Any adverse factor could add substantially to your takeoff run.
7. You can apply this kind of thinking to landing as well. You want to develop a conservative margin of safety above what the operating handbook lists.
8. Do the same for fuel range. Rather than consider miles flown till the tanks are dry, think time of flight. Fuel runs out of the tanks on the basis of time not miles flown.
9. Also, never believe the fuel gauges to determine if you have full fuel – look into each tank. If the airplane was filled on an unlevel surface, with one wing lower than the other, you might be short several gallons.
10. If you are sure they are full, subtract some fuel from the listed capacity for taxi, takeoff, and climb. Then subtract an hours fuel at normal cruise from what is left.
11. You will also want to consider the wind and develop margins to handle it as well. A good way to think of this is to double the forecast headwind or halve the forecast tailwind in case the forecast isn't what it was projected to be.
12. Remember, the number one cause of accidents in single-engine airplanes is engine failure. And the number one cause of engine failure is fuel exhaustion.

Flying to a Towered Airport

Private Pilot Chapter 5 – Video Segment 7

Now that we have gotten our feet wet talking to ATC during flight following, let's take some flights into and out of a Class D airport.

Review:

1. Many tower controlled airports have Automatic Terminal Information Service. ATIS is the continuous broadcast of recorded noncontrol information such as current weather conditions and NOTAMS.
2. ATIS is continuously broadcast over a discrete VHF frequency or the voice portion of a local NAVAID.
3. You should be able to receive the ATIS transmission up to sixty nautical miles from the ATIS site. You should also be able to receive the transmission when on the ground at the ATIS airport.
4. Listen to the ATIS broadcast prior to arrival or departure from an airport with this system. This will help relieve congestion on approach control, ground control, and local control frequencies. You will simply advise the initial controller the phonetic identification for the broadcast that you listened to.
5. ATIS information includes the latest METAR, the instrument approach, and the runways in use. Information for arriving VFR aircraft may also be on the ATIS. This could include how far out to contact approach control and the frequency to use.
6. The ATIS is normally updated near the top hour, but can be updated at any time when a significant change in the weather is observed. A new recording is also made for a change in other information such as runway or the instrument approach in use.
7. Pilots are expected to monitor the ATIS broadcast before contacting clearance delivery, ground control, tower, or approach control.
8. ATIS broadcasts are subject to change at any time. To make the system work, pilots have to tell the controller which ATIS was monitored. This is done on initial contact with any of the tower functions.
9. You may not enter the Class D airspace until you have established radio contact with the controller. This means the controller must acknowledge you with your call sign.
10. An initial call to ATC by a student pilot should include the words "student pilot" at the end of the transmission. This allows the controller to provide the student with extra assistance. It will also encourage the controller to slow down and have patience with the pilot.
11. The "student pilot" identification should be added to the initial contact with each subsequent air traffic control station.
12. Your entry into the traffic pattern at a tower controlled airport may be on any of the four legs. The tower controller will advise his instructions based upon the runway in use and the direction from which you are approaching.

13. At some point, the tower controller will clear you to land. Unless you hear this clearance and confirm it with a read back, do not land.
14. If you are working on landings at a tower-controlled airport, you may decide to ask the tower for "the option." When cleared for the option, the controller is giving you permission to make your landing a touch-and-go, stop-and-go, or full stop landing.
15. Landing clearance at a tower controlled field may include a land and hold short requirement. You may accept the land and hold short clearance provided that you can determine that your aircraft can safely land and stop within the Available Landing Distance.
16. Available Landing Distance data is published in the special notices section of the chart supplement and in the U.S. Terminal Procedures Publications. Controllers will also provide this data upon request.
17. If you are a student pilot or are not familiar with land and hold short operations, you should not participate in the program.
18. You, as the pilot in command, have the final authority to accept or decline any land and hold short clearance. The controller will require a full read back of any accepted land and hold short clearance.
19. Once you have accepted a Land and Hold Short clearance, you must adhere to it unless an amended clearance is obtained or an emergency occurs. If you are unsure that you will be able to stop prior to the hold short point, initiate a go-around and advise ATC.
20. If you are unsure that you will be able to stop prior to the hold short point, initiate a go-around and advise ATC. You are responsible for maintaining aircraft separation during a rejected landing.
21. After landing and reaching taxi speed, you should exit the runway promptly at the first available taxiway or on an ATC instructed taxiway. Do not exit the landing runway onto another runway unless authorized by ATC. Do not stop or reverse course on the runway without ATC approval.
22. Taxi clear of the runway and bring your aircraft to a stop unless otherwise directed by ATC.
23. Change to the ground control frequency when advised by the tower. The tower may omit the ground control frequency if the controller believes you will know the frequency.
24. At slower times, the tower controller may be fulfilling the function of ground control as well. He may have you stay on the tower frequency during taxi operations. Follow his instructions.
25. After landing and reaching taxi speed, you should exit the runway promptly at the first available taxiway or on an ATC instructed taxiway. Do not exit the landing runway onto another runway unless authorized by ATC. Do not stop or reverse course on the runway without ATC approval.
26. Obtain your taxi instructions from the ground controller. Read back the instructions and comply with any hold short requirements that you are assigned. Compare the instructions to your taxiway charts and signs that you see after you have completed your read back.

27. When taxiing, you must receive a specific runway crossing clearance to cross or operate on any active, inactive, or closed runway along your route.
28. When departing from a tower-controlled airport, you should listen to ATIS before making any calls to ATC.
29. The ATIS broadcast will provide you with necessary wind and altimeter information. It will also provide you with pertinent NOTAMs that may not have been available during your preflight planning and it will give you an idea on the runway to expect for departure.
30. At less busy tower-controlled airports, typical of a Class D airspace airport, your VFR clearance will be obtained from ground control or the tower.
31. When ready to taxi onto the movement area of the airport, contact ground control. Advise them where you are located on the airport, what your departure plans are, that you have the appropriate ATIS information, and that you are ready to taxi.
32. The ground controller will give taxi instructions to a specific point on the airport and may provide you with a clearance. Write down these instructions and read them back to the controller.
33. You are expected to taxi to the approach end of the runway assigned unless ATC assigns or approves your request for an intersection departure.
34. Unless told otherwise, monitor ground while performing your before takeoff checks. When ready for takeoff, switch to the tower frequency and call to advise.
35. Don't call the tower at a busy airport until you are number one for takeoff at your location.
36. When the tower advises you to "fly or maintain runway heading," this is precisely what the controller means. You are expected to fly or maintain the magnetic heading that corresponds with the extended centerline of the departure runway. Do not apply drift correction in this situation.
37. If you need to change frequency to open your flight plan before leaving the tower's airspace, contact the controller with this request. He may or may not ask you to report back to his frequency once your flight service communications are complete.
38. During the normal course of your departure, the tower controller may release you from his frequency, but this is not a requirement. Once you are clear of the tower's airspace, you are free to change to your next frequency.
39. You might also want to contact the tower controller as you are departing the airspace if you need to obtain a frequency for flight following.

Max Performance Takeoffs and Landings

Private Pilot Chapter 5 – Video Segment 8

In this section we will investigate short-field and soft-field maximum performance takeoff and landing techniques.

Review:

1. Taking off and climbing from fields where the takeoff area is short or the available takeoff area is restricted by obstructions requires that the pilot operate the airplane at the limit of its takeoff performance capabilities.
2. You must learn to control attitude and airspeed so that takeoff and climb performance results in the shortest ground roll and the steepest angle of climb.
3. To do this, you must be completely knowledgeable regarding the best angle of climb speed and best rate of climb speed for your airplane.
4. The best angle of climb speed, VX, is the speed that produces the greatest gain in altitude for a given distance over the ground.
5. The best rate of climb speed, VY, is the speed that produces the greatest gain in altitude per unit of time.
6. When making a short-field takeoff, start as close to the beginning of the takeoff area as possible. Set your flaps as recommended by the manufacturer before starting the takeoff roll.
7. After getting lined up, advance up to allowable or maximum takeoff power before you release the brakes.
8. During the takeoff roll, adjust the airplane's pitch attitude to provide minimum drag – allowing for the fastest acceleration. As you reach VX, firmly apply back elevator pressure until airborne and maintain that speed until obstacles have been cleared or until reaching at least 50 feet above the ground.
9. Don't try to pull the airplane off the ground too soon or climb at too steep an angle. This could cause the airplane to settle back to the runway or into obstacles.
10. Now lower the pitch attitude to attain VY.
11. At a safe maneuvering altitude, slowly retract the flaps.
12. The objective of a soft-field takeoff is to get the airplane flying as soon as possible to eliminate the retarding force of soft surfaces like mud, sand, high grass, or snow.
13. During a soft-field takeoff, you want to get the airplane's weight carrying capability moved from the wheels to the wings as soon as possible. You do this by establishing and maintaining a nose high pitch attitude by use of elevator control as soon as possible during the takeoff roll.
14. Set your flaps as recommended by the manufacturer prior to starting the takeoff roll. Once you start to taxi keep moving so you don't get bogged down in the soft surface. When lined up for departure, apply takeoff power.

15. As the airplane accelerates, apply enough back elevator pressure to maintain a positive angle of attack and keep the weight off the nose wheel.
16. In this attitude the airplane will fly itself off the ground – lifting off and flying at a slower airspeed than you are accustomed to. This is due to ground effect.
17. Roughly, ground effect extends up to a height above the ground equal to your airplane's wingspan.
18. Once flying, and while just above the ground, slowly lower the pitch attitude and let the airplane accelerate to VX if you have to clear obstacles.
19. If no obstacles are in the way, accelerate to VY. Don't attempt to fly out of ground effect before reaching a safe airspeed. If you do so, the greater induced drag may cause the airplane to settle back to the ground.
20. Once you have established VY, and reached a safe maneuvering altitude, then slowly raise the flaps.
21. A short-field approach and landing, especially over obstacles, presents a unique challenge.
22. In a short-field landing, you have to use a low speed, power-on type of approach right to touchdown, because you must control the rate of descent and airspeed accurately.
23. You do this so you touch down at the slowest airspeed to stop in the shortest possible distance.
24. The use of full flaps is usually recommended. Adjust the power and pitch attitude to maintain the manufacturer's recommended approach speed.
25. If you are too high, reduce power and lower the pitch to increase the descent without increasing airspeed. If too low, increase power and raise the pitch attitude to slow the rate of descent without lowering airspeed.
26. Don't get too slow. Adding full power and increasing pitch may only increase the rate of descent. In this case, you are operating on the back side of the power curve.
27. Touchdown in an attitude that will produce a power-off stall when you reduce the power to idle. Hold the elevator control full back, and firmly apply brakes.
28. In making a soft-field landing, use flaps as recommended by the airplane's manufacturer. Use the same final approach speed as you did for the short-field landing.
29. After the round-out, fly the airplane just above the surface. Do this as long as practical so you can be as slow as possible at touchdown.
30. Once down, hold the airplane in a nose high attitude with full back elevator pressure. This is to help keep the nose-wheel clear of the surface while you slow down. You don't want it to dig in.
31. Don't use the brakes. In fact, you might have to add power to keep moving and prevent becoming bogged down.
32. NOTE: When faced with making a short, soft-field takeoff or landing, don't, except under the most dire emergency situation.

Closer Look: ADS-B

Private Pilot Chapter 5 – Video Segment 9

In this section we will take a closer look at ADS-B or Automatic Dependent Surveillance – Broadcast.

Review:

1. As part of the FAA's NextGen initiative to modernize ATC, ADS-B will eventually replace radar as the primary tool for separating aircraft.
2. A-D-S-B is different from radar in that it does not depend on radar sites actively pinging aircraft as they fly. Instead, aircraft equipped with A-D-S-B self-report their position in a networked environment, so pilots can see the entire air traffic picture around them
3. ADS-B depends on a network of small antennas to receive aircraft reports and send them back to ATC. These ground stations also transmit weather and traffic information back up to properly-equipped aircraft.
4. ADS-B Out is a surveillance technology for tracking aircraft--it's what ATC needs to manage traffic. An A-D-S-B Out transmitter reports your aircraft's position, velocity and altitude once per second.
5. ADS-B In allows an aircraft to receive transmissions from ADS-B ground stations and other aircraft. This is how pilots can get subscription-free weather and traffic in the cockpit.
6. Flight Information Services-Broadcast (FIS-B) is just a fancy name for datalink weather.
7. Traffic Information Services-Broadcast (TIS-B) is what the name suggests--datalink traffic.

Federal Aviation Regulations

Private Pilot Chapter 5 – Video Segment 10

To apply for your private pilot certificate, you must meet the federal aviation regulations concerning aeronautical experience and flight proficiency that apply to cross-country flights.

Review:

1. The FARs state that you must receive twenty hours of flight instruction including at least 3 hours of cross-country.
2. These 3 hours of cross-country training must include at least one night cross-country flight of over 100 nautical miles.
3. You also need 10 hours of solo flight time that includes at least 5 hours of solo cross-country. Each cross-country flight must have a landing more than 50 nautical miles from the original departure point.
4. One flight must be at least 150 nautical miles, with full-stop landings at a minimum of 3 points, and at least one segment of 50 nautical miles or more.
5. An endorsement in your logbook from an authorized flight instructor is necessary to state your competency in cross-country flight.
6. Before starting a cross-country flight, you will have to plan the flight thoroughly.
7. To fly VFR in the daytime, you need enough fuel to fly to the first point of intended landing, and to fly after that for at least 30 minutes at normal cruising speed. At night, the time increases to 45 minutes.
8. Any VFR flight above 3,000 feet AGL must maintain the appropriate altitudes. If you are on a magnetic course of 0 degrees through 179 degrees, you will need to maintain an odd thousand foot altitude plus 500 feet. If you are on a magnetic course of 180 through 359 degrees, you need to maintain an even thousand foot altitude plus 500 feet.
9. For other rules, review Volume 3, What You Should Know Before You Solo.
10. Your instructor is the final authority as to when you're ready.

Cloud Formations

Private Pilot Chapter 5 – Video Segment 11

All changes in weather are due to variations in solar energy received by the different regions on Earth.

Review:

1. The amount of solar radiation received depends upon time of day. It will vary for any particular spot with season, and for the globe as a whole with latitude.
2. Variations in solar radiation create differences in temperature which, in turn, create areas of high and low atmospheric pressure.
3. During the day the heat received is greater than the heat that's lost in the form of terrestrial radiation. At night the situation is reversed.
4. Often, fog forms just after sunrise, as the coldest temperature is approached.
5. During the afternoon, the maximum daily temperature occurs several hours after the sun is directly overhead.
6. Seasonal variations of solar radiation occur because the axis of earth tilts to the plane of Earth's orbit around the sun and the axis always points in the same direction.
7. For example, during June, July, and August the sun is higher in the sky in the northern hemisphere making it warmer than the southern hemisphere due to the more intense sunshine.
8. There is a temperature gradient from warm equator to cold poles which drives the weather machine.
9. Because water has a tremendous capacity to absorb heat, large water bodies heat and cool more slowly than the adjacent land areas. As a result, temperature variations near the water are much smaller than temperature variations further inland.
10. A light colored surface will reflect a large portion of the solar radiation. A dark surface will absorb most of it.
11. There are two basic cloud forms – cumulus and stratus.
12. Cumulus clouds have some vertical development, and result from rising currents of air. They represent unstable, but not necessarily bad flying weather.
13. Stratus clouds form in horizontal layers. They result from the cooling of a stable layer. Stratus clouds represent stable flying, but not necessarily good flying conditions.
14. Clouds are also classified into four families according to their altitude – low clouds, middle clouds, high clouds, and clouds that develop vertically and may span all three levels.
15. High clouds are called cirrus and are almost entirely ice crystals. Their bases range in altitude from about 16,500 to 45,000 feet.
16. Cirrocumulus clouds are high clouds formed by rising currents of air that cool as they rise. They look like puffy patches.

17. Cirrostratus clouds indicate a high-level stable layer that was cooled enough for clouds to form. Cirrostratus look like a uniform layer high in the sky.
18. Middle-level cloud bases extend from 6,500 to about 23,000 feet and are more frequently made of water than ice crystals.
19. Middle-level clouds are named using the prefix alto.
20. Altocumulus clouds are cumuliform clouds, indicating rising air currents and an unstable layer.
21. Alto-stratus clouds are stratiform clouds indicating the cooling of a stable layer.
22. Stratus clouds, producing precipitation, are called nimbostratus. They have a high water content and may be thousands of feet thick.
23. Low-level cloud bases extend from the surface to about 6,500 feet. Low-level clouds are mostly water but may contain supercooled water drops which cause aircraft structural icing.
24. Low-level clouds include stratus – layered clouds indicating a cooled stable layer at low-levels, and cumulus, indicating low-level vertical currents. A third type is stratocumulus – part cumulus and part stratus.
25. Vertically developed clouds, the fourth family, indicate increased instability in the atmosphere. The extensive vertical development shows rising currents are penetrating high into the atmosphere.
26. Towering cumulus and cumulonimbus, the thunderstorm cloud, indicate turbulence, wind shear, lightning, and possibly hail, and are quite an aviation hazard.
27. Towering cumulus are tall cumulus clouds that may have enough energy to grow into cumulonimbus.
28. Cumulonimbus may extend to an altitude of 60,000 feet or higher. These powerful storms are an extreme aviation hazard and must be avoided.

Atmospheric Stability

Private Pilot Chapter 5 – Video Segment 12

Atmospheric stability is an important concept for pilots to understand and it is a major factor when determining when rain showers and thunderstorms might develop.

Review:

1. In an unstable atmosphere vertically moving currents of air continue to move upward, possibly developing into cumulus clouds.
2. Temperature changes caused by expansion or compression are called adiabatic temperature changes.
3. As a volume of atmosphere expands, there is more distance between molecules, and therefore fewer collisions. So the temperature is lower. The standard ambient lapse rate is two degrees Celsius per 1,000 feet of altitude change.
4. The dry adiabatic lapse rate is three degrees Celsius per 1,000 feet.
5. Humid air at the surface is a good indicator of instability and the formation of afternoon thunderstorms. Whether the atmosphere is stable or unstable is determined by the ambient lapse rate and the amount of low-level moisture.
6. Clouds are good indicators of stability, but there are more clues you can use. For example, if the temperature is constant or rises as altitude increases the air is stable.
7. An inversion occurs when temperature rises as you ascend. A telltale sign of an inversion is an elevated layer of low visibility caused by the trapping of pollutants and other airborne particles in the stable layer.
8. If the temperature decrease approaches 3 degrees Celsius for every 1,000 feet of ascent, suspect unstable conditions especially if the air near the ground is moist.
9. When stable air crosses a mountain barrier, flying is relatively smooth on the windward side and standing lenticular clouds may form.
10. Always anticipate mountain wave turbulence when stable air is blown by strong winds of 40 knots or greater across mountain ridges.
11. Another cause of turbulence is wind shear which is the change of wind direction, wind speed, or both. Low-level wind shear is always present in thunderstorms.
12. Wind shear can lead to a stall – especially dangerous near the ground.
13. The low-level inversion may also be a wind shear zone – found just above the inversion.
14. Thunderstorms always have wind shear in and around them. Gusts in all thunderstorms can cause stalls and the downbursts associated with thunderstorms can be a deadly hazard to aviation.
15. All fronts are accompanied by a change in wind. Winds ahead of a cold front are usually from the south through southwest and behind the cold front blow from west through north.
16. Ahead of a warm front the wind is from the east through southeast and after warm frontal passage the winds blow from the south through the southwest.

17. Icing is another major weather hazard to aviation. Icing occurs when flying through visible water such as a cloud or rain and the temperature where the water strikes the aircraft is freezing or below.
18. Freezing rain will cause the most rapid and severe ice accumulation.
19. Frost can occur in clear air whenever the dew point temperature is freezing or below and the temperature of the airplane is equal to, or lower than, the dew point. Frost causes airflow separation reducing lift.
20. Never attempt takeoff with frost on the airplane.

Air Facts: Laying a Foundation

Private Pilot Chapter 5 – Video Segment 13

Because of the amount of IFR days during the year, you may want to consider acquiring an instrument rating as a next step in your learning process.

Review:

1. Practice studying the weather in relation to flying in VFR as well as IFR conditions. You may want to get an instrument rating somewhere down the line.
2. You will be on your own after you get your Private Pilot certificate. No one will be checking your preparation prior to your cross-country flights.
3. You will encounter days of MVFR weather. How will you handle it? Now is the time to set up personal guidelines and boundaries as to when you will fly and when you won't.
4. Legal is definitely not always safe. Remember that weather is only reported at a few airport locations – who knows what it's like in between?
5. To ensure a safe cross-county flight you want to set personal limits well above MVFR.
6. Start to study IFR weather as if you already have the rating. What would be safe IFR conditions for you? Now is a good time to be laying the foundation for the ability to interpret weather data for use on an IFR flight as well as on a VFR flight.
7. When you are flying VFR, you can often see the thunderstorms and avoid them.
8. When you are VFR, icing can happen only in relatively rare freezing rain conditions. In IFR, icing occurs in the clouds, usually when the temperature is between minus 15 and 0 degrees Celsius.

Winds Aloft, AIRMETs and SIGMETs

Private Pilot Chapter 5 – Video Segment 14

In this section we will continue our study of the weather and discuss winds aloft forecasts, AIRMET and SIGMET hazardous weather forecasts and how to get in-flight weather updates using ADS-B.

Review:

1. Winds, direction of weather, and weather movement are measured from true north. The exceptions to this are winds you get over the radio for takeoff or landing, which are given as "magnetic," as are PIREPs and ASOS, AWOS and ATIS voice messages.
2. Runways are numbered on the basis of magnetic north. This is because the instruments in your aircraft read magnetic. So, ATIS and ASOS voice broadcasts and telephone messages give winds relative to magnetic north.
3. But, when sending a METAR on the computer, the ASOS reports the winds relative to true north not magnetic. A way to remember this is, "If it's in print, it must be true."
4. Visibility is measured in statute miles. But the speed of weather movement and winds are measured in knots.
5. Temperature, wind direction, and speed are forecast for specific levels.
6. Wind is not forecast for levels which are less than 1,500 feet above a station.
7. SIGMETs (significant meteorological information) deal with convective conditions, specifically thunderstorms.
8. Severe weather forecast alerts indicate that a severe weather watch bulletin is being issued. Severe weather watch bulletins notify the public of areas of severe thunderstorms or tornadoes.
9. SIGMETs also advise of weather, other than convective activity, potentially hazardous to all aircraft – including severe icing, severe or extreme turbulence, dust storms, sandstorms, or volcanic ash.
10. Practice reading and interpreting SIGMETs.
11. AIRMETs deal with weather that may be hazardous to light aircraft and VFR pilots. They cover moderate icing, moderate turbulence, sustained surface winds of 30 knots or more, obscured mountains, and IFR conditions affecting more than half of an area.

Closer Look: The Standards (ACS)

Private Pilot Chapter 5 – Video Segment 15

In this section we will take a quick look at the airman certification standards that you'll encounter during the practical portion of your FAA test. As an example, turns around a point should be performed between 600 and 1,000 feet AGL.

Review:

1. The A-C-S integrates specific knowledge, skills, risk management elements and performance metrics for each task.
2. FAA inspectors and designated pilot examiners use these standards so that all pilot candidates will be tested to the same degree of proficiency.
3. Use the ACS, included in this program, as a self-critiquing guide during solo.
4. Included are items the examiner may quiz you on in the oral portion of the test.
5. We'll examine these test standards more completely in the next volume.

Basic Instrument Flying

Private Pilot Chapter 5 – Video Segment 16

Before the 1950's, most general aviation airplanes did not have equipment for instrument flight. After that period, weight and cost reductions made it possible to fully equip light airplanes for instrument flight.

Review:

1. The pilot must be trained and qualified to fly by reference to instruments. To reduce weather related accidents, certification rules were changed to require private pilot applicants to demonstrate basic instrument flying skills.
2. The skill level required is for emergency use of the flight instruments to survive an unintentional encounter with instrument weather conditions. It is not for unrestricted flight into instrument weather conditions.
3. In most weather related accidents, pilots lose control of the airplane because of spatial disorientation.
4. In this condition, the tendency is for a pilot to believe more of what he feels than the information from the flight instruments.
5. There are three sensory systems for orientation – vision, inner ear, and the nerves of the muscles, joints, and skin.
6. These confusing sensations can be made worse by making sudden head movements, especially when the airplane is turning or pitching.
7. You must disregard these sensations, and control the airplane by believing the instruments.
8. Flying the airplane on instruments is no different than flying with outside references.
9. Various combinations of pitch and power result in level, climbing, or descending flight. Coordinated banks result in turns.
10. The attitude indicator takes the place of the natural horizon – the only instrument which provides an instantaneous, direct, visual indication of the airplane's pitch and bank attitude.
11. The other flight instruments can only give us an indirect indication of the attitude.
12. The control performance method emphasizes the attitude indicator as the control instrument which is used to establish, change, and maintain attitudes. The other instruments are used to check the performance produced by the attitude of the airplane.
13. A second method labels instruments as being either primary or supporting. Primary is used to indicate the instrument which gives the most pertinent information and supporting indicates those instruments which confirm that information.
14. For example, in level flight, the altimeter is used as the primary instrument for pitch – airspeed and the vertical speed indicators could be seen as supporting.
15. Three skills are involved in all instrument flight. They are scanning the instruments, interpreting the instrument indications, and aircraft control.

16. An instrument scan must be developed before you can interpret the instrument indications.
17. Some common scanning errors are fixation, omission of an instrument, or too much emphasis on a single instrument.
18. Fixation occurs when you stare at one instrument. Omission of an instrument is usually caused by failing to anticipate the result of an attitude change. Eye scan studies show that proficient instrument pilots spend up to three quarters of the time looking at the attitude indicator.
19. The components of airplane control are power, pitch, and bank.
20. Trim must be used to relieve control pressures.
21. The instructor is responsible for watching for other aircraft. Simulated instrument flight is not done solo.
22. The attitude indicator simplifies pitch and bank control. Supporting instruments are the altimeter for level flight, and the heading indicator for straight flight.
23. When making small corrections, avoid over controlling.
24. The width of the attitude indicator horizon bar is an excellent reference for pitch changes to correct altitude.
25. Pitch changes to correct 100 feet or less of altitude should not exceed half the width of the horizon bar, or half a dot on indicators which do not have a wide horizon bar.
26. If altitude is off by more than 100 feet, initially use a full bar width or full dot of change.
27. For more precise control of bank, use the bank pointer and the banking index at the top of the attitude indicator, rather than the miniature airplane wings.
28. In straight flight, slight deviations from wings level can be corrected by using rudder. When correcting for a heading deviation, use coordinated aileron and rudder.
29. In straight-and-level flight, the vertical speed indicator should remain in the zero position. The airspeed indicator should show normal cruise speed. The turn coordinator or turn needle should be centered with the ball centered, showing coordinated flight.
30. Climbs and descents on instruments are to be made straight at constant airspeed. The pitch attitude for climbs and descents can be determined by checking the attitude indicator when making climbs and descents using outside references.
31. To enter a climb straight ahead, raise the nose of the miniature airplane to the approximate climb attitude while increasing to climb power. As the airspeed slows add nose up trim. Use right rudder to compensate for the left turning tendency.
32. With a constant power setting, airspeed changes can only be made by changing pitch. If a pitch change is necessary, use the attitude indicator and make small adjustments. Don't expect the airspeed to change quickly.
33. As the pitch change is made, the vertical speed indicator will show the trend by moving upward but will not show the actual rate of climb until several seconds after the climb stabilizes.
34. Use the heading indicator as the instrument for straight flight.
35. When the climb is stabilized, use the trim to relieve control pressure.
36. As a rule of thumb, a level off from both climbs and descents should be started approximately 10 percent of the rate of climb or descent prior to reaching the assigned

altitude. For example, at 500 feet per minute, start your level off 50 feet before the desired altitude.

37. As airspeed reaches cruise, reduce power to cruise power setting and make the final trim adjustment.
38. To enter a straight descent, first reduce power to the desired setting, and apply back pressure to maintain altitude.
39. To correct airspeed, make small pitch changes, using the attitude indicator to make the changes. When the airspeed is stabilized make the final trim adjustment.
40. Keep the wings level using the attitude indicator, and use the heading indicator to check for and correct deviations from the desired heading.
41. Turns by reference to the instruments should be limited to no more than standard rate. Turns of less than 30 degrees should be made at half standard rate.
42. Using coordinated aileron and rudder pressure, establish the desired bank on the attitude indicator. Use the banking scale on the top of the instrument.
43. At relatively shallow bank angles, very little back pressure is needed to maintain altitude.
44. If you are losing altitude, shallow the bank rather than adding a lot of back pressure. Check, but don't fixate, on the heading indicator.
45. To roll out, assuming a 15 degree bank, start the roll out about 8 degrees before reaching the new heading. Less bank will require less lead.
46. You'll be asked to close your eyes and take your hands and feet from the controls. The instructor will then put the airplane in either a diving spiral or a nose high attitude approaching a stall. You'll then be told to open your eyes take the controls and return the airplane to straight-and-level flight.
47. The attitude indicator will give you an instantaneous direct indication of the pitch and bank attitude.
48. Pitch attitude can be indirectly determined by the airspeed indicator, the vertical speed indicator, and the altimeter. The bank can be indirectly determined by the heading and turn indicators.
49. If the nose is high with the airspeed decreasing, use the same recovery technique used in the approach to the stall, add power to prevent altitude loss, lower the pitch attitude to the level flight position and level the wings.
50. The other possible unusual attitude is when the pitch attitude is below level flight, and airspeed is increasing. Reduce power to prevent excessive airspeed, level the wings, and then raise the nose to the level flight attitude.
51. Using radio aids to navigation, while controlling the airplane by reference to the instruments, adds to your workload both physically and mentally.
52. Your first concern is to fly the airplane. Keeping the wings level is a primary concern.

Air Facts: Calm in the Clouds

Private Pilot Chapter 5 – Video Segment 17

At first, flying on instruments will seem uncomfortable. Once you do it for a while, things get a lot better.

Review:

1. Learn to make gentle corrections and become smooth on the controls. A small altitude or heading adjustment can be done with very slight pressures.
2. Don't rush. Occasionally, relax your grip on the control wheel and lift your feet off the rudder pedals.
3. To prevent flying into adverse weather, always fly in conditions that are better than minimum.
4. Weather accidents often take two forms; the pilot flies into terrain or an obstruction or gets into clouds and loses control of the aircraft. In this second case, disorientation often leads to a graveyard spiral.
5. If this happens, you must roll the wings level and then pull the airplane out of the dive.
6. An airplane is not so stable in roll – concentrate on keeping the wings level.
7. Don't allow any distraction when you are turning.
8. Make gentle control inputs.

Flying Out of Trouble

Private Pilot Chapter 5 – Video Segment 18

In this section we investigate what to do if you encounter adverse conditions causing you to fly on instruments.

Review:

1. To reduce inadvertent instrument flight in IFR, become well prepared before you fly. Prevention is better than a cure. The best prevention is getting, and heeding, a preflight weather briefing.
2. In many weather related accidents, the pilot did not get a weather briefing or flew in the face of a bad one. In some cases, pilots thought they could handle forecast bad weather. In others, marginal conditions became worse than forecast.
3. Occasionally it turns out that the flight could have been made. However, don't look back on missed flights that may have turned out okay. Rather, consider all the times the poor forecasts were correct.
4. Don't fly when weather conditions are at the bare legal minimum requirements. In controlled airspace the legal VFR minimum is a 1,000 foot ceiling and 3 miles visibility. That's not much.
5. Be especially wary at night. Usually the first sign of clouds is when the ground lights disappear and the navigation lights glow in the cloud.
6. Keep up with what's happening to the weather while you are en route. Flight watch and flight service stations are there to serve you.
7. To ask for help, climb to enhance communications and radar detection. Communicate with the nearest ground station. Confess your predicament and comply with instructions.
8. If you are not sure of the frequency, use the emergency frequency 121.5. ATC will help you.
9. ATC can vector you to VFR or provide headings to keep you clear of obstructions.
10. The controller will determine your position. Then, he will tell you the minimum safe altitude for your location. He will then ask for more information such as fuel remaining, airspeed, and navigation capability.
11. Remember, in all of this, the final decision rests with you – you are PIC.
12. If fuel remaining allows, choose radar vectors. The controller will assign headings and altitudes to fly to VFR conditions.
13. If VFR conditions cannot be reached, you will have to make a radar approach to an airport – an ASR, approach.
14. The controller vectors the aircraft to a position on final at least 3 miles from the runway, and calls the aircraft position each mile from the runway.
15. He will give you the heading to fly, minimum altitudes, when to descend, how to abandon the approach, and the missed approach point.

16. If you are having difficulty controlling the airplane, request a no-gyro approach. This approach is used if the aircraft does not have a functioning heading indicator or the pilot is not able to maintain heading within reasonable limits.
17. During a no-gyro approach the controller will tell you when to start and stop turns.
18. On final approach the turns should be made at half standard rate.

Closer Look: ASOS - Behind the Scenes

Private Pilot Chapter 5 – Video Segment 19

Most weather observations come from an automated system called an ASOS - Automated Surface Observing System - or an AWOS - Automated Weather Observing System.

Review:

1. An ASOS is typically placed near a runway and is simply a collection of weather instruments. Measurements of temperature, dew point, and precipitation are measured by a thermometer, a hygrothermometer, and heated tipping bucket gauge, respectively.
2. Algorithms in the ASOS process the data to make a complete weather report.
3. Because it is not a human, there are limitations to what an ASOS can report. Tornadoes, smoke, snowfall accumulations, and virga are some of the meteorological phenomena that cannot be sampled by an ASOS.
4. An ASOS is often too slow to report a significant change in cloud cover.
5. AWOSs are very similar to ASOSs, but AWOSs can have fewer weather instruments.
6. METARs may be augmented or adjusted by FAA observers at major airports in the United States.
7. It is important to review the date and time when you read a weather observation to ensure it is the most up-to-date information available.

Lost and Found

Private Pilot Chapter 5 – Video Segment 20

In this section we will discuss the best way to handle getting off course, becoming lost, and asking for help.

Review:

1. A common problem on a cross-country flight is getting off course or temporarily becoming disoriented.
2. For example, unexpected poor visibility or a wind shift develops that causes you to miss seeing some checkpoints, causing you to drift off course.
3. As you proceed, you will keep track of each checkpoint and the surrounding terrain.
4. What if you don't see anything you recognize?
5. First of all, don't panic. You are probably just a bit off course.
6. Stay on your heading and watch for landmarks you might recognize while reviewing your calculations.
7. Use your calculated compass heading, time, and groundspeed, and figure where you would be in a no- wind condition. In this way you can estimate the distance from your last known position and determine a point within an area where the airplane may be located. This area is frequently called a circle of error.
8. Draw a circle around this point, 5 to 8 miles in diameter. You are somewhere in this circle.
9. Continue on your original compass heading and check the landmarks within this circle. Especially check on the downwind side of your course line, since the wind may have drifted you off course.
10. If possible, climb to a higher altitude so you can get a better view of the area.
11. When you find a recognizable landmark, continue on but don't make an abrupt course change until you verify with two or more additional landmarks that you are back on the course you want.
12. What if you can't figure out your location? If you have maintained your heading, turn toward the nearest concentration of landmarks shown on the chart and then reorient yourself. Or, if possible, land at a local airport and regroup.
13. Your ability to cope with a changing situation will prove invaluable in your flying career.
14. In the future, when weather, fuel, or simply changing your mind about a destination requires a diversion to an alternate, you will be able to do it successfully.
15. It's always good to have an out or an alternate plan if problems arise.
16. Once back on course, figure out what went wrong so the same mistake will not be made again.
17. When navigating only by pilotage and dead reckoning, make sure you keep an accurate time and checkpoint log. Adjust your wind correction angle to reflect actual wind speed

and direction if different than forecast. Double check that you are reading the map and compass correctly and are using the proper scale on the plotter.

18. Whenever possible, use radio navigation aids to help keep on course.
19. If you are using VOR, turn up the audio and listen to the voice or Morse code identifier to identify the station. If you don't hear one or the other, the station is probably down.
20. Try another VOR and see what happens – your VOR receiver may be inoperative.
21. If your VOR receiver isn't working, communicate your problem with FSS, ATC, or a local control tower if necessary. Use the emergency frequency of 121.5.
22. If you do contact ATC, you will be given a transponder code so they can identify you and your position. The controller will give you vectors to reach your destination.
23. Once you are in sight of your destination, the controller will let you go and say, "Radar service is terminated, squawk 1200. Frequency change approved."
24. If you plan well and fly your plan, the likelihood of having a real problem on any of your cross-country trips is remote.

ForeFlight Weather Imagery

Private Pilot Chapter 5 – Video Segment 21

The ForeFlight app is an excellent resource for flight planning and preflight weather, allowing you to view weather layers directly on the moving map.

Review:

1. For a more comprehensive collection of weather forecast charts and graphics, head over to the Imagery section of the app. This is the place to find prognostic charts, surface weather charts, cloud forecasts and much more.
2. By default, most images are for the United States, and come from the Aviation Weather Center at the National Weather Service.
3. In general, there's a loose top-to-bottom flow that mirrors the way you plan a flight: start with big picture weather maps and long range forecasts at the top, then work down toward current observations that affect smaller areas, like radar and PIREPs. it's easier to work through Imagery in a systematic way.
4. First, look at the big picture. Whether you're flying VFR or IFR, it's always smart to begin with a look at the major weather systems.
5. Where are the highs and lows, the cold fronts and warm fronts? Where are these systems forecast to move? Use the Prog Charts product to answer these questions, and get an overview of major weather trends.
6. 6 Hr Qty of Precipitation and 12 hour Prob of Precipitation (or PoP) are oddly-named charts, but they're really valuable. That's because, while moisture or precipitation doesn't necessarily equate to bad weather, there's often a correlation.
7. In the winter, areas of precipitation often mean icing aloft; in the fall it might mean IFR conditions. Get a general sense of where the moisture is and where it's moving (or not as the case may be).
8. The other benefit of these precipitation forecasts is that they stretch out far into the future. Whereas TAFs are fairly near term forecasts, the PoP forecast goes out to 7 days. That's valuable if you're planning the return leg of an out and back trip. Use it to get a general sense of the long term weather trends.
9. The final piece of the "big picture" briefing is a look at convective hazards, which you can find in the last three maps in the first section (CONUS weather).
10. Convective hazards can be added to your knowledge of the precipitation areas to determine whether that precip is just rain or perhaps something a lot more serious.
11. With that background in mind, the graphical aviation forecasts will make a lot more sense. You'll find two different types of charts here – cloud and surface forecasts. Both rely on computer models to generate the data shown on the charts.
12. The Cloud forecast maps graphically depict cloud coverage across the U.S. and includes AIRMETs for ice and mountain obscurations.

13. The surface chart forecasts visibility, surface winds, precipitation and other weather hazards.
14. Next it's time to consider the full three dimensions of the atmosphere. Specifically, ForeFlight offers forecasts for three conditions at altitude – winds, icing and turbulence.
15. The winds aloft forecast maps are helpful for choosing the fastest cruise altitude, but they are also valuable for understanding how the highs and lows are moving.
16. For instrument pilots, the icing forecasts are essential maps. You can get a detailed look at potential in-flight icing risks, by both altitude and time.
17. The legends on the icing forecasts explain the colors well, but make sure you know whether the chart you're viewing forecasts the probability of icing (that is, how likely it is that icing conditions exist) or the severity of icing (whether any ice will be light, moderate or severe). You could be flying in an area where the probability is high but the severity is low - or vice versa.
18. Comparing different altitudes will tell you which altitudes might be above or below any potential icing.
19. The turbulence charts can help you find a smooth ride. Like the winds aloft, they are divided into low-level, mid-level, and high-level sections, with each section showing specific altitudes and forecasts out to 18 hours.
20. The turbulence charts are further divided by the cause of turbulence: clear air or mountain wave.
21. Like the icing forecasts, the turbulence maps are model-driven, so back them up with actual Pilot Reports.
22. All three of the upper level products - winds, turbulence, and icing - make it easy to plan not only your route, but the right altitude.
23. So far we've dealt with mostly forecasts – that is, predictions about what might happen. These are helpful, especially if your flight isn't for a few days.
24. As you get closer to your time of departure, you need more real-time, more regional information – observations instead of forecasts. The three main observations in ForeFlight are satellite, radar and PIREPs.
25. Remember that, that satellite, radar, and PIREPs can be overlaid on the Maps page.

Self-Serve Fuel

Private Pilot Chapter 5 – Video Segment 22

Many airports offer a self-serve fuel option at a cheaper price per gallon, which can offer big savings for large fill-ups and serve as a plan B for fuel when landing after hours when the FBO is closed.

Review:

1. First, identify the location of the fuel pump at the airport.
2. Park close to the pump, but not too close.
3. After shutdown, remove the keys from the ignition and verify the master switch is off.
4. All fuel pumps will have a grounding wire at the pump that has to be connected to the aircraft.
5. Swipe your credit card first and enter either how many gallons or dollars and fuel type you need.
6. Most pumps require you to activate the pump with a lever or switch before fuel will flow.
7. Fuel pumps for aircraft do not have an auto-shutoff so fill the tanks with caution to avoid over-fueling and spillage.
8. After the tank is fueled, immediately replace the cap.
9. Turn off the pump with the switch or lever, and retract the fuel hose when finished.
10. Make sure to leave the self-serve fuel pump the same as you found it.
11. Take a walk around the airplane to verify the fuel caps are on, the area is cleaned up, and your aircraft is ready to fly.

Chapter 6 – Your Private Pilot Test

Rules to Fly By

Private Pilot Chapter 6 – Video Segment 1

In this section we will discuss the FAA regulations that apply to you as the holder of a private pilot certificate.

Review:

1. Most of the FAA regulations are logical and provide a framework for good operating practices.
2. The pilot in command is directly responsible for, and the final authority as to, the operation of the aircraft. This comes with the accompanying responsibility for safe and legal operation.
3. The pilot in command may, in an emergency, deviate from any rule or clearance to the extent required to meet that emergency. A written report may be required.
4. Your pilot certificate has no expiration date. However, to fly legally you must have a current medical certificate appropriate to the kind of flying you will be doing.
5. Personal and business flying requires a third class medical and a private certificate. To fly for hire, you need a second class medical, and a commercial certificate. Air transport operations require an ATP and a first class medical certificate.
6. A third class medical is good for 60 calendar months if you're less than 40 years old. Over 40, it's good for 24 calendar months.
7. A second class is good for 12 calendar months except where the pilot needs only a third class for the type flying he'll be doing.
8. A first class is good for six calendar months for air transport operations and reverts to second class privileges for commercial flying and to third class privileges for personal and business flying.
9. All pilots must complete a flight review. A flight review is good for 24 calendar months, or until the end of the month, year after next.
10. Part of the flight review goes over the current general operating rules of FAR Part 91. The other part reviews proficiency in an aircraft for which the pilot is rated. You will have a minimum of one hour each of flight and ground instruction.
11. There are some exceptions to this rule.
12. The aeronautical training and experience used to meet the requirements for a certificate or rating, or the recent flight experience requirements of Part 61, must be shown in your logbook. The logging of other flight time is not required.
13. You log as solo only the time you are in the airplane alone. Pilot in command time is that flight time during which you are the sole manipulator of the controls of an airplane for which you are rated.

14. Pilot in command time is also when you are the sole occupant of an aircraft for which you are rated.
15. Instrument flight is only that time during which you operate the airplane solely by reference to instruments, under actual or simulated conditions.
16. Entries must include the place and type of each instrument approach completed, and the name of the safety pilot for each simulated instrument flight.
17. You'll use the time you logged to verify recent experience requirements.
18. You can't act as pilot in command of an aircraft carrying passengers unless within the preceding 90 days you have made three takeoffs and three landings as the sole manipulator of the flight controls in an airplane of the same class. This would be to a full stop in a tail wheel airplane.
19. At night, you can't act as pilot in command of an airplane carrying passengers unless, within the preceding 90 days, you have made three takeoffs and three landings to a full stop at night in the category and class aircraft to be used.
20. Night for this currency is defined as the period beginning one hour after sunset and ending one hour before sunrise.
21. If you change your permanent mailing address, you must notify the FAA Airman Certification Branch within 30 days to keep your certificate valid.
22. When you fly, you must have your pilot and medical certificates plus a photo ID in your possession or readily available in the aircraft. For a photo ID you need either a driver's license; passport, armed forces ID, or other credential acceptable to the FAA.
23. No person may act, or even attempt to act as a crewmember of a civil aircraft within 8 hours after the consumption of any alcoholic beverage, while under the influence of alcohol, while using any drug that affects the person's faculties in any way contrary to safety, or while having an alcohol concentration of zero point zero four or greater in a blood or breath specimen.
24. You can't carry a person as a passenger who appears to be intoxicated or under the influence of drugs, unless that person is under proper medical care or if it's an emergency.
25. Supplemental oxygen is required to be provided for all occupants when flying at a cabin pressure altitude above 15,000 feet. The crew must use it above 12,500 feet, except they can operate above 12,500 to 14,000 feet for 30 minutes without supplemental oxygen.
26. You can't do aerobatics over any congested area of a city, town, or settlement; over an open air assembly of persons; within the lateral boundaries of the surface areas of Classes B, C, D, or E airspace which is designated for an airport, within 4 miles of an airway centerline, below 1,500 feet above the surface, or when the flight visibility is less than three miles.
27. Any parachute that is worn must have been packed within the past 180 days if its canopy, shrouds, and harness are composed exclusively of nylon, rayon, or similar synthetics. If the chute is composed of silk, pongee, or other natural fibers it must have been packed within the past 60 days.

28. During takeoff and landing, and while en route, each required crewmember must be at his station unless absence is necessary in connection with the operation of the aircraft or in connection with physiological needs.
29. A crewmember must keep his seat belt fastened while at his station and must, if the airplane is so equipped, keep his shoulder harness fastened during takeoff and landing.
30. Other occupants must wear seat belts, and shoulder harness if installed, during taxi, takeoff and landing. It's the pilot in command's responsibility to brief passengers on the use of seat belts.
31. High performance airplanes have an engine of more than 200 hundred horsepower, while complex airplanes have retractable gear, flaps, and a controllable pitch propeller.
32. Before you may act as pilot in command of either a high performance or a complex aircraft, you must receive flight instruction and a logbook endorsement.
33. Before flying you must make certain there is an airworthiness certificate, a registration certificate, weight and balance data, equipment list, and operating limitations in the aircraft.
34. The operating limitations may be found in the airplane's flight manual, approved manual material, markings, placards, or any combination thereof.
35. The maintenance of an airplane is the operator's responsibility and the mechanic's job, but it is also the pilot in command's responsibility to determine that an aircraft is in condition for safe flight.
36. The airworthiness certificate is valid as long as the airplane is maintained in accordance with regulations.
37. If an aircraft is used to carry passengers for hire, or flight instruction for hire, it must have both an annual and a 100 hour inspections. If it's not used for hire, it must have only an annual inspection. Annuals are good for 12 calendar months.
38. Annuals, airworthiness directive compliance, and other maintenance, must be recorded in the aircraft's maintenance records.
39. Pilots can perform such minor maintenance as servicing the landing gear wheel bearings but the nature of the work, and the name, certificate number, and type of certificate of the person performing the work must be entered in the maintenance records.
40. Any work done that substantially affects an airplane's operation in flight, must be flight tested by a pilot with at least a private pilot certificate and approved for return to service prior to being operated with passengers on board.
41. A transponder must have been tested and inspected within the preceding 24 calendar months.
42. Emergency locator transmitters, ELTs, are installed in most aircraft in the United States. Non- rechargeable ELT batteries must be replaced when 50 percent of their usable life expires or when the ELT has been activated for more than one cumulative hour.
43. NTSB Part 830 defines what constitutes a serious injury and substantial aircraft damage. The operator of an aircraft must notify the NTSB immediately in the case of an aircraft accident.
44. In the case of an incident, a report must be filed only if requested.

45. The FAA has a safety reporting program designed to gather data about incidents in the hope of preventing future accidents. If you are ever involved in a situation where you believe it would help others to know about it, you should get a copy of Advisory Circular 00-46.
46. Your anonymity as the filer of the report is guaranteed unless you volunteer the information at a later date.
47. One other very real benefit to filing this form is that it grants you limited immunity from any FAA enforcement action that may be contemplated as a result of that particular incident.

Air Facts: 6 Rules for Cross Country Flights

Private Pilot Chapter 6 – Video Segment 2

Getting out of the traffic pattern and going on a real trip is a lot of fun. It may even be the reason you're learning to fly in the first place. But the same reasons these trips are so much fun - new places to see, a goal at the end of the flight - can lead to challenges if you aren't prepared.

Review:

1. When it comes to weather, wait for a sure thing. If you've been waiting on the clouds to lift or for the visibility to improve, don't take off until you think there's a very good chance of success.
2. Know what kind of air mass you're flying in. We've talked a lot about weather in this course, but one of the key questions to ask is whether the air mass you're flying in is unstable or stable.
3. Always have an out. This cliche is often used with weather, and that's very true, but it's equally applicable to fuel planning. If changing weather conditions mean you can't make your destination, have a good Plan B in mind.
4. Slow down. No matter how well you plan the flight, something will inevitably go wrong. When that happens - and especially if you're frustrated by it - force yourself to slow down and double check your last few steps.
5. Understand the terrain. If you're crossing a mountain range or even just flying over some foothills, consider the effect such terrain can have on your flight.
6. Use technology wisely. Recent advances in technology have made cross country flying easier and safer, and you should use these tools without hesitation.

Class C and B Airport Operations

Private Pilot Chapter 6 – Video Segment 3

Once you have mastered communications at a smaller Class D airport, moving on to an airport in Class C and B airspace is not that much more difficult.

Review:

1. You will likely find Tower, Ground, and Clearance Delivery controllers and an ATIS broadcast, much like you may have found at the slower airport.
2. Class C and B airspace will add approach and departure controllers to guide you into and out of the airspace.
3. The process will tend to be well aligned with the Aeronautical Information Manual and you will usually have fewer "non-standard" surprises.
4. The outer ring of Class C airspace is typically ten nautical miles from the center of the airport. An uncharted outer area will generally extend out to twenty nautical miles. You should contact approach control within the outer area, well before reaching the charted outer ring.
5. As with Class D airspace, listen to the ATIS broadcast before making initial contact with the controller.
6. During your initial contact with approach, advise the controller that you have the appropriate ATIS and your intentions. You will find a sector based approach control frequency on the Sectional chart. This frequency may also be found in the chart supplement.
7. If the approach controller does not acknowledge the airplane's call sign, in the eyes of the FAA, radio contact has not been established.
8. As you get closer to the airport, the approach controller will hand you off to the tower controller. The controller may not provide this frequency. You can be prepared by looking this frequency up prior to the handoff and having it set as your standby frequency. Alternatively, you can ask the controller for the frequency.
9. When you are ready to depart from the primary airport in Class Charlie airspace, a logical flow will help you to exit smoothly.
10. First listen to the ATIS frequency. At busier airports, it may be best to listen to ATIS before starting your engine.
11. At a tower-controlled field inside Class C or Class B airspace, your first ground contact with ATC will generally be on the clearance delivery frequency. This controller will provide the VFR clearance for your flight and may provide you with a unique transponder squawk code.
12. Taxi from your parking spot to the edge of the nonmovement area and contact ground for permission to taxi.
13. Continue to monitor ground frequency while completing your before takeoff checks. When ready to go, contact the tower.

14. Shortly after your takeoff, the tower will hand you off to departure. Change to the frequency assigned with your clearance.
15. The departure controller may continue to give you radar vectors or he may allow you to resume your own navigation. Be careful, "resume own navigation" does not release you from the controller. It simply allows you to follow your own course.
16. Once you are clear of the controller's airspace you will be specifically released from the frequency. Then and only then are you permitted to change from the controller's frequency.
17. Class B airspace is found around several of the busiest airports in the US. Radio communications for VFR flights to or from a Class B airport are not that much different than operations at a Class C airport.
18. There are regulatory differences between Class C and B airspace; the airspace and radio may be busier, but the communication procedures are very similar.
19. The shape of Class B airspace will be unique to the needs of the area. Your initial contact with the controllers should occur well outside the depicted airspace.
20. Five to ten miles outside the Class Bravo should provide sufficient time to get permission to enter the controlled area.
21. You must get explicit permission to enter Class B airspace. Simply establishing radio contact does not allow you to enter as it did with Class C and D airspace.

Closer Look: Your Deceptive Flying Mind

Private Pilot Chapter 6 – Video Segment 4

You'll probably realize early on in your flying career that being a pilot has a lot more to do with mental skills than physical ones. Here are some maladies that can affect the mind of a pilot.

Review:

1. Auto-rough is an engine malady that might strike you when you are flying at night, or over rough terrain.
2. The engine seemingly develops an insidious, underlying, grinding noise, or maybe it sounds like one of the spark plugs isn't firing properly.
3. You're sure it doesn't sound like it's supposed to. All the gauges look normal and nobody else in the cabin notices anything out of the ordinary – that's auto rough.
4. There is another affliction that affects pilots, and is more serious– it's called get-there-itis.
5. The pilot decides to fly even though the weather isn't good. He just has to get there.
6. Another example of get-there-itis is trying to stretch the fuel range of the airplane. He says something like, "There should be just enough fuel to make it."
7. Fuel exhaustion is the number one cause of engine failure.
8. Pilots are also susceptible to the thinking of "I made it last time".
9. If you took off on a recent flight when the weather was bad, but you made it to your destination anyway, make sure you don't you can always get away with the same poor decision making.
10. Lastly, watch out for "expectation bias", which occurs when you hear and react to what you expect to hear, not what was actually said by ATC.

Flight Plans

Private Pilot Chapter 6 – Video Segment 5

In this section we'll discuss filing a VFR flight plan and why this is important.

Review:

1. If you have a flight plan on file, and something happens to you along the way, someone will know to begin looking for you.
2. There are several ways to file a VFR flight plan, including calling Flight Service at 1-800-WX-BRIEF, filing online using the Flight Service website at www.1800wxbrief.com or by using the plan filing feature found in many aviation apps.
3. You'll enter information about the planned flight, including aircraft N#, type and designation, special equipment, true airspeed, departure point, proposed time off, and cruising altitude.
4. Continuing, supply your destination, estimated time en route, remarks, fuel on board, a possible alternate airport, personal data, the number of people on board, and the color of the airplane.
5. Usually you will file the plan at the same time you get your weather briefing.
6. You can also file a flight plan in the air by radio.
7. You can open your flight plan either electronically from your mobile app, or over the radio through Flight Service.
8. Close your flight plan on arrival. If you don't, first responders will start to search for you 30 minutes after your estimated time of arrival.
9. Close your flight plan by calling Flight Service on the phone, or using the Close feature in your mobile app, after you have landed. You can also close by radio in the air when you have the destination in sight and are very close to landing.
10. If you're planning on a fuel stop or lunch along the way – that can be noted in the remarks section. However, if you're planning on stopping for more than an hour, a separate flight plan is recommended.

Closer Look: Runway Markings

Private Pilot Chapter 6 – Video Segment 6

In this section we'll discuss two ways runways are marked – the displaced threshold and the closed runway.

Review:

1. The threshold of a runway is the designated beginning of the runway available for landing. Sometimes the threshold is not where the runway pavement begins – it has a displaced threshold. Touchdown should not occur prior to the threshold.
2. This may be for reasons of obstacle clearance, pavement stability, or even noise abatement.
3. The paved area behind this displaced runway threshold can be used for taxiing, landing rollout, and the beginning of the takeoff roll.
4. No operations should be conducted in an area marked with chevrons.
5. A large X at either end of the runway signifies a closed runway.
6. Look up the more complicated markings in the aeronautical information manual.

Weight and Balance

Private Pilot Chapter 6 – Video Segment 7

In this section we'll come to realize that a lot of the performance and handling characteristics of an airplane are a function of weight and balance.

Review:

1. In most 4-place or larger airplanes, you can either fill up the fuel tanks, or fill up the seats, but not both at the same time.
2. A maximum weight limitation is imposed on an airplane for safety. The performance of the airplane is affected by weight.
3. The weight and balance data is specific to an airplane; it will be in the POH or in the weight and balance data papers for each airplane.
4. The basic empty weight includes the airframe, engine, all permanently installed equipment or accessories, unusable fuel, and full engine oil.
5. Full oil is not included in the empty weight of some airplanes.
6. Be sure that the airplane's weight is within limits. Add the weight of the people, useable fuel, and baggage to the basic empty weight of the airplane.
7. Aviation gasoline weighs six pounds per gallon.
8. The balance part of weight and balance is equally important. The center of gravity, CG, is the point at which the airplane would balance – just like a teeter-totter.
9. If the CG is too far forward, the elevator may not be able to rotate the nose up high enough for takeoff, or to keep from hitting on the nose wheel on landing.
10. Getting the CG too far aft is even more critical. The farther aft the CG, the less stable the airplane becomes in pitch.
11. The datum is a reference point on the airplane from which you measure certain items. For example, on the 172, the datum is the front face of the firewall, and you measure distance from that point for balance calculations.
12. This distance is called arm.
13. The effect of a given weight at a certain distance is called moment.
14. Moment is the arm multiplied by the weight, and because it is inches times pounds, moment is stated in inch-pounds, or pound-inches.
15. The arm and moment of the empty airplane, or sometimes only the moment, is given in the Pilot's Operating Handbook or the weight and balance papers for the airplane.
16. No matter how the information is presented you must find the total moment for the airplane as it is loaded.
17. You will want to practice a number of weight and balance problems to become proficient in these calculations.
18. In some airplanes, you could takeoff within balance limits, and end up with the center of gravity outside the limit, simply because of the amount of fuel burned during flight.

19. Some airplanes are certified in both the normal and utility categories, with a wider range of maneuvers allowed in the utility category.
20. The utility category usually results in a much smaller allowable CG and weight range because of spin recovery requirements.
21. You can also practice some weight and balance problems using an electronic calculator.
22. Sometimes, at the end of your calculations, the CG is either forward or aft of the CG limit.
23. You will have to move or remove someone or something to bring the CG back in its envelope.
24. To do this, it's sometimes as easy as eliminating some of the fuel or adjusting the position of some of the passengers or baggage.
25. Weight and balance is rather simple. Weight times arm equals moment. Total moment divided by weight equals the center of gravity.
26. Maximum ramp weight may be slightly higher than maximum takeoff weight in order to take into consideration fuel burned in starting and taxiing.
27. Another weight limitation in some airplanes is maximum landing weight.
28. Useful load is the difference between the maximum ramp or takeoff weight and the empty weight of the airplane.
29. You'll have a favorite airplane or two that you will fly most often. Their weight and balance limitations will become familiar to you, so you won't need to recalculate for every trip.

Air Facts: A Balanced Approach

Private Pilot Chapter 6 – Video Segment 8

In this section we'll investigate how some airplanes perform when loaded right up to their aft CG.

Review:

1. Your calculations have two parts: weight and balance. Many pilots spend a lot of time thinking about the first part: can I take full fuel? How many passengers can come along today? What's my gross weight? Don't neglect the C.G. calculation. It has a direct impact on the performance and handling characteristics of your airplane.
2. An airplane is stable when, if it's disturbed in pitch, it'll dampen itself out. Or, when you reduce the airspeed below the trim airspeed, it'll return to the trim airspeed in a few oscillations.
3. Some airplanes may be almost unstable if they are loaded right up to the aft CG. Going beyond it is always a bad idea.
4. Weight and balance limitations on an airplane are absolutes.
5. Once you've figured your weight and balance and there's any doubt at all, readjust some factor to move the center of gravity more toward the center.

The Knowledge Test and Oral Exam

Private Pilot Chapter 6 – Video Segment 9

In this section we'll investigate preparing for your computerized knowledge test and the oral portion of the flight test.

Review:

1. When you're ready for the written, your instructor will advise you of your options.
2. You can get the administrative requirements out to the way by making an appointment and paying by credit card over the phone.
3. Take a flight computer and/or a calculator along. They are allowed as long as any permanent memory is erased both before and after the test. You may also use a plotter during the test.
4. You are allowed two-and-a-half hours for the private pilot test. An hour and a half is allowed for the recreational to private pilot transition test.
5. A photo ID, such as a driver's license, passport, or other government identification card is required.
6. You must also have a logbook endorsement from your flight or ground instructor stating that you have completed a course of study in preparation for the written portion of the test.
7. You'll be given an orientation which lasts approximately 15 minutes. This introduction includes a sample test allowing you to get comfortable with the surroundings and the computer.
8. You'll then receive a packet which contains a book with the charts and figures, scratch paper, and an overlay needed for the test. Remember, you may not mark in the test booklet, only on the scratch paper and overlay.
9. The private pilot test is 60 questions out of the 900 or so possible. The test to transition from recreational to private pilot has 30 questions.
10. The questions are multiple choice with 3 alternatives offered for each question. You must choose the most correct answer.
11. Take your time and be sure that you understand the question before considering the possible answers.
12. Answer the questions you readily know and then go back to the ones you find difficult.
13. Save the computational and look-up questions for later in the test.
14. When you're finished, you can choose to use the remainder of your time to review or quit.
15. A score of 70 percent is passing. If you don't pass, you can retest once you have a new logbook endorsement from an instructor certifying that you've had ground instruction and are competent to pass the test.
16. Your test is scored immediately and is valid for 24 calendar months. The oral and flight portions of the test must be completed within that time period.

17. The oral and flight tests are usually given on the same day back-to-back. When you are ready, your flight instructor will help you make an appointment with an FAA inspector or designated flight examiner.
18. Study the private pilot airman certification standards. It outlines what will be expected of you.
19. For the aircraft you'll need a view limiting device, the required aircraft documents, current charts, a computer and plotter, a flight plan form, flight logs, and a current AIM.
20. You'll also need your student pilot and medical certificate or your recreational and medical certificate if you're transitioning, a completed 8710-1 airman certificate and/or rating application, the form with your written test results, your logbook with your instructor's endorsement, your notice of disapproval if this is a second try, and the examiner's fee.
21. Some examiners are using IACRA instead of the paper 8710. It's an electronic, web based system, that helps reduce errors and streamlines FAA paperwork.
22. The examiner or inspector will also have to see some form of picture identification before the test can be administered. A driver's license, passport, or armed forces ID will be fine.
23. The oral, preflight, part of the test is given to make certain that you are knowledgeable in various areas. Much of what is covered will have been on the written.
24. Make sure that you can point out all of the required records in the aircraft's logbook.
25. The examiner will make sure of your knowledge of aviation weather and your ability to obtain, read, and analyze it.
26. You'll be asked to explain the whole range of important aviation topics relating to your level of certificate; weight and balance, performance charts, sectional chart, and the like.
27. You will have to prepare a flight plan and a navigation log. Then you will simulate filing your plan.
28. The examiner will make sure you are knowledgeable on aeromedical factors and the effects of alcohol and drugs.
29. If you don't know the answer to a question, admit it. Then immediately offer to look it up and find the answer.
30. Be courteous and complete and you shouldn't have any problems.

Closer Look: AOPA and EAA

Private Pilot Chapter 6 – Video Segment 10

In this section we'll investigate the Aircraft Owners and Pilots Association – the AOPA.

Review:

1. The AOPA is the world's largest civil aviation organization, representing people who own or fly general aviation aircraft. The AOPA fights to maintain the freedom of flight.
2. The AOPA works to make flying safer, less expensive, more useful, and more fun.
3. The AOPA works with such organizations as Congress, the FAA, the Department of Transportation and the like.
4. Safety is a prime concern of the AOPA. They achieve this through flight research, seminars, printed materials, and audio/visual productions benefitting every pilot in the country.
5. By becoming a part of the AOPA, pilots receive a wide range of useful benefits, including the informative monthly magazine AOPA Pilot.
6. Online, members enjoy exclusive access to weather graphics, aircraft valuation service, an airport directory with diagrams, online flight planning, plus an extensive aviation reference library, and the latest news for pilots.

The Flight Test

Private Pilot Chapter 6 – Video Segment 11

In this section we'll investigate what you need to know for the successful completion of your flight test.

Review:

1. Go over the checklist for the preflight and make sure you know why you are looking at each item.
2. You'll be judged on how well you organize things and on your briefing about safety belts, shoulder harnesses, seat latching, and emergency procedures.
3. Clarify with the examiner that if he wants control of the airplane, he will tell you and you will immediately reply, "You have control," and hold your hands up.
4. Be sure to run the checklist carefully, adjust the engine controls precisely, and set the brakes before starting. Avoid aircraft movement and excessive engine RPM after starting.
5. Taxi carefully, without either excessive brake use or speed. Position the controls correctly.
6. At the run-up area, follow the checklist and watch for hazards. Go over with the examiner the airspeeds that will be used on departure as well as the runway length required for takeoff. Describe what you would do in an emergency.
7. Follow the appropriate radio procedures for departure. Use standard radio phraseology. The examiner may simulate radio communications in flight.
8. Correct for wind drift while in the pattern, maintain proper spacing with other aircraft, and run the appropriate checklists.
9. In the pattern, maintain your altitude within 100 feet and the airspeed within 10 knots of the target airspeed.
10. On takeoff consider and correct for crosswinds. Know the recommended flaps setting. Align the airplane carefully on the runway. Apply aileron deflection as required and smoothly apply maximum power.
11. Rotate at the recommended speed, establish a wind drift correction as necessary, and accelerate to VY, the best rate of climb speed.
12. If flaps were used, they should be retracted as recommended. Complete the after takeoff checklist and depart the pattern in an acceptable way.
13. The examiner will expect you to be able to explain and/or perform a short-field takeoff.
14. You may also be asked to explain and/or perform a soft-field takeoff.
15. In the navigation phase, the examiner may ask you to explain pilotage and dead reckoning, and will want to make sure that you can follow that pre-planned course, identify landmarks, and navigate by means of pre-computed headings, groundspeed, and elapsed time.

16. You'll be expected to correct for and record differences between preflight calculations and what actually happens en route.
17. In using navigation systems, you may be asked for an explanation of how these work, and you will be expected to use them properly en route, including locating yourself relative to the radio navigation facility or waypoint.
18. Diverting from the original flight plan is on the test, and you are expected to know how to recognize adverse weather and know the procedures for diverting.
19. You will perform lost procedures as well.
20. You will be asked to fly the airplane solely by reference to instruments including demonstrating your ability to recover from unusual attitudes.
21. Stalls, slow flight, steep turns, and ground reference maneuvers are also tested.
22. A discussion of night flying will be part of your test. The examiner will ask you to explain the preparation, equipment, and factors essential to night flight.
23. A simulated forced landing will most likely be included. You'll be expected to know the proper airspeeds, use of the emergency checklist, and to attempt to determine the reason for the simulated malfunction.
24. Landings are next on the test. If there is a crosswind, it must be handled properly. If there is no crosswind, the examiner will ask how you would handle a crosswind landing.
25. Slips to a landing, go-arounds, soft-field and short-field landings will also be part of the test.
26. After the last landing, don't forget to use the after landing and shutdown checklists. Park and secure the airplane properly.

Air Facts:Training Beyond the Checkride

Private Pilot Chapter 6 – Video Segment 12

There's no doubt your checkride was conducted within the parameters of the ACS and you demonstrated quality decision making skills and judgment, but that's just the beginning. Earning a pilot certificate is a special accomplishment. It also comes with the responsibility to continue learning and refining those skills through practice.

Review:

1. Creating a plan for continued learning will only enhance your aviation experiences and provide even greater personal enrichment.
2. Start out by making a plan to continuously improve your landings. A wise person once said you can't practice anything effectively unless you have goals and a method to measure progress.
3. Judge your improvement on the quality of your "bad" landings. And practice under a variety of conditions like wind, configuration, and time of day to better hone your visual cues and mastery of the airplane.
4. Next make it a habit to continually practice abnormal procedures. Read the insightful section of your POH that includes an expanded discussion of abnormal and emergency procedures.
5. On your next flight, review the table of contents for the emergency section and select an event you haven't practiced. Follow the checklist for that item and understand the "why" behind it.
6. Finally, fly. There's nothing better for proficiency than to fly more and visit new places.

High Performance and Complex Airplanes

Private Pilot Chapter 6 – Video Segment 13

Once you acquire your private pilot certificate, there are many things you can do. Among them is carrying passengers and flying almost anywhere VFR day or night. You'll be able to fly any airplanes for which you are rated – probably single-engine land to begin with.

Review:

1. At this point in your journey, you may want to check out in either a complex or high performance airplane. To do this you will have to be checked out by a flight instructor and have your logbook certified.
2. There is also a grouping called Technically Advanced Aircraft, or T-A-A. This means the aircraft has an electronic Primary Flight Display, Multi Function Display and two-axis autopilot. You do not need a special endorsement to fly this type of airplane.
3. Get a copy of the pilot's operating handbook, which includes the checklists, and read it through, making notes of any questions that you want to ask the flight instructor.
4. In the POH of more complex airplanes, you'll find more speeds defined for certain operations. Review all your V speeds.
5. Many of these speeds decrease when the weight of the aircraft is lighter than maximum takeoff weight because of fuel burn or empty seats.
6. Vle is the maximum speed you can fly with the landing gear extended,and Vlo is the maximum speed you can extend or retract the landing gear.
7. This may be your first experience with a constant-speed propeller. Engine RPM is controlled and changed by changing the pitch of the propeller.
8. The propeller control affects the RPM gauge – tachometer. The manifold pressure gauge is more directly controlled with the throttle.
9. You'll find on the before takeoff checklist, instructions on how to cycle the propeller, to make sure everything is working properly.
10. When the prop control is full forward the propeller pitch is low and the RPM will be high. When the prop control is full back, the pitch of the prop and the RPM will be lower.
11. The advantage of a constant-speed propeller over a fixed-pitch prop is in greater propeller efficiency over a wide speed range.
12. After takeoff, if noise abatement is a consideration, climb at the best rate of climb speed, maintain maximum allowable power until reaching an altitude which will allow an emergency landing, then reduce power to the cruise climb power setting. Reducing RPM does more than anything else to quiet the airplane for those on the ground.

13. When it comes time to reduce power, the generally preferred way to do it is to reduce the manifold pressure first and then reduce the RPM.
14. Not all high-performance airplanes with a constant speed propeller have a propeller control. For example, you'll only find a throttle and mixture control in the cockpit of a Cirrus SR-22, despite it having a constant-speed propeller. The propeller linkage is interconnected with the throttle control – as you adjust power, the propeller is automatically set.
15. If the aircraft is equipped with cowl flaps, they will have been open for the takeoff and climb and should be closed for cruise except in very hot weather, or as dictated by the engine temperatures or the checklist.
16. Most high performance airplanes have fuel injected engines. One advantage, more precise leaning is possible. An exhaust gas temperature gauge is usually available to help with this.
17. A possible disadvantage to fuel injection is in harder starting when the engine is hot because of vapor lock. Follow the POH for proper hot starting.
18. A turbocharger is an exhaust driven supercharger – an air pump that maintains or increases manifold pressure to make available more power, or in some airplanes, to maintain sea level manifold pressure and thus power to a higher altitude.
19. It's especially important to watch the cylinder head temperature when flying turbocharged aircraft at high altitudes where the thin air doesn't cool the engines as well.
20. In regard to retractable landing gear, what the FAA suggests is to leave it extended until a landing can no longer be made on the remaining runway.
21. Before retracting the gear, always make sure you have established a positive rate of climb and have enough altitude to get the wheels back down if needed.
22. When landing, always establish a place to extend the gear. You will be less likely to forget. Downwind is a good place, as is three miles out on a straight in approach or base leg entry.
23. One thing you'll notice when you move up to faster airplanes is an increased requirement to trim. A rudder trim system might also be included.
24. You do have to step up your rate of thinking and acting when flying a faster airplane, requiring you to plan descents more carefully. A GPS and its VNAV function can be a big help here.
25. High-performance airplanes with larger engines are more susceptible to shock cooling, compared to those found in training airplanes. Factor the power settings into your descent planning, and reduce the power by only one or two inches of manifold pressure per minute, to allow the engine temperatures to come down slowly as you approach the airport traffic pattern.

Cessna 182 Skylane

Private Pilot Chapter 6 – Video Segment 14

Once you acquire your private pilot certificate, you might want to step up to something with more performance than your trainers. The Cessna Skylane with the G1000 system would be a great choice.

Review:

1. The Cessna Skylane seats four and cruises at 140 knots. It's powered by a 230 horsepower Lycoming engine.
2. If you haven't flown with the G1000 or one of the other glass panel packages available, you will be amazed at what they can do.
3. Learning these sophisticated avionics will take some time but the effort is highly rewarding.
4. You can input a flight plan before takeoff and the GPS will lead you to your destination. You can even load and follow a vertical descent profile from the cruise portion of the flight plan.
5. Even better, this airplane has a fully integrated GFC 700 autopilot installed. Turn it on after leaving the traffic pattern and it can lead you to your destination.
6. The Skylane has a good useful load and also has a generous 88 gallon fuel capacity. This fuel amount will yield approximately six and a half hours of total flying.
7. The Skylane's maximum takeoff weight limitation won't allow full fuel with all four seats filled and some baggage. This is remedied by not completely filling up the tanks prior to departure.
8. The excellent takeoff and landing performance of the Skylane does a good job on all but the shortest runways. Its handling qualities are impressive as well.

Closer Look: Remote Communications

Private Pilot Chapter 6 – Video Segment 15

In this section we will investigate remote communications with certain ground facilities.

Review:

1. Communication with ground stations can often take place through remote communications outlets, even when you're not line of sight with the facility itself.
2. For example, you can talk to the Boise flight service station when in the Redfish Lake area through the Stanley remote communications outlet.
3. Many NAVAIDs also have remote communication capabilities.
4. For example, in the area of Falmouth, Kentucky, you would communicate with the Louisville flight service station by transmitting on 122.1 and listening over the VOR frequency of 117.0.
5. You may not be able to tune some frequencies on your radio. Your system skips over them. That's because some older radios aren't capable of picking up frequencies put into use since they were manufactured.
6. Some newer radios require a special procedure to get these frequencies. For instance, to tune 126.67 on your radio, you may have to pull out a special knob.
7. If you're not able to communicate on a particular frequency, let someone know at that same facility on a different frequency. They'll give you instructions on what to do.

Expanding Horizons

Private Pilot Chapter 6 – Video Segment 16

In this section we will investigate some of the opportunities that general aviation presents to the holder of the private pilot certificate – especially, night and instrument flying.

Review:

1. It's obvious that a lot of things are different at night. You can't see the horizon, terrain details, or weather formations as well as in the daylight. A night cross-country can be a lot more like an instrument cross-country.
2. One of the biggest challenges at night can be finding the airport. They don't look the same in the dark.
3. Even the alternating green and white beacon can be hidden in the background lights of a city.
4. If you use a combination of visual and radio navigation, you will be successful.
5. There are two advantages that night flying has over daytime; the traffic is less and ATC is not as busy.
6. Before you fly a solo night VFR cross-country make sure the weather is almost perfect – it's difficult to see and avoid clouds in the dark.
7. Plan every detail of the flight carefully, including how you are going to take advantage of the avionics in navigating.
8. Bring extra flashlights and spend some time in the cockpit, in the dark, before heading out to get used to it all.
9. If you are going with an instructor, pick out a large airport in a metropolitan area, and a smaller airport with minimum runway lighting, no VASI, and few lights in the vicinity.
10. While a low percentage of VFR flying is done at night, a high percentage of the weather-related accidents occur at night.
11. There are many interesting aspects of aviation to accomplish; aerobatic flight, seaplanes, soaring, multiengine rating, helicopter, and especially acquiring an instrument rating.
12. With an instrument rating you can venture almost anywhere except that part of the sky that is filled with thunderstorms and ice.
13. You can do more things, go more places, make more plans, meet more schedules, and have more fun.
14. In studying for your instrument rating, you will become better versed in weather analysis, your flying precision will be sharpened, and your overall knowledge of the complete aviation system will be greatly enhanced.
15. Getting an instrument rating opens your day horizons a lot, and your night flying horizons even more.
16. You'll need a total of 40 hours of actual or simulated instrument time, including a long cross-country, 15 hours with an authorized instructor, 3 of those hours within 60 days of

the test. Your logbook must reflect 50 hours of cross-country as pilot in command, 10 of which must be in airplanes.

17. Possibly, once you get the rating, you'll make most of your trips IFR – both for the practice and for the convenience.
18. Flying is a privilege to be protected and cherished. You do this by always putting safety first.
19. Have fun and share your aviation enthusiasm and knowledge with others. This will attract more people to general aviation and help it grow into the future.